OIL AND GAS LEASING ON LANDS ADMINISTERED BY THE DIXIE NATIONAL FOREST

Final Environmental Impact Statement

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US Department of Agriculture
Forest Service
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Cooperating Agency:
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Bureau of Land Management

Cooperating Agency:
State of Utah

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COOPERATING AGENCIES:	Bureau of Land Management Utah State Office U.S. Department of the Interior State of Utah
PROJECT LOCATION:	Garfield, Iron, Kane, Piute, and Washington Counties, Utah
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ABSTRACT

This Final EIS identifies Dixie National Forest lands that could be made available for oil and gas leasing, in accordance with the Mineral Leasing Act, under various leasing alternatives; describes the affected environment; and discusses reasonably foreseeable impacts of oil and gas activities on the human environment resulting from each leasing alternative. Issues and concerns expressed by the public and government agencies during the public comment period for this EIS have been addressed by the analysis. This analysis will be used by the Forest Supervisor of the Dixie National Forest and the Utah State Director of the Bureau of Land Management as the basis for making oil and gas leasing decisions under their authority. Alternative C is the preferred alternative.

PROJECTS WEBSITE

http://www.fs.usda.gov/goto/dixie/projects

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EXECUTIVE SUMMARY

The following information is provided as a convenient synopsis for the public. However, this synopsis is not a substitute for review of the complete Environmental Impact Statement (EIS). If there are any inconsistencies between this summary and the EIS, the EIS should be considered the authoritative document.

In many parts of the United States, National Forest System lands overlie geological formations that may contain oil and/or natural gas. The US Forest Service's (Forest Service) national policy on minerals (USFS 2007a) states that the "Exploration, development, and production of mineral and energy resources and reclamation of activities are part of the Forest Service's ecosystem management responsibility." The Forest Service allows leases on many National Forest System lands for the purpose of drilling wells and extracting oil and/or gas (USFS 2007a). The Department of Interior, Bureau of Land Management (BLM), acts as the onshore leasing agent for the Federal Government. Forest Service regulations (36 CFR 228.102) developed in response to the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (Leasing Reform Act) require a leasing analysis be completed prior to offering leases on National Forest System lands (the federal leasing process is described in further detail in Section 1.8.5.1). The leasing analysis allows the Forest Service to decide whether or not federal lands under its administration will be administratively available for leasing, and under what conditions (leasing options) the leases will be issued. The National Environmental Policy Act (NEPA) of 1969 also requires the Forest Service, along with its cooperating agencies, to identify and assess potentially significant environmental impacts and address issues associated with oil and gas leasing.

Proposed Action and Decision

The Dixie National Forest, with the cooperation of the BLM, is conducting this environmental analysis to identify which lands administered by the Dixie National Forest with federal oil and gas rights to make administratively available for oil and gas leasing. The Dixie National Forest Supervisor will decide which areas of the Forest would be administratively available for leasing subject to the terms and conditions of the standard oil and gas lease form 3100-11 (BLM 2006a), or subject to constraints that would require the use of lease stipulations such as those prohibiting surface occupancy. The BLM Utah State Director will decide whether to offer for lease those National Forest System lands authorized for leasing by the Forest Service and make the required leasing decisions for non-federal lands with federal oil and gas ownership within the Forest Boundaries. The responsible officials of the Forest Service and BLM will release separate Records of Decision. The Records of Decision will not authorize specific, surface-disturbing activities. The Records of Decision will only make a decision about which lands would be available for oil and gas leasing and what conditions and stipulations would apply to any oil and gas leases offered in the future. Environmental impacts of future oil and gas exploration and development activities would undergo future, project-specific environmental analyses.

Purpose and Need

The current Dixie National Forest Land and Resource Management Plan was completed prior to the passage of the Leasing Reform Act and does not determine the availability of National Forest System lands for oil and gas leasing. The purpose of the Proposed Action is to complete a Forest-wide leasing analysis to comply with the Leasing Reform Act and the federal regulatory

requirements of 36 CFR 228, Subpart E, and 43 CFR 3100. This requires the Forest Service to analyze lands under its jurisdiction that are legally available for leasing.

Lands Involved in the Decision

The analysis area (Figure 1.5-1) includes all National Forest System lands on the four Dixie National Forest Ranger Districts, with the exception of lands with private surface rights that cover 79,521 acres. With these areas excluded, the analysis area is approximately 1,710,761 acres. This includes 481,264 acres, 404,283 acres, 388,603 acres, and 436,610 acres on the Pine Valley, Cedar City, Powell, and Escalante Ranger Districts, respectively (Table 1.5-1). Within the analysis area, there are also several areas that are not legally available for leasing. These areas cover a total of 85,503 acres and include designated wilderness areas, Brian Head Ski Area (which is under Special Use Authorization), the areas surrounding the Box-Death Hollow Wilderness Area known as Antone Bench and Areas 2, 3, 4, and 5, and National Forest System lands that have non-federal oil and gas rights. National Forest System lands with non-federal oil and gas rights are included in the analysis area since the Forest Service manages surface uses.

The analysis area encompasses approximately 13,454 acres of existing leases, of which approximately 9,495 acres on all or portions of 15 leases are within the Upper Valley Oil Field. The Upper Valley Oil Field is located in the southeast corner of the Escalante Ranger District and is the only producing oil field on the Dixie National Forest. Also, there are 3,380 acres of leased land on four different leases that predate the formation of the Box-Death Hollow Wilderness. The actual well sites on these leases were cherry-stemmed out of the wilderness when it was created and the wells are currently not producing. New leasing decisions made as a result of this analysis would not affect any of the existing leases; however, leased lands are included in the analysis so that when the leases expire the decision has been made whether or not to offer them for lease again and under what conditions. It is possible that currently leased lands would not be available for lease in the future or that they would be available with stipulations that are not in the current lease.

Relationship to the Forest Plan and other Legislation

Land and Resource Management Plan

The existing Dixie National Forest Land and Resource Management Plan was approved in 1986 and includes general decisions, as part of management prescriptions, to provide for oil and gas leasing, but does not include decisions for leasing specific lands. This EIS and decisions the Forest Supervisor will make, including availability of lands for oil and gas leasing, will be used to develop an amendment to the Land and Resource Management Plan.

Roadless Area Conservation Rule (2001)

The Forest Service identified Inventoried Roadless Areas (IRAs) nationwide as part of its 1972-1985 Roadless Area Review and Evaluation process. All the IRAs in the nation were reviewed again by the Forest Service in 1999 under the Roadless Area Conservation Initiative. In November 2000, the Forest Service issued the Final EIS for the proposed Roadless Area Conservation Rule. The final Roadless Area Conservation Rule was published in the Federal Register on January 21, 2001 (66 FR 3244). For the purpose of this analysis, IRAs are considered to be those areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000. The Forest Service Roadless Area Conservation Rule applied to Forest

Service actions in all IRAs. The Roadless Area Conservation Rule prohibits a Forest Service responsible official from approving road construction and reconstruction and the cutting, sale, or removal of timber in IRAs except when the responsible official determines certain circumstances apply (36 CFR 294; currently under the directive of the Secretary of Agriculture).

There are 38 IRAs on the Dixie National Forest encompassing 570,786 acres of National Forest System land, which represents approximately 35 percent of the analysis area for this EIS. As IRAs represent such a large proportion of the Dixie National Forest, any changes in the roadless area conservation due to judicial actions would impact potential oil and gas leasing and this analysis. As a result, this analysis evaluates a range of alternatives that include leasing options prohibiting road construction and timber removal which meets the intent of the 2001 Roadless Area Conservation Rule, as well as other leasing options that allow new disturbance within IRAs for oil and gas exploration and development (assuming future changes in the status of the 2001 Roadless Area Conservation Rule would allow this). This provides a framework to make decisions concerning oil and gas leasing in these areas should any changes occur in the legal status of the 2001 Roadless Area Conservation Rule in the future.

Federal Onshore Oil and Gas Leasing Reform Act of 1987

The Leasing Reform Act amended the Mineral Leasing Act of 1920 to provide the Forest Service with more input on oil and gas leasing on National Forest System lands. Under the Leasing Reform Act the authority to issue all leases for the production of federally owned oil and gas remained with the BLM. However, the Forest Service's decision to lease with certain stipulations is binding on the BLM for all federal minerals on National Forest System lands, if the BLM decision is to offer the leases for sale.

Energy Policy Act of 2005

The Energy Policy Act of 2005 directs the Secretaries of the Interior and Agriculture to improve administration of federal oil and gas leasing programs. This includes the improvement of inspection and enforcement of oil and gas activities. It also requires the development and implementation of best management practices (BMPs). In addition, it requires the Secretaries of the Interior and Agriculture to enter into a Memorandum of Understanding (MOU) to improve coordination and consultation on oil and gas leasing activities.

Potential Oil and Gas Activity the Dixie National Forest

The potential for oil and gas activity on the Dixie National Forest is described in the Reasonably Foreseeable Development Scenario (RFDS). The RFDS is an estimate of future oil and gas activity, based primarily on known geologic potential for oil and gas occurrence and on past exploration and development activity in and near the Dixie National Forest. The scenario is also developed with consideration of other factors such as economics, technology, physical limitations on access, existing or anticipated infrastructure, and transportation. It is possible that the actual level of oil and gas activity that occurs on the Dixie National Forest may be less, or more, than estimated by the RFDS.

The RFDS indicates that roughly the southern one-third to one-half of the Cedar City, Powell, and Escalante Ranger Districts have high or moderate potential for oil and gas development. The entire Pine Valley Ranger District is rated as having low development potential. Current oil and gas industry interest, which is reflected in the lands nominated for lease sales between 2005 and 2006, is somewhat evenly distributed among the Cedar City, Powell, and Escalante Ranger Districts. Using this information, the RFDS projects a maximum of 60 exploration wells

over 15 years following leasing, or a Forest-wide average of four wells per year. When adjusted by Ranger District, the number of exploration wells that could occur over the 15-year period is:

Pine Valley:	5 wells; an average of one well every three years
Cedar City:	15 wells; an average of one well per year
Powell:	20 wells; an average of four wells every three years
Escalante:	20 wells; an average of four wells every three years

In order to fully evaluate the environmental effects of concurrent exploration activity for this analysis, it can reasonably be assumed that three exploratory drilling operations could occur at one time on each of the Ranger Districts. Furthermore, exploratory drilling during this period could result in a discovery of one oil and gas field with 20 production wells. Due to uncertainty as to where this field would be located, the environmental impacts are evaluated as if it were to occur on each of the Ranger Districts. During the same time period, it is expected that a total of 700 linear miles of seismic line data (i.e., geophysical surveys) could be collected on the Dixie National Forest over the next 15 years, with 100 miles estimated to occur on the Pine Valley Ranger District and 200 miles expected to occur on each of the other Ranger Districts. It is assumed that 50 to 100 linear miles of seismic lines could occur on each of the Ranger Districts in any year (BLM 2007a). It is estimated that approximately half of these miles would be obtained using helicopter-portable equipment.

Significant Issues and Alternative Development

Public and Agency Scoping

The Notice of Intent (NOI) for this EIS was published on December 29, 2006 in the Federal Register, Volume 71, No. 250, Page 78395. The publication of the NOI initiated the formal scoping period. A legal notice describing the proposal and requesting scoping input was also published in *The Spectrum,* St. George, Utah on December 30, 2006 and press releases were sent to the *Cedar City Review* and *Daily News*, Cedar City, Utah and *Garfield County Insider*, Panguitch, Utah. Scoping letters requesting scoping input were sent to interested individuals, agencies, and groups. Scoping meetings were held in St. George, Cannonville, and Cedar City. An additional open house was held in Escalante, Utah.

Key Issues

Through public scoping, 13 key resource issues were identified and alternatives were developed to address these issues. Measurement indicators were also developed to quantify the environmental impacts to each identified resource. The key resource issues include:

- Issue #1: Post-leasing activities could decrease visual integrity and quality, could impact viewsheds, and could have an impact on night skies.
- Issue #2: Post-leasing activities could impact the characteristics and attributes of IRAs.
- Issue #3: Post-leasing activities could degrade the values of eligible Wild and Scenic Rivers and could make these areas ineligible for future inclusion in the National Wild and Scenic River System.
- Issue #4: Post-leasing activities could impact hunting, fishing, recreation, and tourist activities and developed and dispersed recreational sites.

- Issue #5: Post-leasing activities could impact aquatic and terrestrial wildlife and their habitats.
- Issue #6: Post-leasing activities could impact Threatened, Endangered, Proposed, Candidate, Forest Sensitive, and Management Indicator (MIS) species and their habitats, including Designated Critical Habitats.
- Issue #7: Post-leasing activities could impact flow and water quality of surface streams and groundwater, sensitive aquifers, developed water systems, floodplains, wetlands, and riparian areas.
- Issue #8: Post-leasing activities could impact steep slopes and unstable and erodible soils.
- Issue #9: Post-leasing activities could impact major vegetation types, areas containing unique vegetation, biological and chemical crusts, and gypsum type soils, and could introduce noxious weeds.
- Issue #10: Post-leasing activities could increase traffic levels on public roads and forest roads and increase accessibility to other federally-administered lands.
- Issue #11: Post-leasing activities could impact public and private revenues, populations, community services, infrastructure, tourism, and fire management.
- Issue #12: Post-leasing activities could impact air quality.
- Issue #13: Post-leasing activities could impact Research Natural Areas, botanical and geologic trails, scenic byways, national recreation trails, administrative sites, and the Side Hollow Ponderosa Pine Provenance Study Area.

Leasing Options

Alternatives were developed by assigning various leasing options to the resources identified through public scoping. The alternatives were analyzed by applying the leasing options to site-specific resources using a geographic information system (GIS). The leasing options used in development of the alternatives include stipulations listed in the *Uniform Format for Oil and Gas Lease Stipulations* (NSO, TL, and CSU) published by the Rocky Mountain Regional Coordinating Committee in March 1989 (RMRCC 1989). Leasing options used include:

NO LEASE (NL)

All federal minerals within the analysis area would not be administratively available for leasing. Existing leases would remain in effect until they terminate or expire.

NO SURFACE OCCUPANCY (NSO)

Use or occupancy of the land surface for fluid mineral exploration or development is prohibited. With the exception of seismic exploration, NSO applies to all uses and facilities associated with oil and gas development.

TIMING LIMITATIONS (TL)

The TL stipulation (often called seasonal restrictions) prohibits surface use during specified time periods. A TL applies for restrictions longer than 60 days and shorter than one year.

CONTROLLED SURFACE USE (CSU)

The CSU stipulation is intended to be used when fluid mineral occupancy and use are generally allowed on all or portions of the lease area year-round, but because of special values, or resource concerns, lease activities must be strictly controlled. The CSU stipulation is used to identify constraints on surface use or operations that may otherwise exceed the mitigation provided by Section 6 of the standard lease terms and the regulations and operating orders.

LEASE NOTICE (LN)

Any requirements contained in a LN must be fully supported in a law, regulation, SLT, or onshore oil and gas order. A LN is attached to leases to transmit information at the time of lease issuance to assist the lessee in submitting acceptable plans of operation or to assist in administration of leases. A LN is attached to leases in the same manner as stipulations; however, a LN does not involve new restrictions or requirements.

STANDARD LEASE TERMS (SLT)

Under the SLT, the lessee has the right to use as much of the leased lands as is necessary to explore or drill for, extract, remove, and dispose of oil and gas deposits that may be in the leased lands, together with the right to build and maintain necessary improvements thereon. SLT requires the operator to conduct operations in a manner that minimizes adverse impacts to the land, air, water, cultural, biological, visual, and other resources and land uses or users. Operations cannot violate any other federal environmental protection laws (e.g., Clean Air Act, Clean Water Act, Endangered Species Act, etc.). Measures to avoid impacts to specified resources include, but are not limited to, the modification to the siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Well sites may be moved up to 200 meters (656 feet) and operations delayed for up to 60 days without interfering with the lease rights.

Alternatives Considered in Detail

Five alternatives were developed and were assigned a letter (A – E). Alternative A is the no action/no lease alternative and would not authorize new oil and gas leasing on the Dixie National Forest. Alternatives B – E all allow some amount of new oil and gas leasing. The differences between Alternative B – E are in the leasing options applied that would restrict where and under what conditions oil and gas leasing could occur. In general, Alternative B applies the most restrictive leasing options and Alternate E the least restrictive. Alternatives C and D and fall between B and E in term of the leasing options applied.

Alternative A: Section 1502.14(d) of the NEPA regulations requires the analysis of a No Action Alternative. Under Alternative A, present management activities as pertaining to oil and gas leasing would continue unchanged. The Forest Supervisor can also select a Forest-wide No Lease Alternative that would not allow leasing anywhere on the Forest. This would be different from not taking any action, as in the No Action Alternative, since a decision would be made that would prohibit leasing. Both options would result in no new oil and gas leasing and have been combined for analysis purposes. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Existing leases, including those associated with the Upper Valley Oil Field, would not be affected. However, when these leases expire no new leases would be authorized in these areas.

Alternative B: Alternative B was developed in order to address comments offered by conservation groups during the public scoping and through discussions with the groups following the initial scoping period. Alternative B would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. Alternative B would emphasize the protection of particular resources through the application of restrictive leasing options. With the exception of Alternative A, this alternative would apply equal or more restrictive leasing options to the resource components than any of the other alternatives. A NL option would be applied to IRAs regardless of legal decisions concerning the 2001 Roadless Area Conservation Rule and dual analysis of this alternative is not necessary.

Alternative C: Alternative C was developed to be consistent with the management direction and the standards and guidelines identified in the Land and Resource Management Plan; however, an amendment to the existing Land and Resource Management Plan would still be required. Alternative C would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. The leasing options under Alternative C would generally be less restrictive than under Alternative B, but more restrictive than Alternatives D and E. For example, in some resource areas such as IRAs, recreation, fish and wildlife, and water and watershed resources, where Alternative B would apply a more restrictive stipulation, Alternative C may have a less restrictive stipulation. Many of the leasing options are the same across these two alternatives; however, less area is restricted with a 'No Lease.'

Alternative D: Alternative D would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. Alternative D would also require an amendment to the Land and Resource Management Plan. This alternative is less restrictive in regard to oil and gas development and more land would be available for lease under SLT than under either Alternatives B or C. Leasing options are generally less restrictive than Alternative C. However, in many cases the leasing options are the same as under Alternative C. It is more restrictive than Alternative E.

Alternative E: Alternative E would open the majority of the Dixie National Forest to leasing under the standard lease terms and conditions contained on BLM Lease Form 3100-11, with the exception of IRAs with the 2001 Roadless Area Conservation Rule. This is the least restrictive alternative in regard to oil and gas development. An amendment to the Land and Resource Management Plan would be required.

Dual Analysis of Alternatives

Due to uncertainty in the future status of the 2001 Roadless Area Conservation Rule, alternatives D and E underwent a dual analysis. The dual analysis consists of analyzing the environmental impacts of the alternatives under two scenarios: (1) each alternative is analyzed with a NSO stipulation applied to IRAs that would prohibit road construction and timber harvest following the intent of the 2001 Roadless Area Conservation Rule, and (2) each alternative is analyzed based on less restrictive leasing options that would allow new disturbances for oil and gas exploration and development in IRAs, including roads, wells, and other facilities. The second scenario in the dual analysis process provides the framework to make decisions concerning oil and gas leasing in these areas should any changes in the applicability of the 2001 Roadless Area Conservation Rule occur in the future due to judicial actions. With the exception of IRAs, the leasing options applied to other resource components would be the same under both scenarios of the dual analysis. However, the spatial distribution of many resource

components overlaps with IRAs. As a result, the amount of land available under each leasing option differs depending upon the scenario.

Affected Environment

The scenic beauty of the Dixie National Forest is one of its major attractions. Scenic resources are a composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify an area and influence the visual appeal that area may have to people. Concern Level 1 (user-rated high importance) areas on the Dixie National Forest include scenic byways such as Highway 12 through the towns of Escalante and Boulder, and the many viewsheds across the Forest. The night sky views on the Dixie National Forest are also an invaluable resource to many residents and visitors.

IRAs are generally areas without mechanically constructed roads and that contain important environmental values, including nine different features identified in the 2001 Roadless Area Conservation Rule and seven attributes that characterize wilderness potential. IRAs on the Dixie National Forest are frequently adjacent to wilderness areas.

Recreational resources on the Dixie National Forest attract over half a million visitors per year, most of who come to view natural features or wildlife. Between 35-40 percent of visitors come to hike, walk, or drive for pleasure. Annual daily traffic is highest on State Highway 12, such as through Red Canyon (Powell Ranger District) and Upper Valley (Escalante Ranger District), and on State Highway 18 (Pine Valley Ranger District) and U.S. Highway 89 (between Cedar City and Powell Ranger Districts). Other popular activities include downhill skiing, fishing, camping, picnicking, OHV use, and hunting. There are approximately 65 developed recreation areas on the Dixie National Forest, including campgrounds and visitor centers, which are located along the scenic byways and backways. Many developed sites and recreation residences are clustered near the Pine Valley, Duck Creek, and Navajo Lake Recreation Areas. Dispersed recreation opportunities occur throughout the Dixie National Forest and include camping, hiking and equestrian use, mountain biking, hunting and fishing, and winter sports.

The Dixie National Forest contains many wildlife species, including small and large mammals, reptiles, and migratory birds that are protected by the Migratory Bird Treaty Act and other legislation. Migratory bird nests can be found in wet habitats as well as ponderosa pine/woodland, aspen, pinyon juniper, and conifer forest; most nests are found on the ground but may also occur in trees or shrubs. Native fisheries can be found in the 400 miles of aquatic habitat (streams, lakes, and reservoirs) on the Dixie National Forest. Blue Ribbon Fisheries include Panguitch Lake, MaGath Lake, Paragonah (aka Red Creek) Reservoir, and Panguitch Creek. Game fishes that are stocked in lakes and reservoirs on the Forest include tiger trout, splake, and smallmouth bass.

Six threatened, endangered, or candidate (TEC) species are known or suspected to occur on the Dixie National Forest or in waters that flow from the Dixie National Forest. These species include two endangered fishes, three birds (California condor, Mexican spotted owl, and western yellow-billed cuckoo), and Utah prairie dog. Designated Critical Habitat for Mexican spotted owl occurs on the Escalante Ranger District. Many Forest-designated Sensitive species are also known or suspected to occur on the Forest, and include two cutthroat trout species, boreal toad, pygmy rabbit, two bat species, northern goshawk, greater sage-grouse, peregrine falcon, bald eagle, flammulated owl, three-toed woodpecker, bighorn sheep, and 24 plants.

There are approximately 6,243 miles of perennial and intermittent streams within the Dixie National Forest boundary, in addition to 1,971 mapped springs and over 1,079 lakes and reservoirs. Wetlands on the Forest have not been mapped but most are typically located near waterbodies. Floodplains are generally narrow on the Forest because the majority of streams are small and constrained by geology and topography. Riparian areas are generally demarcated by willow (*Salix* spp.) stands in upper elevations, and by cottonwood (*Populus angustifolia*), dogwood (*Cornus stolonifera*), and birch (*Betula fontinalis*) at lower elevations.

The Dixie National Forest straddles the major surface water divide between the Colorado River Basin and the Great Basin. Within the Colorado Plateau, several tributaries head in the Dixie National Forest: Beaver Dam Wash, Santa Clara River, Quail Creek, Ash Creek, North Fork Virgin River, and East Fork Virgin River, which all flow to the Virgin River prior to entering the Colorado; Kanab Creek and its tributary Johnson Wash; the Paria River; and the Escalante River. Within the Great Basin, Dixie National Forest lands produce flows that are tributary to the Sevier River or that flow to internal playa-type basins within the Sevier River watershed. Shoal Creek, Pinto Creek, Coal Creek, and Parowan Creek all head in the Dixie National Forest, and flow to internal basins located outside of the Forest. Bear Creek, Panguitch Creek, Mammoth Creek, and East Fork Sevier River are tributary to the Sevier River. Typical of high elevation lands, much of the Dixie National Forest serves as recharge areas for shallow and regional aquifers, eventually supplying groundwater to the lower elevation, off-Forest lands.

Many local communities obtain culinary and agricultural water from sources located on the Dixie National Forest. Extensive water developments such as reservoirs, diversions, and ditches have been constructed on the Forest to support these and other uses. The primary consumptive uses of surface water include off-Forest irrigation and culinary water supply. On-Forest uses include domestic water supplies for campgrounds and livestock/wildlife watering, and non-consumptive in-stream flows for aquatic habitat maintenance and recreation.

The Dixie National Forest spans a zone of geologic transition from the block faulting and complex rock types of the Basin and Range physiographic province in the west to the gently warped plateau and sedimentary strata of the Colorado Plateau physiographic province in the east. Major vegetation communities on the Dixie National Forest include pinyon-juniper (26% of the Forest), aspen conifer (15% of the Forest), and sagebrush steppe (14% of the Forest). Invasive plants are found mainly in disturbed soils on the Forest. The Red Canyon Botanical Area on the Powell Ranger District contains many sensitive plants, bristlecone pine trees, and pink tertiary Claron Limestone Formation. The Side Hollow Ponderosa Pine Study Area is a five-acre research area devoted to pine tree genetic studies. Research Natural Areas that have been set aside to preserve exemplary vegetation types over the long term on the Forest include Red Canyon (531 acres; Powell Ranger District), Timbered Cinder Cone (225 acres; Cedar City Ranger District), Table Cliff (1,445 acres; Escalante Ranger District), Browse (2,055 acres; Pine Valley Ranger District), and Upper Sand Creek (540 acres; Escalante Ranger District).

The Dixie National Forest lies within five Utah Counties: Garfield, Washington, Iron, Kane, and Piute. County economies are driven by government (Iron), tourism (Garfield, Kane, and Wayne), agriculture (Garfield and Paiute), mining (Paiute), and trade/transportation/utilities and construction (Washington). The federal government is the prominent land administrator in each county. The fasted growing counties are Washington, followed by Iron County, due to population growth in and around St. George (Washington County) and the accreditation of Southern Utah University that has resulted in an increased student population (Iron County). The nearest communities to the Dixie National Forest boundary include Cedar City, St. George, Hilldale, Panguitch, Escalante, Boulder, Parowan, Tropic, Henrieville, and Cannonville.

Active mixing of air and average precipitation for Utah, along with an absence of major air pollution sources results in low pollutant background values for the Dixie National Forest. Prescribed burns and wildfires are a source of air pollution, but in general, the air quality within the Forest is considered good to excellent. Recreational use, residential heating for support facilities, and limited vehicle traffic constitute the main sources of emissions.

Environmental Consequences – Direct and Indirect Effects

The authorization of a lease does not cause environmental impacts; however, authorizing a lease grants the lessee the right to conduct oil and gas activities in the future. The environmental consequences of oil and gas activities, therefore, are analyzed in this EIS as connected actions to oil and gas leasing.

Oil and gas activities that are expected to occur on leases include seismic exploration, exploratory drilling, and development and production. During seismic exploration, some surface disturbance would occur from overland travel by buggies (60-120 acres per Ranger District) and seismic blasts would cause temporary noise disturbances. The introduction of invasive plants is a possibility during overland travel for seismic activities. Relatively more surface disturbance would occur for exploratory drilling (83-332 acres per Ranger District) due to land clearing for short-term roads and pads, as well as noise, visual effects, traffic, and increases in employment and spending for certain supplies associated with drilling. During production field development, 254 acres of surface disturbance would occur due to land clearing for long-term roads, pads, flow lines, storage tank batteries, and other facilities. Development and production disturbances would be long term (≥10 years). Oil and gas activities could degrade the visual quality of an area for as long as the activity occurred, depending upon the amount of contrast between the natural and constructed landscape, the viewing distance, and the concern of the viewer for visual quality. The greatest contrast would occur in sensitive areas such as those designated High Scenic Integrity Objective (e.g., scenic byways). Land-clearing surface disturbance removes topsoil (although it can be stockpiled for reclamation) and vegetation from the land, which also impacts habitat for wildlife, increases erosion potential, and depending on the location, can remove acreage from special or unique areas such as IRAs or Research Natural Areas. Road building is the activity most likely to impact water and watershed resources and fisheries, and may also introduce invasive plants.

Impacts to some resources would not change between the Action Alternatives B, C, D, and E, due to either 1) absence of assigned leasing options, 2) possibility of spill events regardless of leasing options, or 3) possibility of impacts associated with the spread of invasive plants, which could occur under any leasing option that allows surface disturbance. Resource components for which impacts are similar under all Action Alternatives (B-E) include major vegetation types (no leasing options; moderate impacts possible), misc. wildlife species (no leasing options; moderate impacts possible), biological soil crusts (no leasing options; minor impacts possible), and socioeconomics (moderate impacts possible). Impacts to other resources would differ under each alternative because alternatives carry different leasing options for each resource component, which restrict activities to varying degrees. Impacts under each alternative are summarized below.

<u>Alternative A</u>
There would be no adverse impacts to resources under Alternative A because no new leases would be authorized, and no connected actions associated with new oil and gas leasing would occur on the Dixie National Forest.

Alternative B

A NL or NSO leasing option would be applied to much of the Dixie National Forest under Alternative B. Less restrictive leasing options would be applied to 4 percent of the Forest. Alternative B applies a larger buffer (500 feet) around waterbodies on the Dixie National Forest than the other alternatives (300 feet). On lands covered by NSO, temporary noise or visual disruptions may cause minor adverse impacts within Semi-Primitive or Roaded Natural Recreational Opportunity Spectrum (ROS) areas, or within Low or Moderate SIO areas. Moderate adverse impacts are possible for Utah prairie dog and Forest-sensitive plants due to potential habitat losses. Minor impacts may occur to migratory birds, including some special status species, pygmy rabbit, Forest-sensitive bats, streams/lakes/springs/etc, caves, and the Red Canyon area. Alternative B impacts may be the most severe within sensitive soil types, including rockfall areas, steep or unstable slopes, or areas with high erosion potential.

Alternative C

Potential impacts to many resource components, including recreation resources, sensitive soils, fish and wildlife, and vegetation resources would be similar to Alternative B due to similar leasing options under both alternatives. Impacts under Alternative C would be more adverse to many special status species, and water resources, due to the allowance of some surface occupancy and the unknown location of the disturbance. Impacts to IRAs, Unroaded-Undeveloped Areas, and eligible Wild and Scenic Rivers could also occur under Alternative C due to NSO or CSU stipulations, respectively, which would not be possible Alternative B.

Alternative D1 (NSO in IRAs)

Under Alternative D1, impacts to IRAs, Unroaded-Undeveloped Areas, eligible Wild and Scenic Rivers, recreation resources, streams/lakes/springs/etc, and many special status species, and vegetation resources under this alternative would be similar to or the same as under Alternative C. Relative to Alternative C, more adverse impacts would be possible to SIO High and Very High areas, night skies, aquatic species, MIS and Sensitive fishes, greater sage-grouse, big game, Sensitive raptors, municipal watersheds, soil resources, and Research Natural Areas.

Alternative D2 (CSU in IRAs)

Few impacts to resources besides IRAs would be measurably different under this alternative than under Alternative D1. Only those resource components that overlap substantially with IRAs would have measurably greater adverse impacts under this alternative relative to Alternative D1. These resources include Semi-Primitive Non-Motorized ROS areas and Mexican spotted owl Designated Critical Habitat. These areas overlap with IRAs so impacts would be slightly more adverse under Alternative D1, although CSU stipulations would still apply and provide some protection to these resources. Moderate impacts to Mexican spotted owl would be possible due to habitat impacts during periods of low occupancy, and in the case of Semi-Primitive Non-Motorized areas, although oil and gas activities would be restricted to minimize impacts under CSU, developments would still be possible in these areas and could compromise the characteristics of the Semi-Primitive Non-Motorized ROS.

Alternative E1 (NSO in IRAs)

Alternative E1 impacts that are relatively more adverse than Alternative D1 or D2 would include those to suitable Wild and Scenic Rivers, recreation resources, migratory birds, endangered fish species, Utah prairie dog, greater sage-grouse, Sensitive bats, streams/lakes/springs/etc, municipal watersheds, rockfall areas, and caves. In general, major adverse impacts would be possible to many resources under Alternative E1 (and E2) due to the lack of protective leasing options. Potentially major impacts are possible to developed recreation sites, recreation

residences, Utah prairie dog, Mexican spotted owl, sage grouse, rockfall areas and steep slopes, Research Natural Areas, and Botanical/Geological Areas.

Alternative E2 (SLT in IRAs)
As for Alternative D2 (relative to D1), few impacts to resources besides IRAs would be measurably different under this alternative (E2) relative to Alternative E1. Besides IRAs, resource components for which impacts may be measurably more adverse (i.e., potentially major) under this alternative include Primitive and Semi-Primitive Non-Motorized ROS areas, Mexican spotted owl habitat, and within the Side Hollow Ponderosa Pine Provenance Study Area.

Environmental Consequences – Cumulative Effects

Cumulative effects are the total effect, including direct and indirect effects, on a given resource resulting from the incremental impact of past, present, and reasonably foreseeable future actions. They can result from individually minor, but collectively significant actions taken over a period of time. Cumulative effects may arise from single or multiple actions and the effects may be additive or interactive. The net adverse effect of interactive actions may be less than the sum of the individual effects (countervailing) or the actions may interact to create a net adverse cumulative effect that is greater than the sum of the individual effects (synergistic). The magnitude and extent of the effect on a resource depends on whether the cumulative effects exceed the ability of a resource to function at a desired level (CEQ 1997).

Under all action alternatives, connected actions as a result of full development of the RFDS could result in cumulative effects related to road maintenance costs and public safety if an oil field were developed and resulted in adding additional truck traffic to those routes currently used to transport oil from the Upper Valley oil field. This impact would be long term and moderate. Similarly, cumulative effects could occur if both a production field and the potential Coal Hollow Mine were to transport product on the same routes. This impact would be long term and major. Cumulative impacts would also be possible under all action alternatives (B-E) to the following resources: Moderate Scenic Integrity Objective areas (visual resources), air resources (including ozone, $PM_{2.5}$, and climate change) migratory birds, unstable soils and caves, major vegetation types that are at risk, and noxious weeds. Cumulative impacts to big game would be possible under Alternatives C-E. Cumulative impacts would be possible under Alternatives D and E for suitable Wild and Scenic Rivers, recreation resources, aquatic species, greater sage-grouse, Forest-sensitive plants, Mexican spotted owl, water and watershed resources, and Research Natural Areas. Cumulative impacts to IRAs would be possible under alternatives for D2 and E2, with CSU and SLT in IRAs, respectively.

Oil and Gas Leasing on the Dixie National Forest FEIS

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1.1 General Background on Oil and Gas Leasing

In many parts of the United States, National Forest System lands overlie geological formations that may contain oil and/or natural gas. The US Forest Service's (Forest Service) national policy on minerals (USFS 2007a) states that the "Exploration, development, and production of mineral and energy resources and reclamation of activities are part of the Forest Service's ecosystem management responsibility." In addition, the policy (USFS 2007a) indicates that the need to provide commodities for current and future generations should be balanced with the need to sustain the long-term health and biological diversity of ecosystems. Further direction comes from the Mining and Mineral Policy Act of 1970, which states that the federal government is to "foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs." In accordance with these directives, the Forest Service works with the Bureau of Land Management (BLM) to make many National Forest System lands available for leasing for the purpose of drilling exploratory wells and extracting oil and/or gas (USFS 2007a).

The Department of Interior, BLM, acts as the onshore leasing agent for the federal government. However, the Federal Onshore Oil and Gas Leasing Reform Act of 1987 increased the role of the Forest Service in the oil and gas leasing process. Consequently, the Forest Service developed new regulations (36 CFR Part 228 Subpart E and Part 261) to be consistent with the Leasing Reform Act and to provide guidance for oil and gas leasing and surface-use management on National Forest System lands. This established a staged decision process, which is designed to accommodate the speculative nature of oil and gas exploration and development. The first step in the process (other steps are outlined in Section 1.8.5.1) is a Forest Service leasing analysis. The Forest Service decides whether or not lands will be available for leasing, and under what conditions (leasing options) the leases will be issued.

The National Environmental Policy Act (NEPA) of 1969 also requires the Forest Service, along with its cooperating agencies, to identify and assess potentially significant environmental impacts and address issues associated with oil and gas leasing. In accordance with NEPA, the Forest Supervisor of the Dixie National Forest has decided to prepare an Environmental Impact Statement (EIS) to document the Forest Service leasing analysis process and disclose the potential effects of oil and gas leasing on the human environment. As the agency responsible for lease issuance and administration, the BLM has participated as a cooperating agency. The State of Utah also participated as a cooperating agency due to existing state jurisdiction by law and special expertise related to many resources including air quality, mining regulation, water quality, wildlife, and socioeconomics.

This EIS is not a decision document to grant the right to explore for and develop oil and gas. Rather, it is a document disclosing the environmental consequences of implementing various alternatives on the potential oil and gas leasing of lands that could be offered for lease in the future. Actual surface disturbing activities for oil and gas exploration and development would undergo future, project-specific environmental analyses.

The act of deciding which Dixie National Forest lands could be offered for lease in the future in itself does not cause environmental impacts. Environmental impacts described in this EIS are analyzed as the connected actions of the oil and gas exploration and development activities that could follow leasing actions. Connected actions are defined by the Council on Environmental Quality (CEQ 1508.25) as actions that: 1) automatically trigger other actions which may require

EISs, 2) cannot or will not proceed unless other actions are taken previously or simultaneously, and, 3) are interdependent parts of a larger action and depend on the larger action for their justification. Forest Service regulations (36 CFR 228.102(c)(4)) require the Forest Service to consider the subsequent actions that would be authorized by a lease as connected actions. Connected actions are the basis of the environmental analysis from which leasing decisions would be made. In this EIS, connected actions are the predicted disturbance from oil and gas leasing activity, which is discussed in the Reasonably Foreseeable Development Scenario (RFDS), Section 2.2.

1.2 Proposed Action

The Forest Supervisor of the Dixie National Forest and the Utah State Director of the BLM propose to decide which lands administered by the Dixie National Forest with federal oil and gas rights to make administratively available for oil and gas leasing. As the basis for making these decisions, the Forest Service and BLM conducted the analysis documented in this Final EIS. The analysis identifies areas that are legally available for leasing and could be made administratively available for leasing subject to the terms and conditions of the standard oil and gas lease form 3100-11 (BLM 2006a), or subject to constraints that would require the use of lease stipulations such as those prohibiting surface occupancy. Additionally, the analysis: 1) identifies four leasing alternatives, and the No Action/No Lease Alternative; 2) projects the type/amount of post-leasing activity that is reasonably foreseeable; 3) analyzes the reasonably foreseeable impacts of the projected post-leasing activity [36 CFR 228.102(c)] for each alternative on the human environment, including the cumulative impacts of past, present, and future actions; 4) provides the analysis needed to make the required agency decisions; and, 5) would be used to develop an amendment to the Dixie National Forest Land and Resource Management Plan (USFS 1986), if necessary.

1.3 Need for the Proposed Action

The current Dixie National Forest Land and Resource Management Plan (USFS 1986) was completed prior to the passage of the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (Leasing Reform Act) and does not determine the availability of National Forest System lands for oil and gas leasing. Since the Leasing Reform Act was signed into law, no new oil and gas leases have been authorized on the Dixie National Forest. All parcels leased prior to the 1986 Land and Resource Management Plan and the Leasing Reform Act of 1987 were drilled and held in production, closed, or suspended. However, the oil and gas industry continues to express interest in leasing, and interest has recently escalated due to the increased demand for oil and gas, high prices, and discoveries of oil and gas reserves in other areas with similar geologic conditions. The BLM Utah State Office has also received numerous written expressions of interest for leasing portions of the Dixie National Forest over the past several years. The Forest Service and BLM must process lease requests in accordance with the Energy Security Act, Leasing Reform Act, Energy Policy Act of 2005, and other existing laws and regulations.

Prior to processing lease requests and applications, the Forest Supervisor and Utah State Director of BLM must conduct the environmental analysis and make the administrative lease availability decisions required in the Leasing Reform Act and federal regulations 36 CFR 228, Subpart E, and 43 CFR 3100.

1.4 Purpose of the Proposed Action

The purpose of the Proposed Action is to complete a Forest-wide leasing analysis to comply with the Leasing Reform Act. This requires the Forest Service to analyze lands under its jurisdiction that are legally available for leasing. This analysis is also required to meet the federal regulatory requirements of 36 CFR 228.102, which established guidance for the process for oil and gas leasing on National Forest System lands in order to comply with the Leasing Reform Act.

1.5 Lands Involved

1.5.1 Analysis Area

The analysis area for this EIS is divided into the four ranger districts administered by the Dixie National Forest: Pine Valley, Cedar City, Powell, and Escalante. Oil and gas potential varies across the Dixie National Forest due to differences in geology, and dividing the analysis area by ranger district will allow for a more localized analysis of impacts. The four ranger districts cover approximately 481,264 acres, 404,283 acres, 388,603 acres, and 436,610 acres, respectively, for a total acreage of 1,710,761 acres. The analysis area (Figure 1.5-1) includes all National Forest System lands on the four ranger districts, with the exception of lands with private surface rights (referred to hereafter as private land) that cover 79,521 acres. With these areas excluded, the Analysis Area is approximately 1,631,240 acres. This includes 463,020 acres, 353,424 acres, 383,899 acres, and 430,897 acres on the Pine Valley, Cedar City, Powell, and Escalante Ranger Districts, respectively (Table 1.5-1). Within the analysis area, there are also several areas that are not legally available for leasing by the BLM. These areas cover a total of 85,503 acres and include designated wilderness areas, Brian Head Ski Area (which is under Special Use Authorization), the areas surrounding the Box-Death Hollow Wilderness Area known as Antone Bench and Areas 2, 3, 4, and 5, and National Forest System lands that have non-federal oil and gas rights. Areas not legally available for leasing are described in the analysis to provide context to the impacts analysis. Also, National Forest System lands with non-federal oil and gas rights are included in the analysis area since the Forest Service manages surface uses. The specific areas not legally available for leasing are listed in Table 1.5-1 and described in further detail in Section 1.5.2.

The analysis area encompasses approximately 13,454 acres of existing leases, of which approximately 9,495 acres on all or portions of 15 leases are within the Upper Valley Oil Field. The Upper Valley Oil Field is located in the southeast corner of the Escalante Ranger District and is the only producing oil field on the Dixie National Forest. Also, there are 3,380 acres of leased land on four different leases that predate the formation of the Box-Death Hollow Wilderness. The actual well sites on these leases were cherry-stemmed out of the wilderness when it was created and the wells are currently not producing. New leasing decisions made as a result of this analysis would not affect any of the existing leases; however, leased lands are included in the analysis so that when the leases expire the decision has been made whether or not to offer them for lease again and under what conditions. It is possible that currently leased lands would be available in the future with stipulations that are not in the current lease.

1.5.2 Lands not Legally Available for Leasing (NA)

1.5.2.1 Designated Wilderness Areas

The Dixie National Forest manages four designated wilderness areas: Pine Valley Mountain, Cottonwood Forest, Ashdown Gorge, and Box-Death Hollow. These wilderness areas are

located on the Pine Valley, Cedar City, and Escalante Ranger Districts, respectively (Table 1.5-1). The National Wilderness System was created by the Wilderness Act of 1964, which sought to provide the American people with the benefits of wilderness resources by establishing a national preservation system composed of "wilderness areas" that are managed by the federal agency having jurisdiction over the land prior to its establishment as wilderness. Subject to valid existing rights at the time the wilderness areas were established, minerals in lands within wilderness are withdrawn from appropriations under mining laws and disposition under mineral leasing laws. Leases adjacent to the Box Death Hollow Wilderness Area, for example, were either held by production or suspended during the Wilderness Review and signing of the Utah Wilderness Act of 1984 (see Section 1.5.2.3). These leases are subject to valid existing rights at the time the wilderness areas were established. All lands designated as Wilderness are withdrawn from mineral leasing by law, direct impacts to these lands are not analyzed in this EIS.

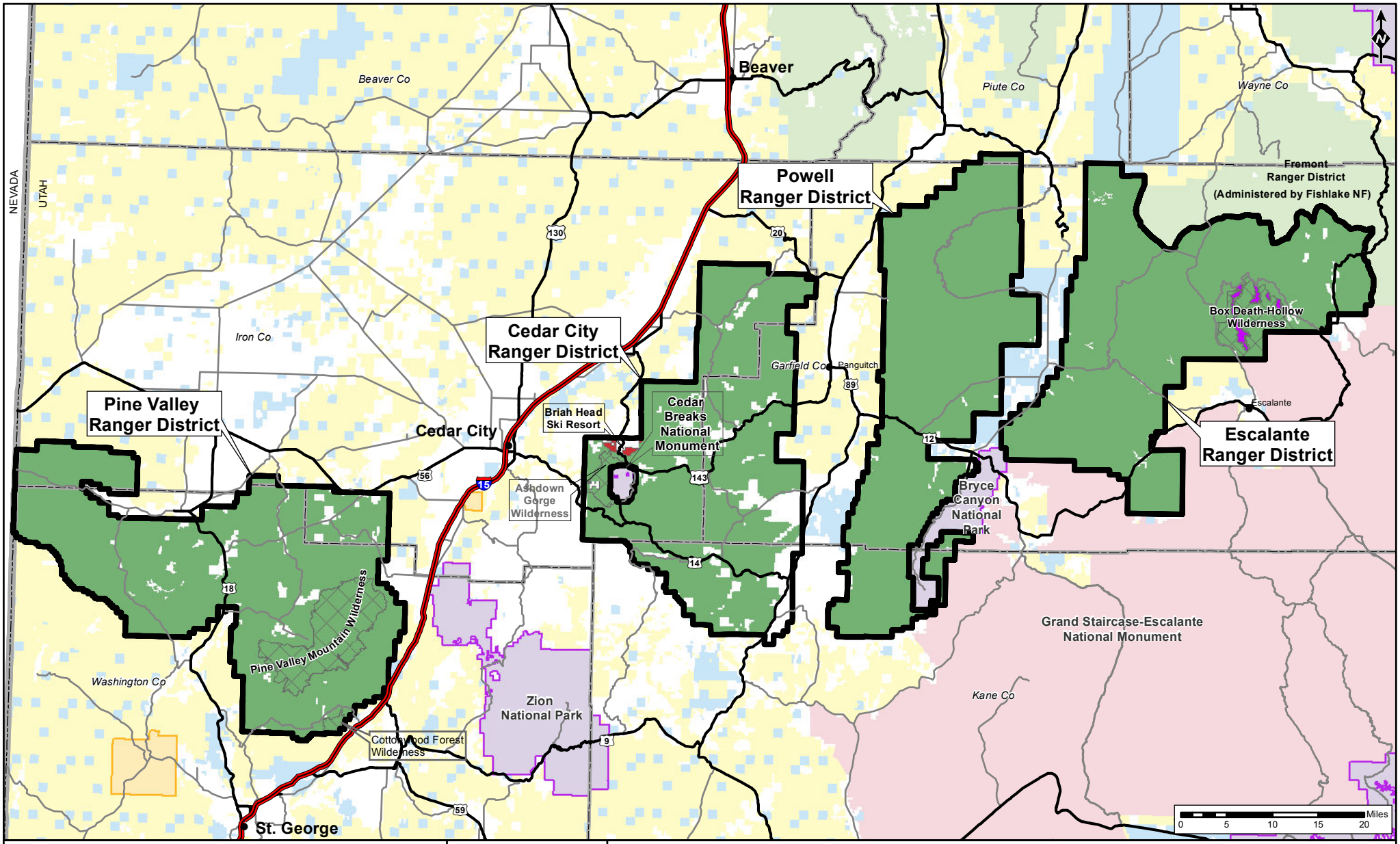
Table 1.5-1 Analysis Area and Acres of Lands not Available for Leasing, by Ranger District

Analysis Area		Acres				
		Pine Valley	Cedar City	Powell	Escalante	Forest Total
Base acreage (no lands excluded)[1]		481,264	404,283	388,603	436,610	1,710,761
Private land (excluded from analysis)[2]		18,244	50,859	4,705	5,713	79,521
Total analysis area		463,020	353,424	383,899	430,897	1,631,240
Not available for leasing (in analysis area)						
Wilderness Areas	Pine Valley Mountain	50,221				50,221
	Cottonwood Forest	2,643				2,643
	Ashdown Gorge		7,037			7,037
	Box Death Hollow				25,602	25,602
Brian Head Special Use Area			1,673			1,673
Antone Bench and Areas 2, 3, 4, and 5					3,224	3,224
National Forest System lands with non-federal minerals		165	488	85	70	808
Total not available for leasing		53,029	9,198	85	28,896	91,208

[1] Includes all National Forest System Lands within the administrative boundaries of each ranger district.
[2] Includes all lands with private surface rights, regardless of ownership of subsurface mineral rights

1.5.2.2 Brian Head Ski Area Special Use Area (SUA)

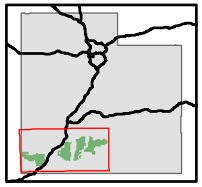
Lands located within the boundaries of ski areas under Special Use Authorization are not available for leasing under the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497c(j)). These lands are automatically withdrawn from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral and geothermal leasing. Brian Head Ski Area is the largest ski area in southern Utah. It is located on a mix of private land and approximately 1,673 acres of land administered by the Cedar City Ranger District.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 1.5-1
Analysis Area

1 inch = 14 miles	1:900,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Minor Roads*
- Highways
- Freeways
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Brian Head Ski Resort
- Withdrawn from Leasing**
- Fishlake National Forest

Other Land Administration
- Bureau of Land Management
- GSENM***
- National Park Service
- Private
- State of Utah
- Tribal

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil and gas leasing by the Utah Wilderness Act of 1984.
***Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

1.5.2.3 Antone Bench and Areas, 2, 3, 4, and 5

The Box-Death Hollow Wilderness Area was created by the Utah Wilderness Act of 1984 (98 Stat. 1657). When it was created, the areas adjacent to the Box-Death Hollow Wilderness known as Antone Bench and Areas 2, 3, 4, and 5, were cherry stemmed out of the wilderness area boundary due to the presence of several existing carbon dioxide leases. However, Section 306a of the Utah Wilderness Act of 1984 specified that, subject to valid existing rights, these areas would be withdrawn from any future oil and gas leasing provided no leases were issued in the five years following the 1984 Act that led to production in commercial quantities (no additional leases were issued). As a result, these areas are considered to be not available to oil and gas leasing in this EIS.

1.5.2.4 Split Estate Lands

Split estate lands are those lands where the surface rights and the subsurface mineral rights are controlled by different parties. Split estate lands on the Dixie National Forest include approximately 808 acres on which the Forest Service has surface rights but not mineral rights. Federal agencies do not have the authority to issue oil and gas leases on any lands where the subsurface oil and gas mineral estate is not under federal jurisdiction, and cannot make a decision about their leasing availability. However, the Forest Service can issue authorization for surface use of these lands. Due to the ability of the Forest Service to manage surface use on these lands and the fact that the amount of these lands within the Dixie National Forest boundary is relatively small (808 acres), these lands were not withdrawn from the analysis area or depicted on any maps. Despite this, any leasing decisions made in this EIS would not apply to any lands with a non-federal mineral right. Furthermore, there are additional lands within the Dixie National Forest boundary that have 1) both non-federal oil and gas rights and private surface rights, and 2) either state (85 acres) or private (105) acres surface rights and federal oil and gas rights, which are under BLM authority. These areas are excluded from the analysis area as described in Section 1.5.1. Although leasing decisions made in this EIS would not apply to split estate lands, the development of stipulations and Best Management Practices (BMPs) in this EIS may provide useful reference for any future surface use on split estate lands. The Forest Service would recommend stipulations for surface use similar to the Dixie National Forest lands surrounding any split estate parcel.

1.6 Decisions to be Made

The Dixie National Forest Supervisor will decide which federal lands administered by the Dixie National Forest with federal oil and gas ownership will be administratively available for oil and gas leasing and will identify required lease stipulations for specific areas (36 CFR 228.102(d)). The Forest Supervisor will also authorize the BLM to offer available lands for lease, subject to the Forest Service identified stipulations (36 CFR 228.102(e)).

The Dixie National Forest will amend the Land and Resource Management Plan, as necessary, to incorporate the leasing decisions and other changes as indicated in the analysis.

The BLM Utah State Director will decide whether to offer for lease those National Forest System lands authorized for leasing by the Forest Service and make the required leasing decisions for non-federal lands with federal oil and gas ownership within the Forest boundaries (43 CFR 3100).

The responsible officials of the Forest Service and BLM will release separate Records of Decision. The Records of Decision will identify which lands will be administratively available for oil and gas leasing along with associated conditions and lease stipulations.

The Records of Decision will not authorize specific surface-disturbing activities. Post-lease proposals to conduct operations will be evaluated on a site-specific basis and the respective decisions will be documented in accordance with applicable laws and regulations. The process for evaluating post-lease application to conduct operations is described in Section 1.8.5.1.

In addition, the conditions and stipulations identified in the Records of Decision would apply to those actions occurring on lease and do not necessarily apply to roads, pipelines, or seismic activity that may extend beyond the boundaries of a lease. The appropriateness and location of those activities and facilities would be evaluated in separate, project-specific environmental analyses and would be based on standards and guidelines in the Land and Resource Management Plan.

1.7 Cooperating Agencies

The BLM is responsible for issuing oil and gas leases on federal lands and on private lands for which the federal government retains mineral rights. The BLM cannot issue leases for lands administered by the Forest Service without consent from the Secretary of Agriculture. As the agency responsible for federal lease issuance and administration, the BLM participated in this EIS as a cooperating agency. The State of Utah participated as a cooperating agency due to existing state jurisdiction by law and/or special expertise related to many resources including air quality, mining regulation, water quality, wildlife, and socioeconomics.

1.8 Decisions, Policy, and Legislation that Influence this EIS

This section summarizes the Dixie National Forest decisions, Forest Service policy, and other legislation and policy that influence the scope and content of this EIS. Section 1.8.1 summarizes the Dixie National Forest Land and Resource Management Plan and how it pertains to this EIS. Section 1.8.2 summarizes the 2001 Roadless Area Conservation Rule, the legal decisions effecting its management, and how it relates to this EIS. Section 1.8.3 summarizes the Wild and Scenic River Suitability Study for National Forest System Lands in Utah and how it relates to this EIS. Section 1.8.4 summarizes general decisions, policy, and legislation relating to oil and gas leasing on federal lands, and Section 1.8.5 provides a more detailed summary of the federal leasing process.

1.8.1 Land and Resource Management Plan

Management of each administrative unit of the National Forest System (one or more National Forest(s) or National Grassland(s)) is governed by a Land and Resource Management Plan. The existing Dixie National Forest Land and Resource Management Plan was approved in 1986 and includes general decisions, as part of management prescriptions, to provide for oil and gas leasing, but does not include decisions for leasing specific lands. Prior to the passage of the Leasing Reform Act and except for acquired lands, the Forest Service had no authority to make decisions related to issuing or not issuing oil and gas leases on National Forest System lands. As a result, the current Land and Resource Management Plan, which predates the Leasing Reform Act, does not fully meet the intent of the current regulations to make site-specific leasing decisions. This EIS and decisions the Forest Supervisor will make, including availability of lands for oil and gas leasing, will be used to develop an amendment to the Land and Resource Management Plan.

1.8.2 2001 Roadless Area Conservation Rule and Legal Activity

The Forest Service identified Inventoried Roadless Areas (IRAs) nationwide as part of its 1972-1985 Roadless Area Review and Evaluation process. All the IRAs in the nation were reviewed again by the Forest Service in 1999 under the Roadless Area Conservation Initiative. In November 2000, the Forest Service issued the Final EIS for the proposed Roadless Area Conservation Rule. The final Roadless Area Conservation Rule was published in the Federal Register on January 21, 2001 (66 FR 3244). For the purposes of this analysis, IRAs are considered to be those areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps. The Roadless Area Conservation Rule and the interim protection leading up to it replaced forest-by-forest decision making with uniform national protections.

The Forest Service Roadless Area Conservation Rule applied to Forest Service actions in all IRAs. The Roadless Area Conservation Rule prohibits a Forest Service responsible official from approving road construction and reconstruction and the cutting, sale, or removal of timber in IRAs except when the responsible official determines certain circumstances apply (36 CFR 294). Among the circumstances when the rule does not apply are:

(1) A road is needed to protect public health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property.

(2) A road is needed to conduct a response action under the Comprehensive Environmental Response, Compensation, and Liability Act or to conduct a natural resource restoration action under Comprehensive Environmental Response, Compensation, and Liability Act, Section 311 of the Clean Water Act, or the Oil Pollution Act.

(3) A road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty.

(4) Road realignment is needed to prevent irreparable resource damage that arises from the design, location, use, or deterioration of a classified road and that cannot be mitigated by road maintenance. Road realignment may occur under this paragraph only if the road is deemed essential for public or private access, natural resource management, or public health and safety.

(5) Road reconstruction is needed to implement a road safety improvement project on a classified road determined to be hazardous on the basis of accident experience or accident potential on that road.

(6) The Secretary of Agriculture determines that a Federal Aid Highway project, authorized pursuant to Title 23 of the United States Code, is in the public interest or is consistent with the purposes for which the land was reserved or acquired and no other reasonable and prudent alternative exists.

(7) A road is needed in conjunction with the continuation, extension, or renewal of a mineral lease on lands that are under lease by the Secretary of the Interior as of January 12, 2001 or for a new lease issued immediately upon expiration of an existing lease. Such road construction or reconstruction must be conducted in a manner that minimizes effects on surface resources, prevents unnecessary or

> unreasonable surface disturbance, and complies with all applicable lease requirements, land and resource management plan direction, regulations, and laws. Roads constructed or reconstructed pursuant to this paragraph must be obliterated when no longer needed for the purposes of the lease or upon termination or expiration of the lease, whichever is sooner.

In 2001, several groups and states filed lawsuits challenging the 2001 Roadless Area Conservation Rule. The Idaho Federal District Court issued a preliminary injunction on May 10, 2001 prohibiting the Forest Service from implementing the rule. On December 12, 2002, the Ninth Circuit Court of Appeals reversed and remanded the Idaho District Court's injunction, concluding that the Forest Service had provided adequate notice and opportunity to comment and had properly considered a reasonable range of alternatives under NEPA. The Ninth Circuit Court issued its mandate to the Idaho District Court to remove its preliminary injunction on April 4, 2003, thereby putting the Roadless Area Conservation Rule into effect. However, on July 14, 2003, the US District Court for the District of Wyoming found the Roadless Area Conservation Rule to be unlawful and ordered the rule be permanently enjoined. The Forest Service did not appeal the ruling; however, several other groups did.

On July 12, 2004, Ann M. Veneman, then Secretary of Agriculture, announced a proposal to establish a state petitioning process for IRA management. The proposed rule was published on July 16, 2004. On May 13, 2005, the Forest Service issued a Final State Petition Rule, which replaced the enjoined 2001 Roadless Area Conservation Rule. This 2005 rule established a process for governors with National Forest System IRAs in their state to petition the Secretary of Agriculture to establish or adjust management requirements for these areas. Unless governors chose to initiate a change through the petition process, existing IRA management requirements contained in individual land and resource management plans would remain unchanged. With adoption of the State Petition Rule, the Wyoming District Court's decision was vacated by the Tenth Circuit Court and the associated appeals were dismissed, on grounds that the case was made moot by the State Petition Rule. However, in 2005, several states and groups filed lawsuits challenging that the Forest Service replaced the 2001 Roadless Area Conservation Rule with the State Petition Rule without conducted additional NEPA analysis or consultation under the Endangered Species Act (ESA), which was a violation of these laws.

On September 20, 2006, the United States District Court for the Northern District of California set aside the 2005 State Petitions Rule and reinstated the 2001 Roadless Area Conservation Rule nationwide, except in the Tongass National Forest. The Court ruled that in adopting the State Petition Rule the Forest Service failed to adequately consider the environmental and species impacts, in violation of NEPA and ESA. In addition, on November 29, 2006, the Court issued an injunction halting all activities inconsistent with the 2001 Roadless Area Conservation Rule. In the injunction, the Court stated that the 2001 rule had been repealed illegally and therefore all projects in roadless areas inconsistent with that rule were also illegal and must be halted. On February 6, 2007, the Court issued a final injunction, clarifying that the injunction extended to oil and gas drilling permits (as well as leases) issued since May 2005. As a result of this ruling, the 2001 Roadless Area Conservation Rule currently governs roadless area management on National Forest System lands.

On August 8, 2008, the Federal District Court for the District of Wyoming again held that the Roadless Area Conservation Rule was unlawfully promulgated in violation of NEPA and Wilderness Act. As a result, there are two conflicting court decisions in different federal courts both issuing decisions with nationwide impact.

On May 28, 2009, Secretary of Agriculture Tom Vilsack issued Memorandum 1042-154 which reserves "to the Secretary the authority to approve or disapprove road construction or reconstruction and the cutting, sale, or removal of timber in those areas identified in the set of inventoried roadless area maps contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000." Approximately, 49.2 million acres are affected. The Secretary has since re-delegated some authorities back to the Forest Service. On May 29, 2010, the Secretary issued a new Memorandum 1042-155. It is essentially the same as the previous memorandum with the re-delegations, but includes the re-delegation to the Under Secretary Natural Resources and Environment for decisions covered by the 1872 Mining Laws. The new memorandum expires within one year, but can be re-issued.

The Forest Service is actively seeking advice and counsel from the Office of the General Counsel and Department of Justice on how to proceed in light of these two orders. The range of alternatives analyzed in this document should cover any potential disposition of the 2001 Roadless Area Conservation Rule.

There are 38 IRAs on the Dixie National Forest encompassing 570,786 acres of National Forest System land, which represents approximately 35 percent of the analysis area for this EIS. As IRAs represent such a large proportion of the Dixie National Forest, any changes in roadless area conservation due to judicial actions would impact potential oil and gas leasing and this analysis. As a result, this analysis evaluates a range of alternatives that includes leasing options prohibiting road construction and timber removal to meet the intent of the 2001 Roadless Area Conservation Rule, as well as other leasing options that allow new disturbance within IRAs for oil and gas exploration and development (assuming future changes in the status of the 2001 Roadless Area Conservation Rule would allow this). This provides a framework to make decisions concerning oil and gas leasing in these areas should any changes occur in the legal status of the 2001 Roadless Area Conservation Rule in the future.

1.8.3 Wild and Scenic River Suitability Study for National Forest System Lands in Utah

In November 2008, the Forest Service issued a Record of Decision for the Wild and Scenic River Suitability Study for National Forest System Lands in Utah. Out of 86 eligible river segments on National Forests in Utah that were found eligible for consideration for Wild and Scenic Rivers designation during forest planning efforts, ten rivers were found suitable for designation. The Dixie National Forest had six eligible segments and four of these segments were found suitable for inclusion in the National Wild and Scenic Rivers System. If a river was not found suitable, but previously had been found eligible, it is no longer eligible after the suitability decision. These segments are discussed in Section 3.3.

1.8.4 Legislation and Policy Relating to Oil and Gas

1.8.4.1 The Mineral Leasing Act of 1920 (as amended)

The Mineral Leasing Act of 1920, as amended, authorizes and governs oil and gas leasing on lands with federal oil and gas rights. The primary authority and responsibility for determinations regarding leasing remained with the Secretary of the Interior and the BLM. The Act makes deposits of oil and gas on federal lands available for oil and gas leasing, unless a specific land order has been issued to close an area. The Act also mandates that oil and gas surface-disturbing activities be regulated and reclamation procedures developed for the conservation of surface resources. Further, with the exception of National Park System lands and Indian Trust lands, it authorizes rights-of-ways through federal lands for oil and gas pipelines. The

development of regulations and stipulations for the protection of the environment, and individuals relying on the environment for subsistence purposes, are required for all rights-of way.

1.8.4.2 The Mineral Leasing Act for Acquired Lands of 1947

The Mineral Leasing Act for Acquired Lands of 1947 states that all deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulfur that are owned or may be acquired by the US and that are within lands acquired by the US may be leased by the Secretary of the Interior under the same conditions as contained in the leasing provisions of the mineral leasing laws. No mineral deposits shall be leased without the consent of the head of the executive department having jurisdiction over the lands containing the deposit and subject to such conditions as that official may prescribe.

1.8.4.3 Multiple Mineral Development Act of 1954

The Multiple Mineral Development Act of 1954 was enacted to amend the mineral leasing laws and the mining laws to provide for multiple mineral development of the same tracts of public lands. Prior to passage of the act, locatable minerals could not be patented on tracts of ground with existing mineral leases, and mineral leases could not be offered on lands with mineral patents. The Multiple Mineral Development Act was included as Chapter 12 in the Mining and Minerals Policy Act of 1970 (30 U.S.C 521 et seq.)

1.8.4.4 The Mining and Minerals Policy Act of 1970

The Mining and Minerals Policy Act of 1970 indicates that the continuing policy of the federal government is to foster and encourage private enterprise in the development of economically sound and stable domestic mining and minerals industries and the orderly and economic development of domestic mineral resources.

1.8.4.5 The Energy Security Act of 1980

The Energy Security Act of 1980 directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on National Forest System lands, notwithstanding the current status of any management plan being prepared.

1.8.4.6 The Federal Onshore Oil and Gas Leasing Reform Act of 1987

The Leasing Reform Act amended the Mineral Leasing Act of 1920. It provided the Forest Service with more input on oil and gas leasing on National Forest System lands. Under the Leasing Reform Act, the authority to issue all leases for federally owned oil and gas remained with the BLM. If the BLM decision is to offer the leases for sale, the Forest Service decisions for leasing with certain stipulations are binding on the BLM for National Forest System lands. Prior to the Leasing Reform Act of 1987, the Forest Service's authority regarding oil and gas leases issued on National Forest System lands was varied, and in most cases the Forest Service only made nonbinding recommendations to the BLM. The 36 CFR 228 subpart E regulations, issued in April 1990 and discussed in Section 1.1.1.3 and Section 1.8.5.1, established the process for making oil and gas leasing decisions in accordance with the Leasing Reform Act. An overview of the entire federal leasing process is presented in Section 1.8.5.

1.8.4.7 Leasing Decision May 4, 1988

A leasing decision was made as the result of the Escalante Known Geological Structure EIS (USFS 1988). Subsequently, 34,544 acres of National Forest System land were authorized for

lease. Since then, the majority of these leases have expired, and Forest Service officials have decided to re-examine this decision in the bigger context provided by this EIS.

1.8.4.8 36 CFR 228E Regulations 1990

Title 36 CFR, Subpart E, provides direction to the Forest Service to administer and regulate surface uses and leases on National Forest System lands. These regulations prescribe methods by which the Forest Service will make decisions with regard to oil and gas leases and subsequent management of oil and gas operations. These regulations lay out the process for determining lands administratively available for leasing, including the designation of stipulations and the projection and analysis of post-leasing activity. The regulations describe the Forest Service process for authorizing the BLM to offer leases for sale. This process is described in more detail in Section 1.8.5.1.

1.8.4.9 Forest Service Strategic Plan for Fiscal Years 2007-2012

The Government Performance and Results Act of 1993 requires the Forest Service to prepare a Strategic Plan at the National level. As part of Goal (2) of the Strategic Plan for Fiscal Years 2007-2012 (to Provide and Sustain Benefits to the American People), Objective 2.3 is to help meet energy resource needs. The Strategic Plan does not specify objectives specific to oil and gas leasing but provides general direction to considering opportunities for energy development and the supporting infrastructure on National Forest System lands.

1.8.4.10 Title 43 CFR 3160: Federal Oil and Gas Regulations 1996

Title 43 CFR Part 3160 provides regulations for all onshore oil and gas operations. The regulations govern operations associated with the exploration, development, and production of oil and gas deposits from leases issued under the direction of the Director of the BLM. The objective of these regulations is to promote the orderly and efficient exploration, development, and production of oil and gas.

1.8.4.11 Forest Service Manual 2820

Chapter 2820 (Mineral Leases, Permits and Licenses) of Forest Service Manual 2800 (Minerals and Geology) provides direction for the Forest Service to regulate surface use directly related to the drilling and production of an oil and gas well, including uses located off lease. No permit to drill on a Federal oil and gas lease for National Forest System lands may be granted without the analysis and approval of a surface use plan of operations covering proposed surface disturbing activities. (CFR 228.106)

1.8.4.12 The Energy Policy Act of 2005

The Energy Policy Act or 2005 directs the Secretaries of the Interior and Agriculture to improve administration of federal oil and gas leasing programs. This includes the improvement of inspection and enforcement of oil and gas activities. It also requires the development and implementation of BMPs. In addition, it requires the Secretaries of the Interior and Agriculture to enter into a Memorandum of Understanding (MOU) to improve coordination and consultation on oil and gas leasing activities. The Secretaries of Agriculture and Interior entered into a MOU in April 2006 (FS Agreement No. 06-SU-11132428-052). The purpose of the MOU was to satisfy requirements of the Energy Policy Act of 2005 and to establish joint BLM and Forest Service policies and procedures for managing oil and gas leasing and subsequent actions.

1.8.4.13 Onshore Oil and Gas Order Number 1

In March 2007, Onshore Oil and Gas Order Number 1, Approval of Operations, was revised (72 FR 10308). The order provides the requirements necessary for the approval of all proposed oil and gas exploratory, development, or service wells and their subsequent well operations, including abandonment, on all federal oil and gas leases. The order includes leases where the surface is managed by the Forest Service. The revisions were necessary due to provisions in the Leasing Reform Act, the Energy Policy Act of 2005, legal opinions, court cases since the original order was issued, and other policy or procedural changes. The revised order assures that the processing of Applications for Permit to Drill is consistent with the Leasing Reform Act and clarifies the regulations and procedures that are to be used when dealing with split estate lands. The revised rule also addresses using Master Development Plans, encourages the voluntary use of BMPs as part of Applications for Permit to Drill processing, and requires additional bonding on certain off-lease facilities.

1.8.5 Federal Management of Leases and Associated Development

1.8.5.1 Federal Leasing Process

Under the Leasing Reform Act, the BLM continues to act as the onshore leasing agent for the federal government. However, it also increased the role of the Forest Service in the leasing process. The Leasing Reform Act states that the BLM cannot lease National Forest System lands over the objection of the Forest Service and authorizes the Forest Service to regulate all surface-disturbing activities conducted pursuant to a lease on National Forest System lands. The act also requires site-specific environmental analysis at the leasing stage. Consequently, the Forest Service developed new regulations (36 CFR Parts 228 and 261) to be consistent with the Leasing Reform Act and to provide guidance for oil and gas leasing. A result of this process was the establishment of a staged decision making process for consideration of oil and gas leasing activities on National Forest System lands. The process is designed to accommodate the tentative nature of oil and gas exploration and development. In general, the various steps that are undertaken are:

(1) Forest Service leasing analysis

(2) Forest Service notification to BLM of lands administratively available for leasing

(3) Forest Service review and verification of BLM leasing proposals

(4) BLM assessment of Forest Service conditions of surface occupancy

(5) BLM offers lease

(6) BLM issues lease

(7) Forest Service review and approval of lessee's SUPO

(8) BLM review and approval of lessee's Application for Permit to Drill (APD), which includes the SUPO

(9) Ensure final reclamation

Based on the Forest Service leasing analysis (step 1 above), the Forest Service decides whether or not lands will be available for leasing and under what conditions (stipulations) the leases will be issued. This EIS will fulfill this step for the Dixie National Forest. If lands are determined to be available for leasing, the Leasing Reform Act requires that leases be offered first for competitive leasing at an oral auction. Noncompetitive leases may be issued only after

no competitive bids have been received. Competitive and noncompetitive leases are held for a period of ten years. If oil and/or gas are discovered, the leases continue for the period that oil and/or gas are produced in paying quantities. In the lower 48 states, the maximum competitive lease size is 2,560 acres and the maximum noncompetitive lease size is 10,240 acres.

As shown above, there are many activities for which BLM has joint or sole responsibility regarding the implementation of the Dixie National Forest leasing analysis. The BLM retains sole responsibility for making decisions with regard to the analysis of subsurface impacts. The USFS and BLM will delegate authority and responsibility as outlined in the provisions of the National BLM/USFS MOU (2006; see Section 1.8.4.12).

1.8.5.2 Standard Lease Terms

Standard lease terms (SLTs) are contained in BLM Lease Form 3100-11 (BLM 2006a), Offer to Lease and Lease for Oil and Gas. As a minimum, all leases must contain SLTs. Under the SLTs, the lessee has the right to use as much of the leased lands as is necessary to explore or drill for, extract, remove, and dispose of oil and gas deposits that may be in the leased lands, together with the right to build and maintain necessary improvements thereon. Section 6 of the standard lease form requires the operator to conduct operations in a manner that minimizes adverse impacts to the land, air, water, cultural, biological, visual, and other resources and land uses or users. In addition, if threatened or endangered species; objects of historic, cultural, or scientific value; or substantial unanticipated environmental effects are encountered during operations, all work affecting the resource must cease, and the land management agency contacted. Standard lease term operations cannot violate any other federal environmental protection laws (e.g., Clean Air Act, Clean Water Act, Endangered Species Act, etc.). Measures to avoid impacts to specified resources include, but are not limited to, the modification to the siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Well sites may be moved up to 200 meters (656 feet) and operations delayed for up to 60 days without interfering with the lease rights.

1.8.5.3 Stipulations

A lease does not convey an unlimited right to explore or to develop any oil or gas resources found under the land. In areas where the exploration and development of oil and gas resources would conflict with the protection or management of other resources and public land uses, terms and conditions may be applied to the lease to manage how operations are conducted or where they can be located. These terms and conditions, derived from legal statutes and measures to minimize adverse impacts to other resources, are defined in a lease as stipulations. Stipulations modify the rights the government grants to a lessee. However, the terms and conditions in a stipulation would only apply to the lessee and not to all potential land uses. All applicable stipulations are provided to by potential lessees prior to any lease sale.

The Rocky Mountain Regional Coordinating Committee published the *Uniform Format for Oil and Gas Lease Stipulations* in March 1989 (RMRCC 1989). This guidance provides uniform definitions, format, and wording for federal oil and gas leasing stipulations including No Surface Occupancy (NSO), Timing (or seasonal) Limitations (TL), and Controlled Surface Use (CSU). This guidance also includes the use of Lease Notices (LN). There is also provision for special administration or unique stipulations, such as those required by prior agreements between agencies or other instances when standardized forms are not appropriate. These formats have been adopted for nationwide use and are as follows:

NO SURFACE OCCUPANCY (NSO)

Use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values under the NSO stipulation. NSO is intended for use only when other stipulations are determined insufficient to adequately protect the public interest. With the exception of seismic exploration, NSO applies to all uses and facilities associated with oil and gas development including occupancy for well sites, drilling and pad construction, and central tank batteries. It may either prohibit or permit access roads, pipelines, or other related facilities if identified in specific NSO stipulations. The suitability and acceptability of constructing a road, pipeline, or similar linear facility outside of the subject lease would be evaluated using standards and guidelines in the Land and Resource Management Plan, the same as roads related to other resource uses would be.

TIMING LIMITATIONS (TL)

The TL stipulation (often called seasonal restrictions) prohibits surface use during specified time periods to protect identified resource values. A TL applies for restrictions longer than 60 days and shorter than one year. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient. Examples of a TL stipulation include, but are not limited to, limitations developed to protect wildlife habitat during critical time periods or prevent erosion during periods of high soil erodibility. The TL may also specify that the restrictions apply when certain surface conditions exist, such as water-saturated soils or during spring thaws when road beds are too soft to allow traffic without unacceptable damage to the road.

CONTROLLED SURFACE USE (CSU)

The CSU stipulation is intended to be used when fluid mineral occupancy and use are generally allowed on all or portions of the lease area year-round, but because of special values, or resource concerns, lease activities must be strictly controlled. The CSU stipulation is used to identify constraints on surface use or operations that may otherwise exceed the mitigation provided by Section 6 of the standard lease terms and the regulations and operating orders. The CSU stipulation is less restrictive than the NSO or TL stipulations, which prohibit all occupancy and use on all or portions of a lease for all or portions of a year. The CSU stipulation should not be used in lieu of an NSO or TL stipulation. The use of this stipulation should be limited to areas where restrictions or controls are necessary for specific types of activities rather than all activity. The stipulation should explicitly describe the activity that is to be restricted or controlled or the operation constraints required, and must identify the applicable area and the reason for the requirement.

LEASE NOTICE (LN)

A LN is attached to leases to transmit information at the time of lease issuance to assist the lessee in submitting acceptable plans of operation or to assist in administration of leases. A LN is attached to leases in the same manner as stipulations; however, there is an important distinction between a LN and stipulations – a LN does not involve new restrictions or requirements. Any requirements contained in a LN must be fully supported in a law, regulation, SLT, or onshore oil and gas order.

1.8.5.4 Mitigation Measures

Mitigation is employed in three major areas. First, standard terms of BLM Lease Form 3100-11, 43 CFR 3100, and 36 CFR 228E, contain basic mitigation measures to protect the environment.

Second, at the time lands are offered for lease, special stipulations may be added to protect specific resource values. Examples are NSO on steep slopes or TL for big game winter range. Finally, at the Application Permit to Drill stage, additional site-specific mitigation measures may be required or incorporated through negotiations with the applicant to protect site-specific resources. Additional mitigation measures may be required or negotiated at this stage as a result of on-the-ground examination and NEPA analysis. Conditions of Approval (COA) can be required if they are within the terms of the lease and negotiated if they are outside the terms of the lease. These are determined on a site-specific, case-by-case basis. Any post-lease mitigation applied must be approved and may not change the intent of the lease or impose undue constraint upon the lessee or their operator. Authority to require such standards is provided by the Mineral Leasing Act of 1920, as amended, Federal Regulations at 36 CFR 228.106-108 (Submission, Review, and Requirements of Surface Use Plans of Operations) and 43 CFR 3162.3 (BLM procedures for approval of post-lease applications for operations).

The Dixie National Forest has developed a set of standards for oil and gas operations (Appendix C - *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements*), which will be added to the Dixie National Forest Service Handbook (Geology and Minerals). Operators are encouraged to obtain these operating standards from the Forest Service early in the planning and approval process and to incorporate them into their Surface Use Plans of Operations to help streamline the NEPA analysis and approval process. If not incorporated into the initial SUPO, the Forest Service will work with the operator to revise the SUPO to include them or may otherwise require them as COA. They may be modified if needed to address site-specific conditions. Other standards or mitigations may be required based on site-specific evaluations of proposed activities.

1.8.5.5 Bonding

The lessee or their operator must furnish a lease bond of at least $10,000 before beginning any surface-disturbing activities related to drilling. In lieu of individual lease bonds, lessees, owners of operating rights (sublessee), or operators may furnish a bond in an amount of not less than $25,000 covering all leases and operations in any one state; or a bond in the amount not less than $150,000 covering all leases and operations nationwide. The bond is intended to ensure compliance with all lease terms, including protection of the environment. The BLM may increase the bond amount any time conditions warrant such an increase, or the Forest Service can require additional bonding under 36 CFR 228.109

1.8.5.6 Lease Terms and Conditions

The lease grants the lessee the right to explore and drill for, extract, remove, and dispose of oil and gas deposits, except helium, that may be found in the leased lands. Subject to special stipulations as noted above, the leases are granted on the condition that the lessee will obtain BLM and Forest Service approval before conducting any surface-disturbing activities. The oil and gas lease conveys the right to develop those resources on the leased land. The lessee or their operator cannot build a house on the land, cultivate the land, or remove any minerals other than oil and gas from the leased land (BLM 2007a).

1.8.5.7 Rentals and Royalties

During the first five years of the lease, current annual rental rates for competitive and noncompetitive leases are $1.50 per acre or fraction of the acre. After the first five years, current annual rental rates increase to $2.00 per acre. The current royalty rate on production is 12.5 percent.

1.8.5.8 How a Lease Expires or Terminates

Oil and gas leases expire at the end of their term. A term is ten years, but leases may be extended (not to exceed two years) beyond their primary term for diligent drilling operations or be eliminated from an approved Unit Agreement. Leases that produce paying quantities of oil or gas do not expire until production ends. Leases without producing wells automatically terminate if the lessee fails to make full and timely payment of the annual rental. The rental must be received by the federal government on or before the anniversary date of the lease. The owner of a lease may also relinquish the lease in whole or in part by filing a written relinquishment with the BLM State Office having jurisdiction over the leased lands. The lessee is responsible for plugging any abandoned wells and for other work required by the BLM to place the leasehold in proper condition for abandonment and bring the lease account into good standing. If the lessee fails to perform the required abandonment work, the bond will be used to pay for the costs of abandonment, and the lessee will be prohibited from leasing any additional federal lands.

1.8.5.9 Lease Stipulation Modifications, Waivers, and Exceptions

As outlined in 36 CFR Sec 228.104, a lessee may request that a stipulation included in a lease be modified (permanently changed), waived (permanently removed), or granted an exception (case-by-case exemption). The lessee must provide all information necessary for the authorized Forest Service official to review the request and make a decision whether or not to authorize the BLM to modify, waive, or grant an exception to the stipulation. As part of the review, the Forest Service official must ensure compliance with NEPA and any other applicable laws. In addition, the Forest Service official must assure that, if the stipulation were modified, waived, or granted an exception, the subsequent action would comply with the following requirements (listed in 36 CRF Sec 228.104):

- The action would be consistent with applicable federal laws.
- The action would be consistent with the current Forest Land and Resource Management Plan.
- The management objectives, which led the Forest Service to require the inclusion of the stipulation in the lease, can be met without restricting operations in the manner provided for by the stipulation given the change in present conditions of the surface resources involved, or given the nature, location, timing, or design of proposed operations.
- The action is acceptable the authorized Forest Service official.

1.9 Public Involvement and Key Issues Identified

1.9.1 Public Involvement

The Notice of Intent (NOI) is the first step in initiating the public scoping process under NEPA. The NOI for this EIS was published on December 29, 2006 in the Federal Register, Volume 71, No. 250, Page 78395. The publication of the NOI initiated formal scoping. A legal notice describing the proposal and requesting scoping input was also published in *The Spectrum,* St. George, Utah on December 30, 2006 and press releases were sent to the *Cedar City Review* and *Daily News*, Cedar City, Utah and *Garfield County Insider*, Panguitch, Utah on January 3, 2007. In addition, scoping letters requesting scoping input were sent to interested individuals, agencies, and groups on December 19, 2006. Scoping meetings were held in St. George, Cannonville, and Cedar City on January 16, 17, and 18, 2007, respectively. The meetings provided a project description, maps of the analysis area, and a forum for exchange of

information and ideas or concerns related to the proposal. An additional open house was held in Escalante, Utah on February 12, 2007. The open house was not an official scoping meeting but did provide a project description, maps of the analysis area, and a forum for exchange of information, ideas, and concerns. Comment forms were available at all three scoping meetings and the open house. Beginning December 29, 2006, the Dixie National Forest's website has contained pertinent information on the project such as a project description, maps, and contact information. In addition, the web site provided an on-line comment form. Additional details concerning public involvement and scoping results can be found in the Project Record.

On October 17, 2008, a Notice of Availability (NOA) announcing the availability the DEIS for a 60-day public comment period was published in the Federal Register (http://www.gpoaccess.gov/fr/) and on the EPA's Federal Register of Environmental Documents (http://www.epa.gov/fedrgstr/). Letters were mailed to all parties that provided scoping comments, along with CDs containing an electronic copy of the DEIS if requested. These letters described the public comment period; and how, where, and when to submit comments. Paper copies of the DEIS were distributed to all cooperating agencies and any requesting interested organization or individual. An electronic copy of the DEIS was also made available for download on the Dixie National Forest website. Additional paper and CD copies were made available for the public at the Cedar City BLM Office and Dixie National Forest Supervisor's Office. Public meetings for the DEIS were held on November 5 in Cedar City, Utah (2 attendees); November 6 in Boulder, Utah (9 attendees); and November 13 in Panguitch, Utah (0 attendees). The public comment period officially closed on December 15, 2008.

On February 19, 2010 a Supplemental Information Report (SIR) to the DEIS was published in the Federal Register. During the 60-day comment period a number of comments were received relative to the impact analysis for air resources.

For more information on the SIR and comments that were received on the DEIS and SIR, please see *Chapter 7: DEIS Comments and Responses*.

1.9.2 Scoping Issues Identified

Preliminary issues to be evaluated in this EIS were first developed by the Dixie National Forest at the onset of the project. These and additional issues were further developed in response to input received during public scoping. Issues that were discussed but not considered relevant to this analysis were termed non-key issues. These non-key issues are discussed below but are not discussed further in this EIS. Key issues are those issues that were determined to merit analysis in this EIS.

1.9.2.1 Non-Key Issues

Three issues were considered non-key and not warranting further analysis. These issues are presented below along with the rationale for why they are not analyzed in this EIS:

LIVESTOCK GRAZING

Development of an oil and gas field could decrease grazing capacity in grazing allotments due to removal of vegetation, causing a decrease in permitted numbers of livestock or duration of use.

The primary impact of oil and gas exploration and development activities on grazing is disturbance of vegetation used for livestock fodder. This effect is evaluated in the vegetation

impact analysis and does not warrant further analysis in this EIS. Further, the analysis of impacts to specific grazing allotments is not possible in this EIS because the specific locations of the potential oil and gas activities are unknown at this time. Oil and gas exploration and development does not automatically restrict use of the land for livestock operations, and grazing typically continues in the affected allotments.

CULTURAL RESOURCES

The construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities has the potential to impact cultural resources including Prehistoric and Historic sites. Sites that may be impacted includes sites currently listed on or that are eligible to be listed on the National Register of Historic Places and Traditional Cultural Properties.

Section 106 of the National Historic Preservation Act of 1966, as amended, requires federal agencies to take into account any action that may adversely affect any site, structure, or object that is, or can be included in the National Register of Historic Places. These regulations, codified at 36 CFR 800, provide a basis for which to determine if a site is eligible for inclusion in the National Register of Historic Places. Prior to any ground disturbing activity associated with oil and gas development, the Dixie National Forest will cause to have identified and evaluated, within the active lease areas, those Historic Properties that need to have mitigation undertaken. Under SLTs included in every lease, oil and gas facilities or activities may be moved by up to 200 meters (656 feet) to avoid impacts to those Historic Properties that warrant this. As a result, impacts to general cultural resources on the Dixie National Forest would be avoided or mitigated at or prior to the construction phase.

There are three sites currently listed on the National Register of Historic Places within the Dixie National Forest: the Mountain Meadows Historic District, Long Hollow Archeological District, and Iron Town Historic District. Other areas of concern include the pinyon-juniper zones of the Forest and the Cedar Mountain Concentrated Sites. These sites have restrictive stipulations applied under most alternatives.

ENVIRONMENTAL JUSTICE

Post-leasing activities could impact Environmental Justice.

Executive Order 12989 (signed February 11, 1994) requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations. Socioeconomic data for the six counties in which the Dixie National Forest is located (Garfield, Iron, Kane, Piute, Washington, and Wayne) was used to identify whether minority or low income populations have the potential to be affected by this decision (see Section 3.11 for a more detailed discussion of socioeconomics). Demographically, the population within these six counties is relatively homogeneous with 91.5 percent of the population composed of whites. However, the use of countywide data has the potential to mask the presence of “pockets” of minority and/or low-income communities (EPA 1998) and the presence of some minority communities cannot be completely ruled out. Regarding low-income populations, average per capita income from 2000 to 2005 was lower than the statewide average. Of the six counties, Piute County had the lowest household income. According to 2000 US census data, 14.9 percent of the households in Piute County had incomes of less than $10,000 in 1999, compared to 6.0 percent for the State of Utah. As a result, there is the potential for impacts to minority and low-income communities. However, most of the environmental impacts from oil and gas activity described in this EIS would be

dispersed across the Dixie National Forest, and generally confined to locations on the Forest that are located away from population centers. Further, few negative socioeconomic impacts are expected for communities located close to the Dixie National Forest. As a result, it was determined that impacts would not constitute a disproportionately high or adverse effect to low income or minority populations.

1.9.2.2 Key Issues

Through public scoping, 13 key resource issues were identified and alternatives were developed. Measurement indicators were also developed to quantify the environmental impacts to each identified resource. The measurement indicators are listed in this section with each key resource issue and are used in Chapter 4 to describe impacts. The existing conditions of the resources listed below are described in Chapter 3. Issues and resources are not ranked by order of importance; rather, they are listed in the order that they will be discussed in Chapters 3 and 4. The 13 key resource issues and the rationale for their inclusion as key issues are as follows:

ISSUE #1: VISUAL RESOURCES

Post-leasing activities could decrease visual integrity and quality, could impact viewsheds, and could have an impact on night skies.

The construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could impact scenic quality, especially as viewed from sensitive recreation areas, adjacent communities, National Parks, and transportation corridors. Changes in air quality can also cause haze and impairments to visibility. Artificial lighting and flaring associated with oil and gas facilities could cause light pollution and impact viewing of the night sky.

Measurement Indicators

- Predicted lumens for various phases
- Narrative of potential changes to the landscape addressing the duration and change for each visual attribute
- Compliance with Scenery Management System (SMS)/Scenic Integrity Objectives (SIO)
- Consistency with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment

ISSUE #2: INVENTORIED ROADLESS AREAS (IRAS)

Post-leasing activities could impact the characteristics and attributes of IRAs.

IRAs represent some of the largest and most extensive tracts of undeveloped land on the Dixie National Forest and are valued for their roadless nature and associated environmental characteristics and attributes. Any construction and reconstruction of roads , associated with oil and gas facilities would fragment or reduce the size of IRAs and the operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities would impact the roadless characteristics and wilderness attributes of IRAs.

Measurement Indicators

- Narrative discussion of impacts to roadless characteristics and wilderness attributes

- Miles of roads (reconstruction and new construction) and acres of disturbance in IRAs or Unroaded-Undeveloped Areas (also known as areas of wilderness potential)

ISSUE #3: ELIGIBLE WILD AND SCENIC RIVERS

Post-leasing activities could degrade the values of eligible Wild and Scenic Rivers and could make these areas ineligible for future inclusion in the National Wild and Scenic River System.

The construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could alter the "outstandingly remarkable" values identified for the four different river segments that have been found suitable for inclusion in the national wild and scenic river system. Further, the construction of roads associated with oil and gas activity within the corridor of suitable streams could impact the tentative classification of the river. Chapter 80, Section 82.5 of Forest Service Handbook 1909.12 (USFS 2006a) specifies that any projects or activities within the river corridor of a suitable or eligible river must protect the "outstandingly remarkable" values and maintain the tentative classification until a decision on suitability.

Measurement Indicators

- Narrative discussion of impacts to suitability and "outstandingly remarkable" values
- Miles of roads (reconstruction and new construction) and acres of disturbance within ¼ mile distance from either bank of suitable stream segments

ISSUE #4: RECREATION

Post-leasing activities could impact hunting, fishing, recreation, and tourist activities and developed and dispersed recreational sites.

Developed recreation sites consist of view areas, campgrounds, lodges, Brian Head Ski Area Special Use Area, toilet facilities, trailheads, interpretive sites, boat ramps, etc. Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities in or adjacent to developed recreation facilities could degrade the recreation setting and recreation experience of the public using these facilities.

Dispersed recreation consists of recreation activities outside of developed recreation sites. Activities generally include sight-seeing, hiking, camping, horseback riding, hunting, fishing, motorized touring, off highway vehicle (OHV) use, mountain biking, snow machine use, cross-country skiing, snowboarding, etc. A potential for conflicts involves reconstruction and use of existing roads and trails by oil and gas activities. In addition, oil and gas facilities could occupy dispersed recreation sites considered important by individuals who use them on a regular basis. Oil and gas activities in areas adjacent to dispersed recreation sites could also impact the user's recreation experience. Oil and gas activities may impact hunter success and enjoyment of their experience on the Forest.

Bryce Canyon National Park and Cedar Breaks National Monument are located within and immediately adjacent to the Dixie National Forest. Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could impact recreation activities and tourist satisfaction in these areas.

Measurement Indicators

- Changes to ROS (Recreation Opportunity Spectrum) recreation setting indicator characteristics
- Potential decrease in use and quality of the recreation experience

ISSUE #5: FISH AND WILDLIFE

Post-leasing activities could impact aquatic and terrestrial wildlife and their habitats.

Construction and operation, including human presence and transportation, of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could negatively impact wildlife both through direct loss of habitat and through indirect loss of habitat due to disturbance. Key terrestrial habitat areas are often a small percentage of the larger area, but are important to a significant portion of a species' population during some life stage. Impacts, both direct and indirect, to these key habitats could impact a large number of animals. Species affected could likely include migratory bird nesting areas, including both passerines and raptors.

All of the perennial water bodies on the Dixie National Forest have populations of fish and aquatic wildlife. Many of these systems have populations of native, Forest sensitive, and sport fish populations. Additionally, since water is such a limiting factor in the arid Southwest, all of the water bodies are a critical ecosystem component. Construction and operation of oil and gas facilities within and adjacent to water bodies (streams, lakes, and reservoirs), riparian areas, and wetlands could have negative impacts on aquatic species due to direct habitat loss, increased sediment, and introduction of other pollutants. Sedimentation and other contaminants could occur from the construction, widening, and use of roads, pads, and other facilities, as well as clearing of vegetation. Species that may be impacted include aquatic invertebrates, sport fish, native non-game fishes, amphibians, and mollusks.

Measurement Indicators

- Acres of direct disturbance of habitat and indirect habitat loss as compared to available habitat
- Number of visits and noise levels
- Estimates of increased sediment production and amount that could reach aquatic habitats
- Number and type of stream, riparian area, and wetland crossings
- Potential changes to aquatic habitat condition (aquatic condition indicators)
- Increases in invasive plants

ISSUE #6: THREATENED, ENDANGERED, PROPOSED, CANDIDATE, FOREST SENSITIVE, AND MANAGEMENT INDICATOR SPECIES

Post-leasing activities could impact Threatened, Endangered, Proposed, Candidate, Forest Sensitive, and Management Indicator species (MIS), and their habitats, including Designated Critical Habitats.

Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could impact threatened, endangered, proposed, candidate, and Forest Service sensitive plant species both through direct loss of habitat and through indirect

loss of habitat due to disturbance. This includes Designated Critical Habitats. See Issue #5 for a description of how oil and gas leasing can affect terrestrial and aquatic wildlife.

Construction and operation, including human presence and transportation, of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could negatively impact wildlife both through direct loss of habitat and through indirect loss of habitat due to disturbance. Key terrestrial habitat areas are often a small percentage of the larger area, but are important to a significant portion of a species' population during some life stage. Impacts, both direct and indirect, to these key habitats could impact a large number of animals. Species likely to be affected include elk (*Cervus canadensis*) and mule deer (*Odocoileus hemionus*) winter ranges, some fawning and calving areas and rutting areas, sage-grouse (*Centrocercus urophasianus*) leks and brooding areas, and northern goshawk (*Accipiter gentilis*) nesting territories.

All of the perennial water bodies on the Dixie National Forest have populations of fish and aquatic wildlife. Many of these systems have populations of native, Forest sensitive, and sport fish populations. Additionally, since water is such a limiting factor in the arid Southwest, all of the water bodies are a critical ecosystem component. Construction and operation of oil and gas facilities within and adjacent to water bodies (streams, lakes, and reservoirs), riparian areas, and wetlands could have negative impacts on aquatic species due to direct habitat loss, increased sediment, and introduction of other pollutants. Sedimentation and other contaminants could occur from the construction, widening, and use of roads, pads, and other facilities, as well as clearing of vegetation. Species that may be impacted include aquatic invertebrates, Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*), sport fish, and native non-game fishes.

Measurement Indicators

- Acres of direct disturbance of habitat and indirect habitat loss as compared to acres available
- Narrative discussion on potential effects related to fragmentation of existing habitats and populations
- Number of visits and noise levels
- Road density by subwatershed (6th-Level HUC)
- Increases in invasive plants
- Impacts determinations (from BA and changes in viability for sensitive species)
- Compliance with UDWR population objectives
- Compliance with the fisheries classification system (Utah) for streams
- Compliance with Land and Resource Management Plan Standards and Guidelines for MIS

ISSUE #7: WATER AND WATERSHED RESOURCES

Post-leasing activities could impact flow and water quality of surface streams and groundwater, sensitive aquifers, developed water systems, floodplains, wetlands, and riparian areas.

Drilling and completion activities are regulated by the BLM and the State of Utah and are subject to Onshore Oil and Gas Orders and BMPs such as casing and dry hole plugging

designs intended to protect groundwater resources. Unexpected failure of these mitigation measures could lead to potential impacts to groundwater.

Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could increase the potential for surface and mass-erosion, which could contaminate surface water. Water from exploration and production facilities could become contaminated with chemical pollutants used at the facilities and flow from the disturbed areas to adjacent surface waters. Streams, lakes, and reservoirs are particularly vulnerable to pollution and increased sediment loads. Culinary and irrigation water sources are of special concern.

Diversion of water from surface water sources for drilling and production could reduce flows. Production of water in conjunction with oil and gas production could decrease underground sources of surface waters. Either of these outcomes could reduce support of Beneficial Uses protected under the Clean Water Act, and could impact public and private water rights downstream.

Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could adversely impact floodplains, stream channels, and aquatic habitats through direct disturbance and increased sediment loads from new roads and well pad construction. Other impacts may include changes in timing and amount of surface runoff and stream flow. Oil and gas activities could adversely impact the function and values of riparian areas, particularly in narrow canyons or V-shaped valley bottoms where activities may be confined by these physiographic features. Wetlands, springs, and riparian areas are particularly vulnerable to pollution and increased sediment loads.

Measurement Indicators

- Narrative description of potential sources of pollutants, the types of pollutants, and the effects to surface waters and groundwater
- Potential to increase sediment in surface streams
- Relative potential for increasing miles of roads within municipal watersheds and lava fields over sensitive aquifers
- Narrative description of potential effects to surface water flow and groundwater availability
- Acres of disturbance

ISSUE #8: SOILS AND GEOLOGIC HAZARDS

Post-leasing activities could impact steep slopes and unstable and erodible soils.

Changes in the topography, removal of vegetation, and soil disturbance from the construction and operation of oil and gas facilities such as roads and drill pads could cause soil compaction, erosion, and increased land instability leading to mass movement events. Erosion and landslides result in soil loss, increased sediment production, and decreased productivity of other resources such as vegetation and wildlife. Landslides can pose safety hazards to people and structures (geologic hazard). Sensitive soil types can be difficult to reclaim.

Measurement Indicators

- Acres of disturbance
- Narrative description of potential effects to soil productivity
- Potential soil loss
- Miles of road and area of disturbance (acres) on sensitive landforms
- Potential for creating hazardous conditions
- Percentage of disturbance on sensitive soil types

ISSUE #9: VEGETATION

Post-leasing activities could impact major vegetation types, areas containing unique vegetation, biological and chemical crusts, and gypsum type soils, and could introduce noxious weeds.

Construction and operation of oil and gas facilities such as power lines, drill pads, drill rigs, roads, and production facilities could result in removal and disturbance of vegetation, including unique vegetation communities. Surface disturbance could also impact biological and chemical soil crusts and gypsum soil types. Some of these vegetation types are not able to be restored once disturbed; others, including biological soil crusts, may take many years to restore.

Soil disturbance makes areas vulnerable to invasion of invasive plants. The Dixie National Forest contains populations of several noxious weeds and other undesirable plants. Soil disturbance and vehicular traffic as a consequence of oil and gas development could result in the spread (through seed-laden mud on tires and in the undercarriage) and establishment of noxious weeds and other undesirable plant species from other places on the Dixie National Forest or from places off the Dixie National Forest.

Measurement Indicators

- Acres of disturbance
- Location of surface disturbance
- Increases in invasive plants

ISSUE #10: TRANSPORTATION SYSTEMS

Post-leasing activities could increase traffic levels on public roads and Forest roads and increase accessibility to other federally administered lands.

Construction and operation of oil and gas facilities could impact the existing transportation system in terms of expanding the road system, increasing maintenance costs, impacting public access, and creating safety concerns. Post-leasing activities could increase the need for gravel sources.

Construction of new roads near National Park Service (NPS) administered lands could provide access for inappropriate use of NPS lands.

Measurement Indicators

- Estimated traffic increase
- Miles of road construction and reconstruction (long and short term)

- Determine the potential gravel quantities needed

ISSUE #11: SOCIOECONOMICS

Post-leasing activities could impact public and private revenues, populations, community services, infrastructure, tourism, and fire management.

Company personnel and contractors (exploration and production activities) purchase supplies, accommodations, and other services, contributing to the local, state, and national economies. Production of oil and gas from leases could create new jobs, contributing employment opportunities and tax base. Some jobs may be filled locally; others may require skills not readily available within the six counties resulting in new residents. New residents may affect the availability and affordability of housing; create additional demand for community services, or impact community composition and values. The level of these impacts will depend upon the community affected. Direct returns to the National Treasury include lease bids and annual lease payments. If production is achieved, operators pay a royalty of 12.5 percent of the wellhead value of oil and gas.

Oil and gas activities in a particular area could displace recreation use to other areas, depending on the recreation experience sought by individuals. This could shift spending by Forest visitors and the associated benefits from one community or vendor to another. Oil and gas activities could impact the attractiveness of national parks and Scenic Byways and reduce visitation or expenditures in adjacent communities.

Public lands can play an important role in shaping the character of local communities. Many rural residents are employed in logging, grazing, or oil and gas related industries that utilize public lands. Many residents also regularly utilize public lands to hunt, fish, hike, and ride OHVs. These connections to public lands are often deeply rooted and central to the identity of a community. Oil and gas operations can change people's perception of the balance of amenities available on public lands, and the character of their communities.

Oil and gas activities could decrease grazing capacity in allotments causing a decrease in permitted numbers of livestock or duration of use.

Oil and gas activities could increase the demand for federal expenditures for road maintenance, enforcement, and compliance work and planning efforts.

Measurement Indicators

- Potential lease bids, lease payments, and royalties generated
- Potential amount of federal receipts transferred to the State of Utah and respective counties
- Potential amount of property tax levied against producing wells
- Number of potential jobs generated
- Potential loss to grazing permittees
- Potential offset of recreation in leasing areas
- Cost per mile of road maintenance for federally managed roads

ISSUE #12: AIR RESOURCES

Post-leasing activities could impact air quality.

Use of gasoline and diesel-powered vehicles, compressors, and other internal combustion engines releases exhaust gasses and particles into the air. Drilling and production also releases wellhead gasses into the air. Vehicle access on unpaved roads and construction activities produce dust. Lastly, oil and gas activities contribute to greenhouse gas emissions.

Measurement Indicators

- Narrative description and modeled estimates of changes to air quality and visibility
- Potential to exceed air quality standards by parameter at issue, where this could occur
- Increase in greenhouse gas emissions

ISSUE #13: SPECIAL AREAS

Post-leasing activities could impact Research Natural Areas, botanical and geologic trails, scenic byways, national recreation trails, administrative sites, and the Side Hollow Ponderosa Pine Provenance Study Area.

The Forest Service maintains administrative sites and has issued special-use permits for facilities and special uses. Facilities on the Forest include administrative sites such as ranger stations, campgrounds, recreation complexes, overlooks, trailheads, and water developments. Special uses include spring developments, water diversions, power lines, water pipelines, troughs, fences, buildings, corrals, spring developments, dwellings, etc. Oil and gas operations including road construction could damage these facilities or conflict with their setting and function.

Special land designations consist of areas set aside for specific purposes such as Research Natural Areas, botanical areas, administrative sites and National Recreation Trails. Oil and gas operations could interfere with the designated uses and management objectives for these areas. Some associated facilities could be moved, but others are tied to specific environmental attributes that only occur at limited specific areas.

Measurement Indicators

- Acres of disturbance
- Compliance with Establishment Records
- Narrative description of the effects and duration of effects that would occur to the limiting attributes of the areas, which led to designation
- Compliance with management objectives

1.10 Consultation with Federal and State Agencies and Tribes

1.10.1 Endangered Species Act Section 7 Consultation

Consultation with the United States Fish and Wildlife Service (USFWS) is required under Section 7 of the Endangered Species Act. Section 7 of the Endangered Species Act directs all federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the USFWS, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of federal lands as well as other federal actions that may affect listed species, such as federal approval of private activities through the issuance of federal permits, licenses, or other actions. Consultation with the USFWS occurred prior to completion of the Final EIS.

1.10.2 National Historic Preservation Act Section 106 Consultation

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are properties that are included in the National Register of Historic Places or that meet the criteria for the National Register. If an agency has determined that its undertakings may affect historic properties, it must contact the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer to consult with during the process. If it determines that it has no undertaking, or that its undertaking is a type of activity that has no potential to affect historic properties, the agency has no further Section 106 obligations. Future, project-specific NEPA analyses that would occur at the lease issuance stage would be required to consider historic properties, and consultation, if necessary, with the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer would occur at that time.

1.10.3 Tribal Consultation

Tribal consultation is required by Executive Order (EO) 13175, which states, “Each agency shall have an accountable process to ensure meaningful and timely input by Tribal officials in the development of regulatory policies that have Tribal implications.”

Scoping letters were sent to seven tribes during the public scoping period described in Section 1.9.1. None of the tribes responded with comments. Tribal consultation letters were sent August 14, 2008. All tribes have been kept informed throughout the NEPA process.

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2.1 Introduction

This chapter describes the alternatives developed for the proposed oil and gas leasing analysis on the Dixie National Forest and the process by which they were developed. The range of alternatives would meet the Purpose and Need of the analysis, which is to determine which lands would be available for leasing in response to requests for leases on the Dixie National Forest. This chapter also provides a summary of the Reasonable Foreseeable Development Scenario (RFDS). The RFDS projects the amount of oil and natural gas exploration, development, and production activities that may reasonably be expected to occur on each of the Dixie National Forest's four ranger districts over the next 15 years. The alternatives developed do not differ in how much oil and gas activity is projected to occur on each ranger district. Rather, the alternatives differ in where and under what conditions the projected activity could occur. However, it is more likely that the projected level of activity would occur under the less restrictive alternatives. Therefore, this chapter will also provide a comparison of alternatives in terms of whether or not leasing would be allowed in an area with identified resource components, and if so, what leasing options would be applied. This chapter only provides a summary comparison of the environmental impacts in order to display the differences between each alternative. The specific impacts on the existing environment are discussed in Chapter 4.

2.2 Reasonable Foreseeable Development Scenario

This section summarizes the RFDS developed for the Dixie National Forest by the Bureau of Land Management (BLM) Utah State Office (BLM 2007a). The RFDS report in its entirety is included as Appendix A. The RFDS is an estimate of future oil and gas activity, based primarily on known geologic potential for oil and gas occurrence and on past exploration and development activity in and near the Dixie National Forest. The scenario is also developed with consideration of other factors such as economics, technology, physical limitations on access, existing or anticipated infrastructure, and transportation. For the baseline scenario of activity, the RFDS assumes all potentially productive areas within the Dixie National Forest can be open to leasing under standard lease terms and conditions, with the exception of those areas withdrawn from leasing as explained in Section 1.5.2. It is possible that the actual level of oil and gas activity that occurs on the Dixie National Forest may be less, or more, than estimated by the RFDS. If more activity occurs, the decisions in this Environmental Impact Statement (EIS) would still apply as long as the impacts are within the scope of the analysis presented here.

2.2.1 Potential Oil and Gas Activity on the Dixie National Forest

The RFDS indicates that roughly the southern one-third to one-half of the Cedar City, Powell, and Escalante Ranger Districts have high or moderate potential for oil and gas development. The northern two-thirds to one-half of these ranger districts have low development potential. The entire Pine Valley Ranger District is rated as having low development potential. Current oil and gas industry interest, which is reflected in the lands nominated for lease sales between 2005 and 2006, is somewhat evenly distributed among the Cedar City, Powell, and Escalante Ranger Districts. No interest was expressed for leasing lands on the Pine Valley Ranger District during the same period.

Using this information, the RFDS projects a maximum of 60 exploration wells over 15 years following leasing, or a forest-wide average of four wells per year. When adjusted by ranger district, the number of exploration wells that are anticipated to occur over the 15-year period is:

Pine Valley: 5 wells; an average of one well every three years

Cedar City: 15 wells; an average of one well per year

Powell: 20 wells; an average of four wells every three years

Escalante: 20 wells; an average of four wells every three years

In order to fully evaluate the environmental effects of concurrent exploration activity for this analysis, it can reasonably be assumed that three exploratory drilling operations could occur at one time on each of the ranger districts. Furthermore, exploratory drilling during this period could result in a discovery of one oil and gas field with 20 production wells. Due to uncertainty as to where this field would be located, the environmental impacts are evaluated as if it were to occur on each of the ranger districts. During the same time period, it is expected that a total of 700 linear miles of seismic lines (i.e., geophysical surveys) could occur on the Dixie National Forest, with 100 miles estimated to occur on the Pine Valley Ranger District and 200 miles expected to occur on each of the other ranger districts. It is assumed that 50 to 100 linear miles of seismic lines could occur on each of the ranger districts in any year (BLM 2007a).

2.2.2 Disturbance Expected from Post-Leasing Oil and Gas Activity

The RFDS estimates the amount of surface disturbance predicted to occur as a result of post-leasing activity. The amount of disturbance described is common to all alternatives except the No Lease Alternative (Alternative A). Disturbance estimates are based on reasonable assumptions as to how the seismic exploration, exploratory drilling, development drilling, and construction of production facilities would proceed. The amount of disturbance is summarized in Table 2.2-1 and described in further detail by phase below.

Table 2.2-1 Estimated Disturbance from Post-Leasing Oil and Gas Activity

Phase	Activity	Disturbance/unit	Total Disturbance
Seismic Exploration	Buggy Surveys	1.2 acres/mile	0.6 acres/mile[1]
	Helicopter Surveys	0.007 acres/mile	
Exploratory Wells	Well Pad	5.9 acres/well	16.6 acres/well
	New Access Roads	4.1 acres/well	
	Road Reconstruction	6.6 acres/well	
Production Field	19 Well Pads, Roads, and Topsoil Storage	176.7 acres	253.9 acres
	Central Production Facility	12.0 acres	
	Water Disposal Well and Road	9.0 acres	
	Overhead Power Line and Substation	25.4 acres	
	Additional Pipeline/Power Line Corridor	30.3 acres	

[1] Assumes a buggy to helicopter use ratio of 1:1

2.2.2.1 Seismic Exploration

Any future, major exploration activity on the Dixie National Forest and the surrounding area would likely begin with seismic surveys of some type. Seismic surveys are generally conducted in one of two ways, high frequency vibrations (Vibroseis method), or explosions. Vibroseis utilizes large trucks with vibrator pads which can be lowered to the ground and thus induce energy into the subsurface. On National Forest System lands, the Vibroseis method is usually used only along existing roads. The explosion method involves drilling shallow, small-diameter

(less than 5 inches) shot holes, placing an explosive charge in the hole, and covering it. The charge is detonated to generate seismic energy for the survey. Drill rigs mounted on trucks are used to drill the holes in areas with roads or trails, but portable rigs may be transported by helicopter in rugged terrain or areas of environmental concern. Off-road buggies mounted with drill rigs are being increasingly used where possible, as they are less expensive than helicopters. Based on other recent surveys in Utah, it is estimated that buggy mounted acquisition usually disturbs 1.2 acres/mile, whereas helicopter surveys disturb 0.007 acres/mile. Assuming a buggy/helicopter use ratio of 1:1, surface disturbance from seismic surveys would be approximately 0.6 acres/mile (BLM 2007a).

2.2.2.2 Exploratory Wells

Two sources of surface disturbance resulting from exploratory drilling are drill pad and access road construction. Drill pads vary in size; however, for this EIS drill pad disturbance area is assumed to be 5.9 acres each (including topsoil storage, drainage diversions, and vegetation clearing). The construction of new access roads would result in the average disturbance of 4.2 acres per well. This estimate takes into account an average width of area disturbed for an access road of 39 feet (including cut and fill) multiplied by an average length of 0.66 miles, with additional disturbance for curve widening and topsoil storage factored in. In addition, National Forest System roads could need to be reconstructed to a standard needed to safely accommodate existing traffic, rig mobilization, and other project traffic. This would disturb approximately 6.6 acres per well access, which includes an average width of new disturbance of 13 feet, an average length of 3.92 miles, plus additional disturbance for turnouts and curve widening. Additional information on the methodology used to estimate road disturbance is available in BLM (2007a) and USFS (2007b). The total estimated disturbance per exploratory well is 16.6 acres. Exploratory wells that do not result in a discovery would be plugged and the site reclaimed. Reclamation includes returning the disturbed drill pad and access road to the approximate original contour, replacing topsoil, and seeding the area to accomplish the required standards for revegetation (BLM 2007a). The operator would not be released from further reclamation responsibility until monitoring shows that final reclamation condition standards have been met.

2.2.2.3 Production Wells

The Dixie National Forest RFDS projects the possible development of one oil field within the Forest during the next 15 years, which would include a total of about 20 production wells. The discovery well would become one of the production wells and 19 more wells would be drilled. The disturbance for each production well would be 9.3 acres, including road construction and areas for topsoil storage, for a total of 176.7 acres for all the production wells (19 wells times 9.3 acres). There would be an additional 12 acres of disturbance for a central production facility, 9.0 acres for a water disposal well, and 0.5 acres for a truck loading facility. Additionally, a production field would require a new overhead electrical power line and substation, which would disturb an additional 25 and 0.4 acres, respectively, for a total of 25.4 acres. Power lines and pipelines within the new oil field would mostly be buried under access roads, and the produced oil would be trucked to market. However, it might be necessary to locate some portions of the lines in other areas or adjacent to existing roads, which would disturb an estimated 30.3 acres. The result is a total projected disturbance of 253.9 acres for a production oil field. The potential field would most likely occur in the high potential areas of the southern portions of the Cedar City, Powell, or Escalante Ranger Districts. However, a potential field could be discovered almost anywhere in the areas available to leasing and open to exploration drilling, depending on the alternative or combination of alternatives selected by the responsible officials. For the purposes of this analysis, it is assumed that it could occur on any of the ranger districts. A

production field is estimated to be productive for approximately 30 years. Production facilities are subject to reclamation requirements once production ceases.

2.2.3 Summary of Disturbance Expected by Ranger District

The amount of projected development and associated disturbance that could occur on each ranger district is presented in Table 2.2-2. The amount of development projected is over a 15-year period, and it is assumed that three exploratory drilling operations could occur at one time on each of the ranger districts. Further, it is assumed that 50 to 100 miles of seismic lines (i.e., geophysical surveys) could occur on each of the ranger districts in any year.

Table 2.2-2 Oil and Gas Development and Associated Disturbance by Ranger District

Ranger District	Seismic Exploration		Exploratory Wells		Production Wells[1]		Total Disturbance[2]
	Miles	Acres	Number	Acres	Number	Acres	Acres
Pine Valley	100	60	5	83	19	253.9	396.9
Cedar City	200	120	15	249	19	253.9	622.9
Powell	200	120	20	332	19	253.9	705.9
Escalante	200	120	20	332	19	253.9	705.9

[1] Only one production field is predicted to occur on the Dixie National Forest with a total of 19 new wells and 253.9 acres of disturbance; however, the production field could occur anywhere on the Dixie National Forest.
[2] The amount of disturbance is based on estimates in the RFDS; actual disturbance could be less than shown.

2.3 Development of Alternatives

Alternatives were developed based on the results of scoping and the determination of issues to be analyzed in detail. The alternatives were then refined through internal discussion with Dixie National Forest resource specialists and through involvement with cooperating agencies and interested parties. Scoping identified 13 resource issues related to the proposed action (Section 1.9.2.2).

2.3.1 GIS Development Process

Alternatives were developed by assigning various leasing options (summarized in Table 2.3-1), including the stipulations described in Section 1.8.5.3, to site-specific resources, defined in this EIS as resource components, using geospatial data. Using a geographic information system (GIS), the spatial distribution of each resource component and associated leasing options were overlaid. Some lands on the Dixie National Forest are not legally available for oil and gas leasing (NA) and include the Brian Head Ski Area Special Use Area, wilderness areas, and the areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. The most restrictive leasing option (i.e., NL or NSO) assigned to a particular resource component supersedes any less restrictive options (i.e., CSU or SLT) assigned to other resource components that occur in the same area or site-specific location. For example, where NSO was assigned to an area of high erosion potential that coincides with the habitat of a sensitive wildlife species assigned CSU, the NSO stipulation would be applied to the area common to both of these resources. As a result, multiple leasing options may apply to a resource component, depending upon its location, even if only a single leasing option was specified for that resource component under an alternative. A full range of leasing options was incorporated into the development of alternatives so that the different alternatives would insure that differing levels of protection were addressed for each specific resource component.

Leasing options were applied to geographical areas that represent the spatial distribution of a resource component. However, it is important to note that leasing options are applied to the resource component and not simply to specific geographic areas. If unmapped resource components are identified in the future, they would be protected by the same leasing option. Furthermore, the geospatial data used in this analysis is the best GIS data available; however, it comes from multiple sources and was created at varying scales. As a result, it is not assumed that these data are 100 percent complete or that they meet the US National Mapping Accuracy Standard of the Office of Management and Budget. Unless otherwise stated, GIS data were provided by the Dixie National Forest.

Table 2.3-1 Summary of Leasing Options Used to Create the Alternatives

Leasing Option	Abbreviation	Summary of Restrictions
Not Legally Available for Lease[1]	NA[1]	Lands not legally available for leasing as described in Section 1.5.2. (not within the oil and gas leasing decision authority of the Responsible Officials).
No Lease	NL	No new leases would be authorized for the designated area (within the oil and gas leasing decision authority of the Responsible Officials). These lands would be classified as not administratively available.
No Surface Occupancy	NSO	Prohibits use or occupancy of the land surface for fluid mineral exploration or development. Seismic exploration could occur.
Timing Limitation	TL	Oil and gas exploration and development activities would be restricted or prohibited during certain time periods.
Controlled Surface Use	CSU	Surface use and occupancy would be allowed but would be limited to avoid impacts to a particular resource.
Standard Lease Terms	SLT	No stipulations would be applied but oil and gas exploration and development activities would be required to comply with current laws, regulations, and Onshore Orders.

[1] NA is not a lease option used to create the alternatives: however, acres of NA lands are presented in the description of the alternatives to provide context to the analysis.

2.3.2 Dual Analysis of Alternatives

As described in Section 1.8.2, the past history of the 2001 Roadless Area Conservation Rule has been full of changes in applicability due to judicial actions. Due to uncertainty in the future status of the rule, alternatives D and E underwent a dual analysis. The dual analysis consists of analyzing the environmental impacts of the alternatives under two scenarios: (1) each alternative is analyzed with a NSO stipulation applied to Inventoried Roadless Areas (IRAs) that would prohibit road construction and timber harvest following the intent of the 2001 Roadless Area Conservation Rule, and (2) each alternative is analyzed based on less restrictive leasing options that would allow new disturbances for oil and gas exploration and development in IRAs, including roads, wells, and other facilities as presented in Table 2.5-1. The second scenario in the dual analysis process provides the framework to make decisions concerning oil and gas leasing in these areas should any changes in the applicability of the 2001 Roadless Area Conservation Rule occur in the future due to judicial actions.

The 2001 Roadless Area Conservation Rule did not explicitly prevent issuing new oil and gas leases (NL) in IRAs. Also, it does not strictly require a NSO stipulation be connected with

mineral leases in IRAs; however, to meet the intent of the 2001 RACR, a NSO stipulation has been applied to IRAs under the dual analysis scenario for alternatives D1 and E1 in this EIS. The NSO prohibits the road construction and timber removal that would be practically necessary for efficient oil and gas exploration and drilling, as well as the road building and timber removal necessary for building oil and gas production facilities. This would effectively prevent surface use of the lease for efficient exploration and development of oil and gas.

With the exception of IRAs, the leasing options applied to other resource components would be the same under both scenarios of the dual analysis. However, IRAs cover approximately 35 percent (570,559 acres) of the Analysis Area for this EIS and the spatial distribution of many resource components overlaps with IRAs. As a result, the amount of land available under each leasing option differs depending upon the scenario. These differences are described in separate sections for Alternatives D and E, including tables indicating the acres and percentage of land under each leasing option. Resource component specific tables are also available in Appendix B.

During the Draft analysis, Alternative C underwent a dual analysis along with Alternatives D and E, and both end members of the dual analysis under Alternative C in the DEIS were assumed to be NSO. Alternative C under the Preferred Alternative in this FEIS is only analyzed under NSO.

For both DEIS and FEIS analyses, Alternatives A and B did not undergo a dual analysis. For these alternatives, no leasing would be allowed in IRAs regardless of rule changes.

2.4 Alternatives Considered but Eliminated from the Analysis

No other alternatives were identified that would meet the Purpose and Need of the Project.

2.5 Alternatives Considered in Detail

Five alternatives were developed and, for ease of comparison, were assigned a letter (A - E). This section provides descriptions of each alternative. The alternatives and the leasing options applied to each resource component under each alternative are presented by resource below in Table 2.5-1. In describing the leasing options under each alternative, the reader is referred back to Table 2.5-1. However, additional tables in the respective sections of each alternative provide a summary of the total number of acres available for lease under each leasing option on each ranger district. Maps of the most restrictive leasing options applying to areas of the Dixie National Forest are also included in the description of each alternative. Tables that compare the number of acres of each resource component under the various leasing options are provided in Section 2.7. The number of acres under each leasing option separated by ranger district is available in Appendix B.

Table 2.5-1 Alternatives Considered in Detail with Leasing Options by Resource Component

Resource Component	Alternative				
	A	B	C	D	E
Visual Resources					
Retention/SIO Very High (Overlaps with Wilderness)	NL	NSO-01	NSO-01	NSO-01	SLT
Retention/SIO High	NL	NSO-02	NSO-02	CSU-01	SLT
Partial Retention/SIO Moderate	NL	CSU-02	CSU-02	SLT	SLT
Modification/SIO Low	NL	SLT	SLT	SLT	SLT
SIO Unassigned	NL	CSU-03	CSU-03	CSU-03	SLT
NPS Protection	NL	NL	NSO-29	SLT	SLT
Roadless/ Wild and Scenic Rivers					
Inventoried Roadless Areas	NL	NL	NSO-03	NSO-03/CSU-04[1]	NSO-03/SLT[1]
Suitable Wild and Scenic Rivers	NL	NL	CSU-05	CSU-05	SLT
Recreation					
Designated Dispersed Areas	NL	NSO-04	CSU-06	SLT	SLT
Developed Sites (with appropriate buffer): Recreation Sites, Camp Grounds, Guard Stations, etc.	NL	NSO-05	NSO-05	CSU-06	SLT
Recreation Residences (with 0.25-mile buffer)	NL	NSO-06	NSO-06	NSO-06	SLT
Administrative Sites	NL	NSO-05	NSO-05	CSU-06	SLT
ROS: Primitive	NL	NL	NSO-07	NSO-07	SLT
ROS: Semi-Primitive Non-Motorized	NL	NSO-08	NSO-08	CSU-07	SLT
ROS: Semi-Primitive Motorized	NL	CSU-08	CSU-08	CSU-08	SLT
ROS: Roaded Natural	NL	CSU-08	CSU-08	SLT	SLT
Fish and Wildlife					
Sage Grouse Leks	NL	NL 2.0-mile buffer[4]	NSO-09 2.0-mile buffer[4]	NSO-10 1.0-mile buffer	SLT
Sage Grouse Summer, Nesting, and Brood Rearing Habitat	NL	NL	CSU-09	TL-01 May 1–Jul 15	SLT
Crucial and Substantial Deer and Elk Winter Range	NL	NL	CSU-10	TL-02 Dec 1–Apr 1	SLT
Crucial Deer and Elk Summer Range	NL	NL	TL-03 May 15–Jul 5	TL-03 May 15–Jul 5	SLT
Active Raptor Nests[2]	NL	CSU-11	CSU-11	CSU-11	SLT
Goshawk Nest Areas	NL	NSO-11 0.5-mile buffer	NSO-11 0.5-mile buffer	CSU-12 0.3-mile buffer	SLT
Goshawk Post Fledgling Areas (PFA)	NL	CSU-13	CSU-13	CSU-13	SLT
Mexican Spotted Owl Protected Activity Centers (PAC)	NL	NSO-12	NSO-12	CSU-14	SLT
Designated Critical Mexican Spotted Owl Habitat	NL	NL	LN	LN	SLT
Potential Mexican Spotted Owl Habitat (40% slope and mixed conifers)	NL	CSU-15	CSU-15	CSU-15	SLT

Resource Component	Alternative				
	A	B	C	D	E
Utah Prairie Dog Colonies (with 0.5-mile buffer from colony edge)	NL	NSO-13	NSO-13	NSO-13	SLT
Migratory Birds	NL	CSU-16	CSU-16	LN	SLT
Bald Eagle Winter Concentration Areas	NL	NSO-14	NSO-14	CSU-17	SLT
Bald Eagle Nests (with 0.5-mile buffer)[2]	NL	LN	LN	LN	SLT
Peregrine Falcon Nests (with 1-mile buffer)	NL	NSO-15	NSO-15	CSU-18	SLT
Peregrine Falcon Rim Habitat	NL	CSU-19	CSU-19	TL-04 Feb 1-Aug 31	SLT
California Condor (Experimental/Nonessential) Rim Habitat	NL	CSU-19	CSU-19	TL-04 Feb 1-Aug 31	SLT
California Condor (Endangered) Rim Habitat and Nest/Roost Area	NL	LN	LN	LN	SLT
Threatened, Endangered, and Candidate Species and Suitable Habitat[3]	NL	LN	LN	LN	SLT
Forest Service Sensitive Species and Suitable Habitat[3]; Including Pygmy Rabbit, Flammulated Owl, Three-toed Woodpecker, Sensitive Bats, Boreal Toad, Bighorn Sheep	NL	NSO-16	CSU-20	CSU-20	SLT
Fisheries Habitat (Occupied and Suitable)	NL	NL 500-foot buffer	NSO-17 500-foot buffer	CSU-21 300-foot buffer	SLT
Water and Watershed Resources					
Lava Fields over Sensitive Aquifers	NL	NL	NL	NSO-18	SLT
Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas (including riparian vegetation)	NL	NSO-19 500 ft buffer NL 300 ft buffer	NSO-20 300 ft buffer	CSU-22 300 ft buffer	SLT
Municipal Watersheds	NL	NL	NSO-21	CSU-23	SLT
Soils and Geologic Hazards					
Active Rockfall, Landslide Areas (Rockfall/unstable)	NL	NSO-22	NSO-22	NSO-22	SLT
Slopes > 35 percent	NL	NSO-23	NSO-23	CSU-24	SLT
Areas of High Erosion Potential	NL	NSO-23	NSO-23	CSU-24	SLT
Marginally Unstable Slopes	NL	CSU-25	CSU-25	SLT	SLT
Cave Resources[2]	NL	CSU-26	CSU-26	CSU-26	SLT
Vegetation					
Research Natural Areas (RNA)	NL	NL	NL	NSO-24	SLT
Botanical and Geological Areas	NL	NSO-25	NSO-25	NSO-25	SLT
Side Hollow Ponderosa Pine Provenance Study	NL	NSO-26	NSO-26	NSO-26	SLT

Resource Component	Alternative				
	A	B	C	D	E
Sensitive Plant Species and Suitable Plant Habitat[3]	NL	NSO-27	CSU-27	LN	SLT
Cultural					
Mountain Meadows Historic Site	NL	NSO-28	CSU-28	CSU-28	SLT
Long Hollow Historic District	NL	NSO-28	CSU-28	CSU-28	SLT
Boulder Area/Cedar Mtn and concentrated Sites	NL	NSO-28	LN	LN	SLT

[1] Alternatives D and E will undergo a dual analysis as described in Section 2.3.2.
[2] GIS data not available.
[3] GIS data partially available.
[4] Sage-grouse 2-mile lek buffer includes all areas within a1-mile radius and only sagebrush habitat from 1- to 2-mile radius.

2.5.1 Alternative A: No Action/No Lease Alternative

2.5.1.1 General Description

Section 1502.14(d) of the National Environmental Policy Act (NEPA) regulations requires the analysis of a No Action Alternative. Under Alternative A, present management activities pertaining to oil and gas leasing would continue unchanged. As the current Land and Resource Management Plan does not make specific decisions about which lands are available for leasing, the Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Existing leases, including those associated with the Upper Valley Oil Field, would not be affected. However, when these leases expire no new leases would be authorized in these areas.

The Forest Supervisor can also select a forest-wide No Lease Alternative that would not allow leasing anywhere on the Forest. This would be different from not taking any action, as in the No Action Alternative, since a decision would be made that would prohibit leasing. Both options would result in no new oil and gas leasing and have been combined for analysis purposes.

2.5.1.2 Leasing Options

No new leasing options would be applied to existing leases and the remainder of the Dixie National Forest would be unavailable for leasing. In all tables that list and compare leasing options, including Table 2.5-1, a NL option is listed for all resource components under Alternative A. However, it is important to note that NL would apply not only to the resource components identified, but to all Dixie National Forest land with the exception of lands currently leased (13,454 acres). Figure 2.5-1 (a-d) shows the leasing options that would apply under this alternative, by ranger district.

In addition, to the forest-wide No Leasing option, specific areas of the Forest can be designated as not administratively available for leasing or as No Lease (NL) areas in the other alternatives. These areas are also displayed as NL areas in the tables.

2.5.2 Alternative B

2.5.2.1 General Description

Alternative B was developed in order to address public concerns obtained from conservation groups during the public scoping process and through discussions with the groups following the initial scoping period. Alternative B would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. Alternative B would emphasize the protection of particular resources through the application of restrictive leasing options. With the exception of Alternative A, this alternative would apply equal or more restrictive leasing options to the resource components than any of the other alternatives. A NL option would be applied to IRAs regardless of legal decisions concerning the 2001 Roadless Area Conservation Rule and dual analysis of this alternative is not necessary.

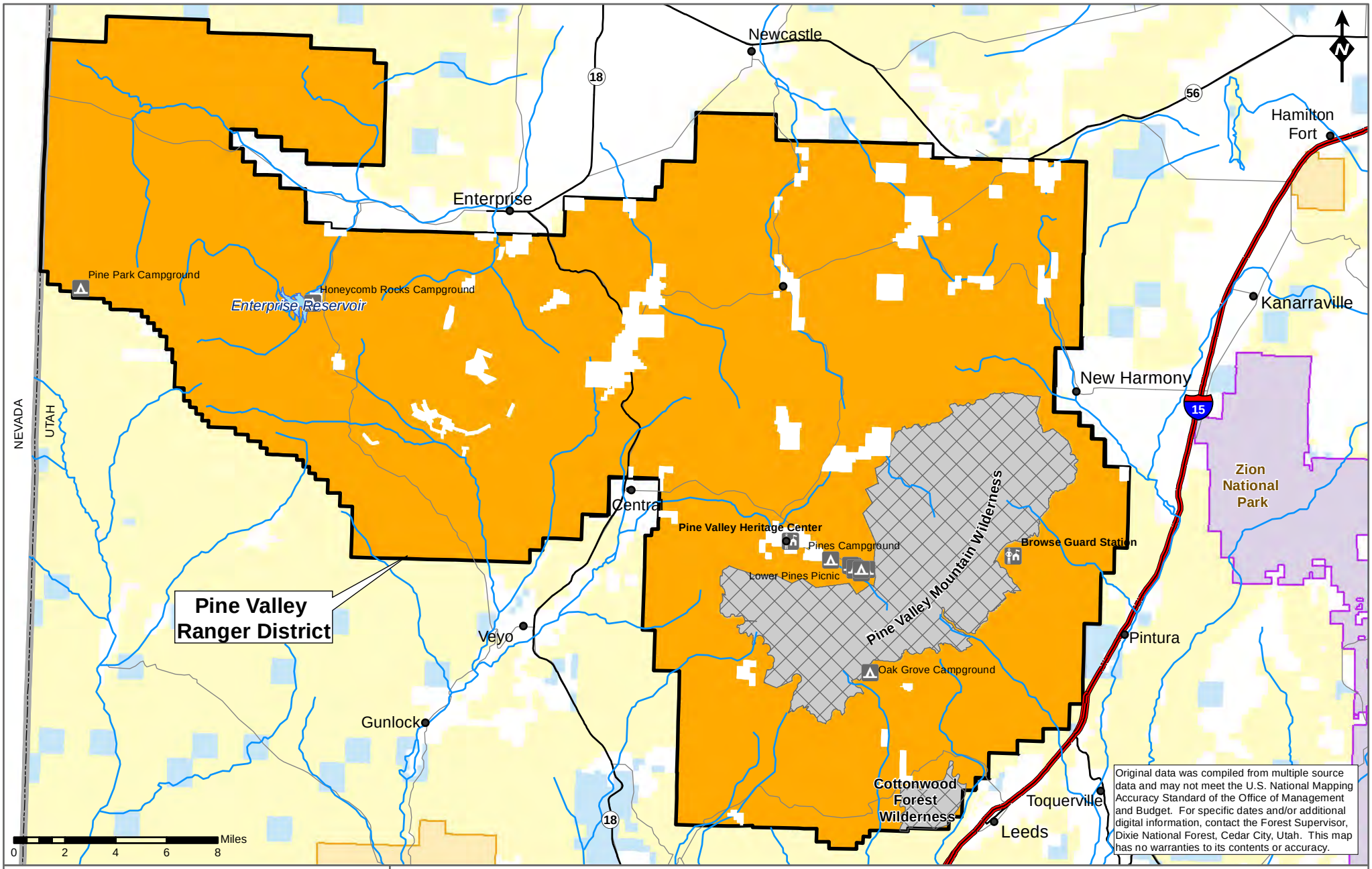
2.5.2.2 Leasing Options

Alternative B would apply restrictive leasing options (leasing options other than SLT) to all identified resource components except visual modification scenic integrity objective (SIO) low, which would be available under SLT. The TL lease option would not be applied to any resource components under Alternative B. One of the differences between Alternative B and Alternatives C and D is that Alternative B would apply a NSO stipulation to a 500-foot buffer and a NL option to a 300-foot buffer around all waterbodies in the GIS database for the protection of these areas as well as for wetlands, floodplains, and riparian areas. The 500-foot buffer provides protection for an additional 200 feet beyond the 300-foot buffer that would have a NSO stipulation under Alternative C and a CSU stipulation under Alternative D. Further, unlike the NSO stipulation for Alternative C, which would allow perpendicular road crossings, the NSO applied to the 500-foot buffer under Alternative B would not allow roads. The amount of each ranger district available under the various leasing options is presented in Table 2.5-2.

Table 2.5-2 Alternative B: Area by Leasing Option for Each Ranger District

Ranger District	Acres[1]/Percent[2] By Leasing Option				
	NA[3]	NL	NSO	CSU	SLT
Pine Valley	52,864 (11%)	351,062 (76%)	33,424 (7%)	25,671 (6%)	0
Cedar City	8,710 (2%)	242,998 (69%)	86,872 (25%)	14,845 (4%)	0
Powell	0	308,003 (80%)	68,043 (18%)	7,852 (2%)	0
Escalante	28,826 (7%)	233,595 (54%)	143,843 (33%)	24,633 (6%)	0
Total	90,399 (6%)	1,135,658 (70%)	332,182 (20%)	73,001 (4%)	0

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Percentages and totals are approximate due to rounding
[3] Areas not legally available for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis. These include designated Wilderness, Brian Head, Antone Bench, and Split Estate Lands. Private lands (NA) are not included.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-1a

Pine Valley Ranger District Alternative A - No Action

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

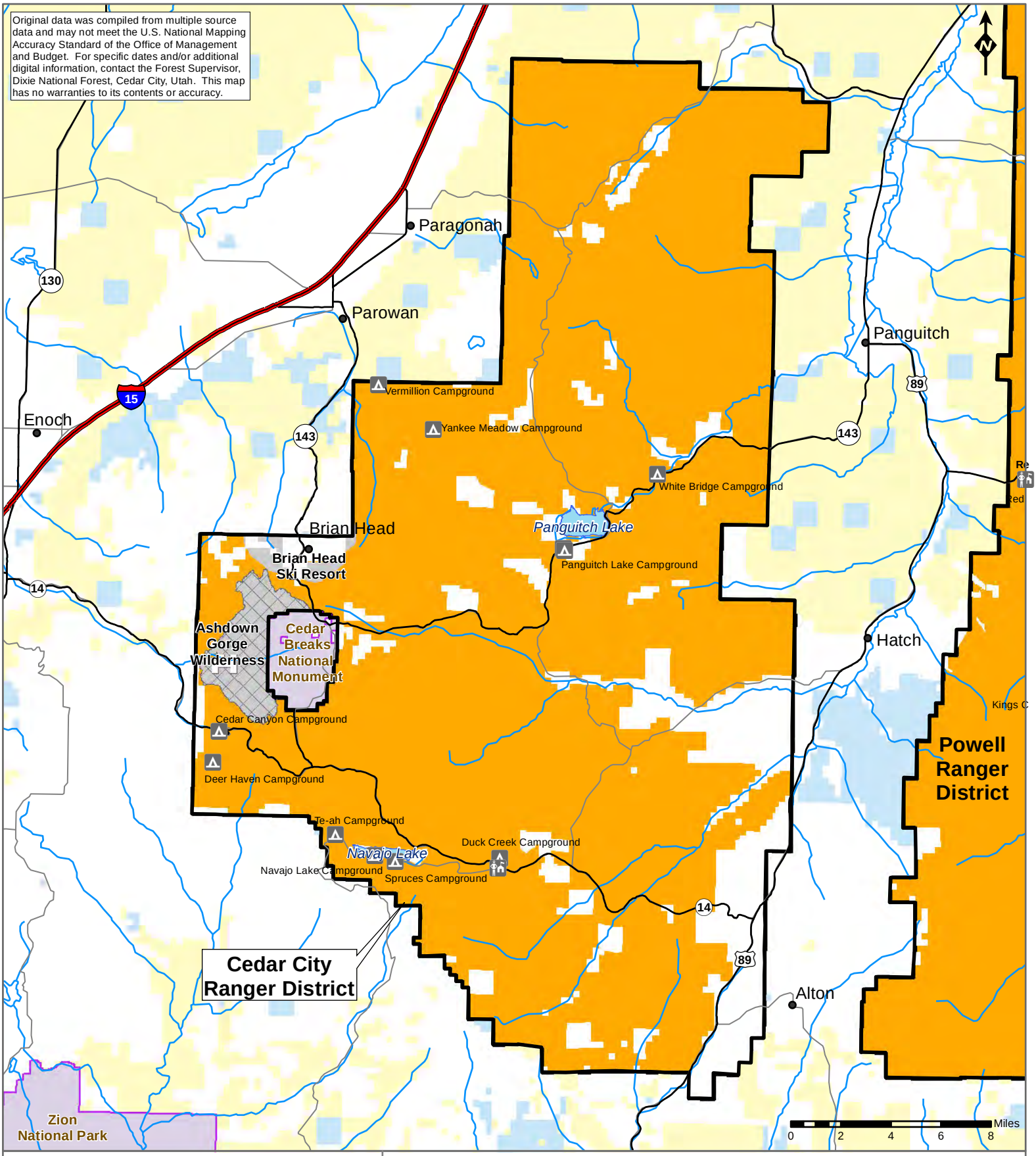
Tribal

Alternative A (% of Dixie National Forest) (2)

Not Available (5.5%)

No Lease (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-1b
Cedar City Ranger District

Alternative A - No Action

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 inch = 5 miles

Cities

Forest Sites
- Campgrounds
- Visitor Centers

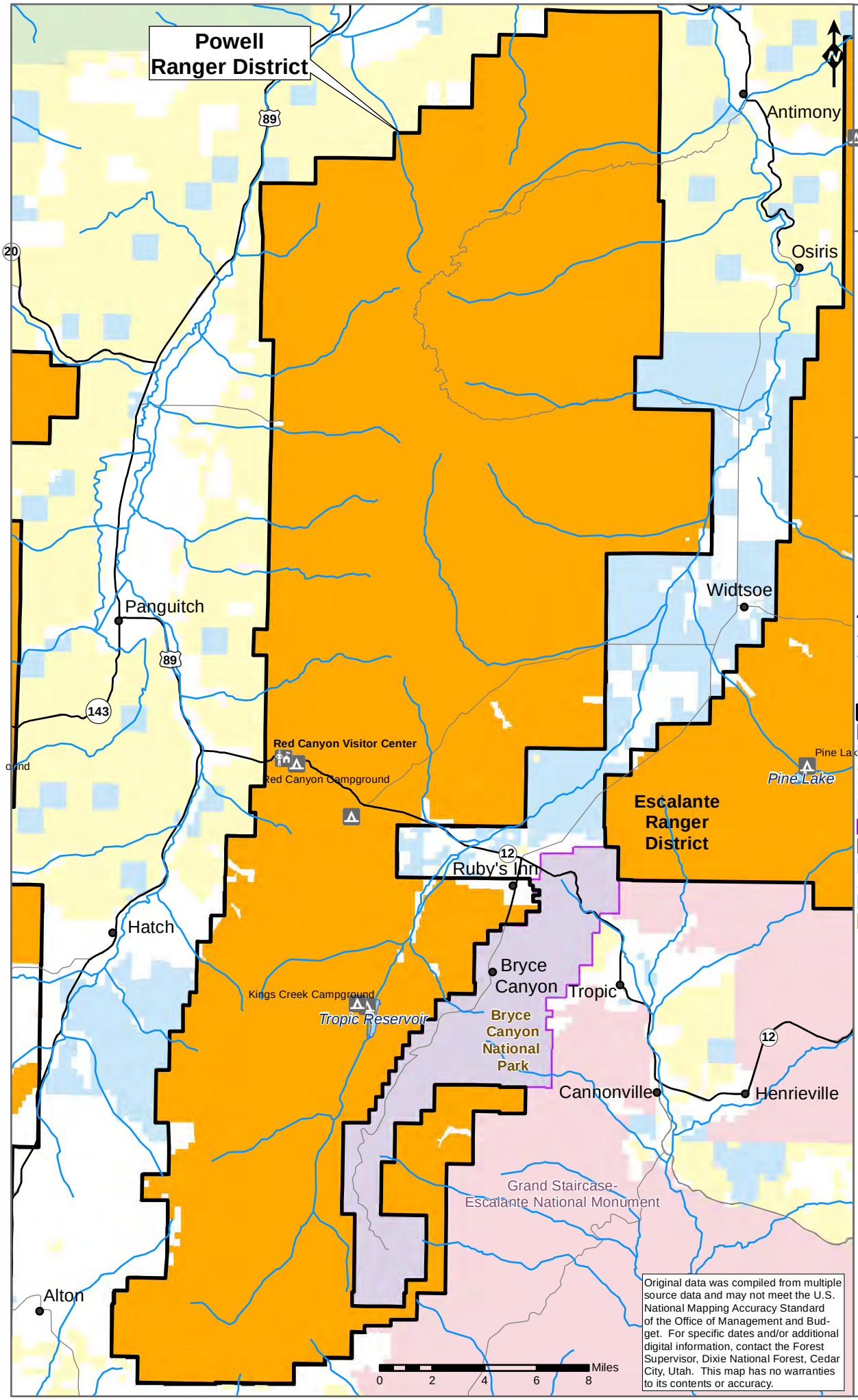
Minor Roads (1)
Highways
Interstates
Major Streams & Rivers
Water Bodies

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- National Park Service
- Private
- State of Utah
- Tribal

Alternative A - No Action (% of Dixie National Forest) (2)
- Not Available (5.5%)
- No Lease (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.

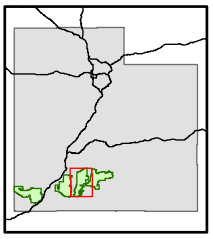


Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-1c

Powell Ranger District Alternative A - No Action



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

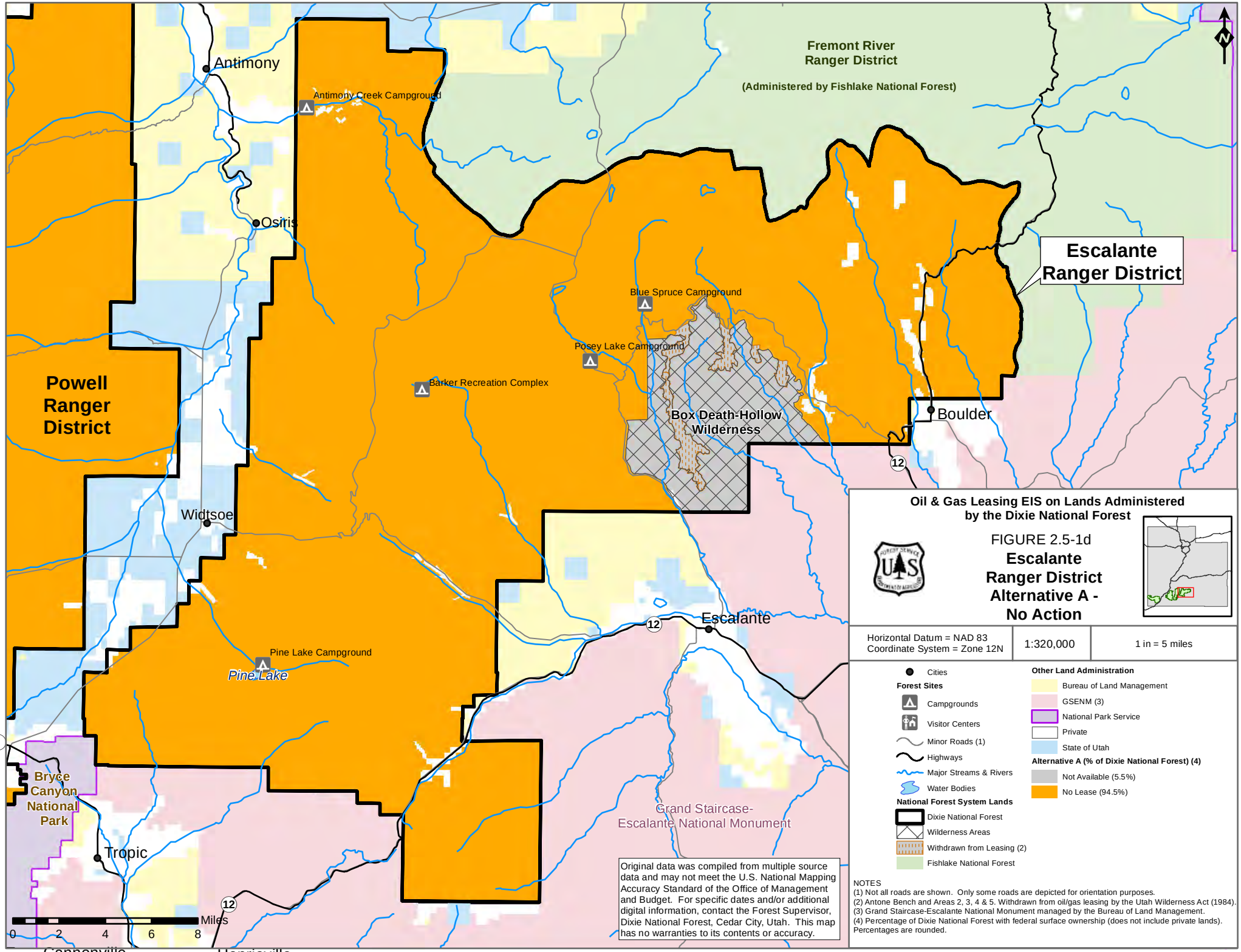
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative A (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Lease (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
Miles
0 2 4 6 8
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-1d
Escalante
Ranger District
Alternative A -
No Action
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative A (% of Dixie National Forest) (4)
Not Available (5.5%)
No Lease (94.5%)
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.

Alternative B would apply a NL option, the most restrictive leasing option, to the following resource components:

- Inventoried Roadless Areas
- Suitable Wild and Scenic Rivers (within ¼ mile of each outer streambank)
- Areas with a ROS classification of primitive
- Sage grouse leks (with a 2-mile buffer)
- Sage grouse summer, nesting, and brood rearing habitat
- Crucial and Substantial deer and elk winter range
- Crucial deer and elk summer range
- Designated Critical Habitat for Mexican spotted owl
- Fisheries Habitat (occupied and suitable)
- Streams, lakes, springs, wetlands, floodplains, and riparian areas
- Lava fields over sensitive aquifers
- Municipal watersheds
- Research Natural Areas
- NPS Protective areas

The leasing options applied to the other resource components are listed in Table 2.5-1. However, where resource components overlap, the most restrictive leasing option would apply. Table 2.5-2 provides a summary of both the acres and percentage of land available under each leasing option by ranger district. Appendix B provides a more detailed summary of the number of acres under each leasing option by resource component and ranger district. Figure 2.5-2 (a-d) shows the most restrictive leasing options that would be applied under this alternative, by ranger district.

2.5.3 Alternative C

2.5.3.1 General Description

Alternative C was developed to be consistent with the management direction and the standards and guidelines identified in the Land and Resource Management Plan; however, an amendment to the existing Land and Resource Management Plan would still occur. Alternative C would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. The leasing options under Alternative C would generally be less restrictive than under Alternative B, but more restrictive than Alternatives D and E. For example, in some resource areas such as IRAs, recreation, fish and wildlife, and water and watershed resources, where Alternative B would apply a more restrictive stipulation, Alternative C may have a less restrictive stipulation. However, many of the leasing options are the same across these two alternatives.

2.5.3.2 Leasing Options

Alternative C would apply restrictive leasing options (leasing options other than SLT) to all of the identified resource components except visual modification SIO low, which would be available under SLT. A NSO stipulation would apply to IRAs under this alternative regardless of the status of the 2001 Roadless Area Conservation Rule (refer to Section 2.3.2 for discussion of the stipulations applied to IRAs). The specific leasing options applied to the other resource components are listed in Table 2.5-1. Table 2.5-3 provides a summary of both the acres and

percentage of land available under each leasing option by ranger district. Appendix B provides a more detailed summary of the number of acres under each leasing option by resource component and ranger district. Figure 2.5-3 (a-d) shows the most restrictive leasing options that would be applied under Alternative C, by ranger district.

A CSU leasing option would be applied to the identified suitable Wild and Scenic River segments and to the area within ¼ mile of each bank. This leasing option would allow only activities that would be compatible with the free-flowing character and outstandingly remarkable values of the identified segment.

Table 2.5-3 Alternative C: Area by Leasing Option for Each Ranger District

Ranger District	Acres[1]/Percent[2] By Leasing Option					Additional TL Overlay[4]
	NA[3]	NL	NSO	CSU	SLT	
Pine Valley	52,864 (11%)	2,053 (<1%)	347,905 (75%)	60,198 (13%)	0	16,866
Cedar City	8,709 (2%)	58,585 (17%)	227,355 (64%)	58,774 (17%)	0	13,186
Powell	0	531 (<1%)	340,776 (89%)	42,592 (11%)	0	14,831
Escalante	28,826 (7%)	1,444 (<1%)	330,677 (77%)	69,949 (16%)	0	3,814
Total	90,399 (6%)	62,614 (4%)	1,246,714 (76%)	231,513 (14%)	0	48,696

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Percentages and totals are approximate due to rounding.
[3] Areas not legally available for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis
[4] Areas of CSU and SLT that have additional Timing Limitations.

2.5.4 Alternative D (D1 and D2)

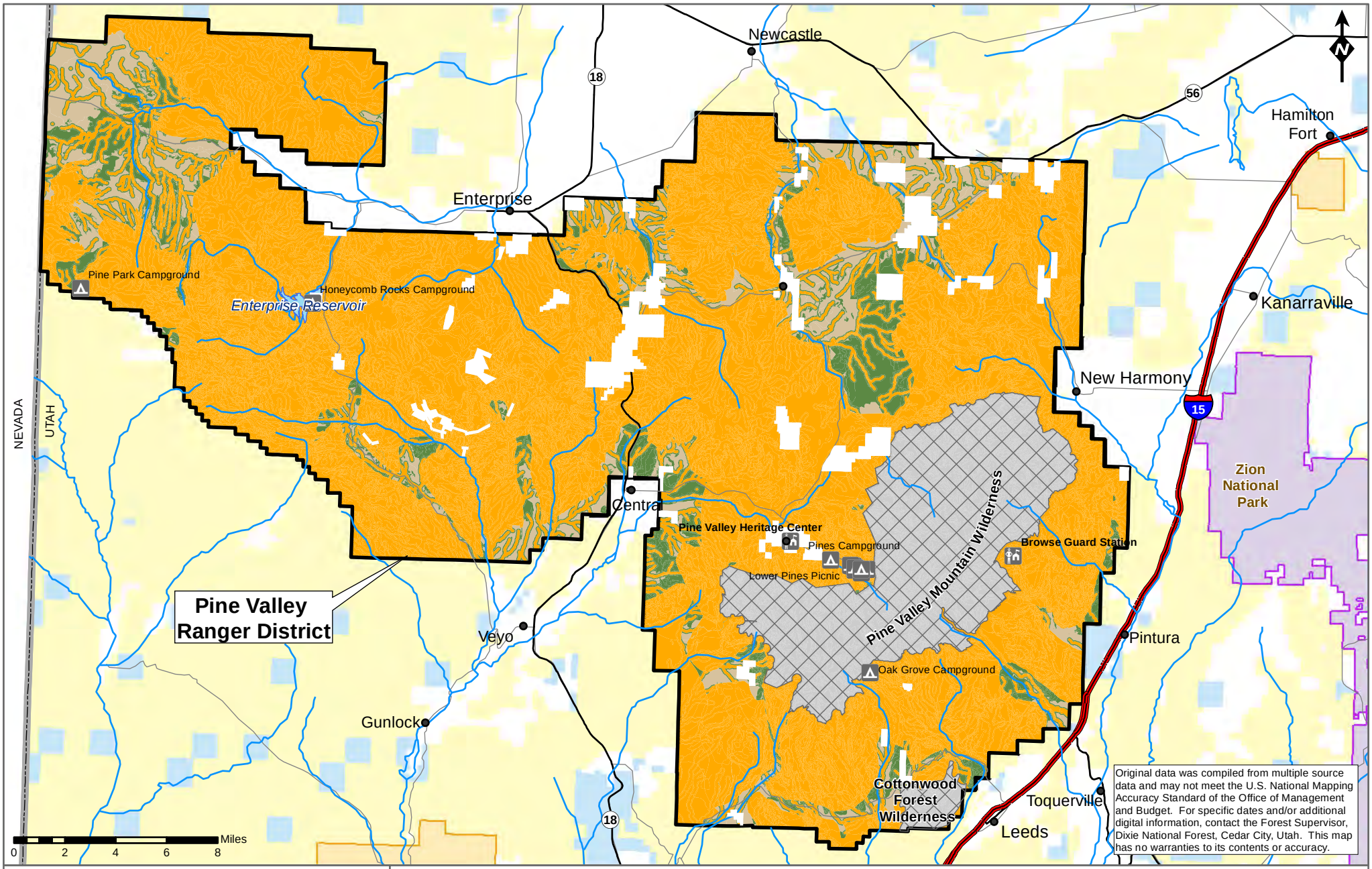
2.5.4.1 General Description

Alternative D would make leasing decisions, including identification of leasing options, as required by 36 CFR 228.102(d) for Dixie National Forest lands. Alternative D would also require an amendment to the Land and Resource Management Plan. This alternative is less restrictive in regard to oil and gas development than under either Alternatives B or C. Leasing options are generally less restrictive than Alternative C. However, in many cases the leasing options are the same as under Alternative C. It is more restrictive than Alternative E.

2.5.4.2 Leasing Options

Alternative D would apply restrictive leasing options (leasing options other than SLT) to many of the identified resource components. However, under Alternative D, the following resource components would be available for lease under SLT.

- Visual Partial Retention/SIO Moderate
- Visual Modification/SIO Low
- Designated Dispersed Areas
- ROS: Roaded Natural
- Marginally Unstable Slopes
- NPS Protective areas



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-2a

Pine Valley Ranger District

Alternative B

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

Tribal

Alternative B (% of Dixie National Forest) (2)

Not Available (5.5%)

No Lease (69.6%)

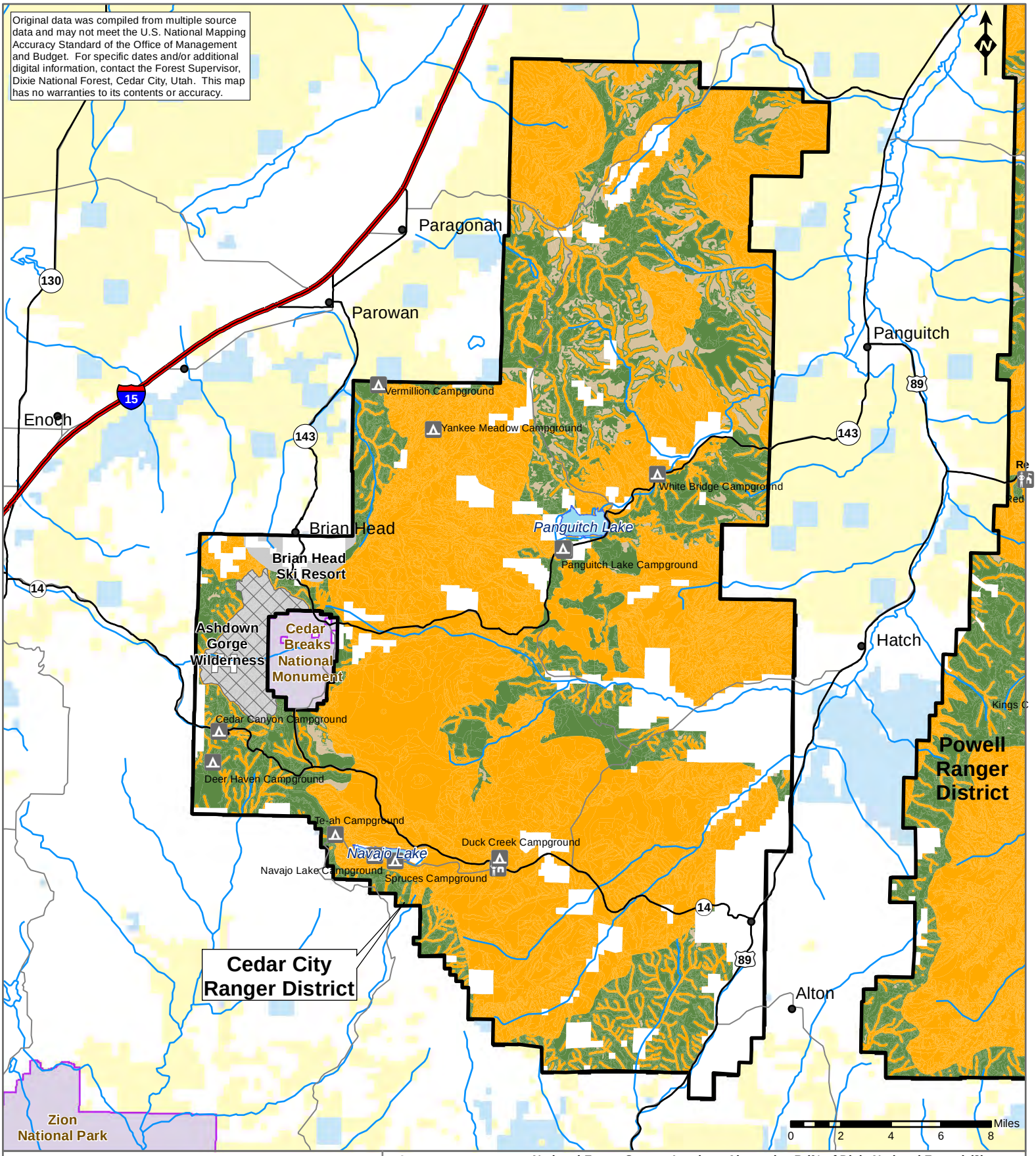
No Surface Occupancy (20.4%)

Controlled Surface Use (4.5%)

NOTES

(1) Not all roads are shown. Only some roads are depicted for orientation purposes.

(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-2b

Cedar City Ranger District

Alternative B

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Minor Roads (1)
- Highways
- Interstates
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Brian Head Ski Resort

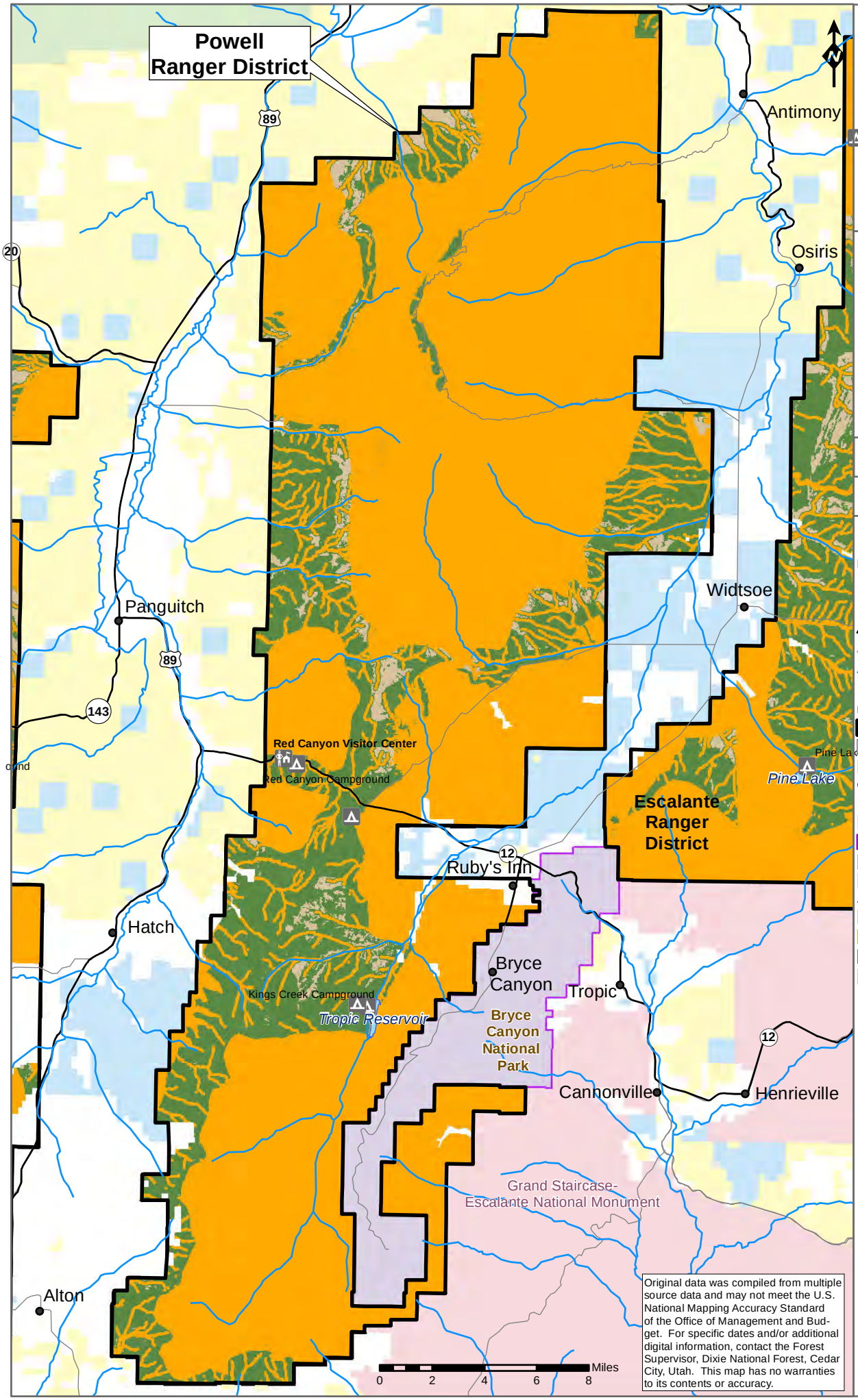
Other Land Administration

- Bureau of Land Management
- National Park Service
- Private
- State of Utah
- Tribal

Alternative B (% of Dixie National Forest) (2)

- Not Available (5.5%)
- No Lease (69.6%)
- No Surface Occupancy (20.4%)
- Controlled Surface Use (4.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



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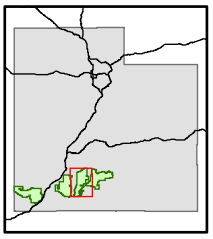
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-2c

Powell Ranger District

Alternative B



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

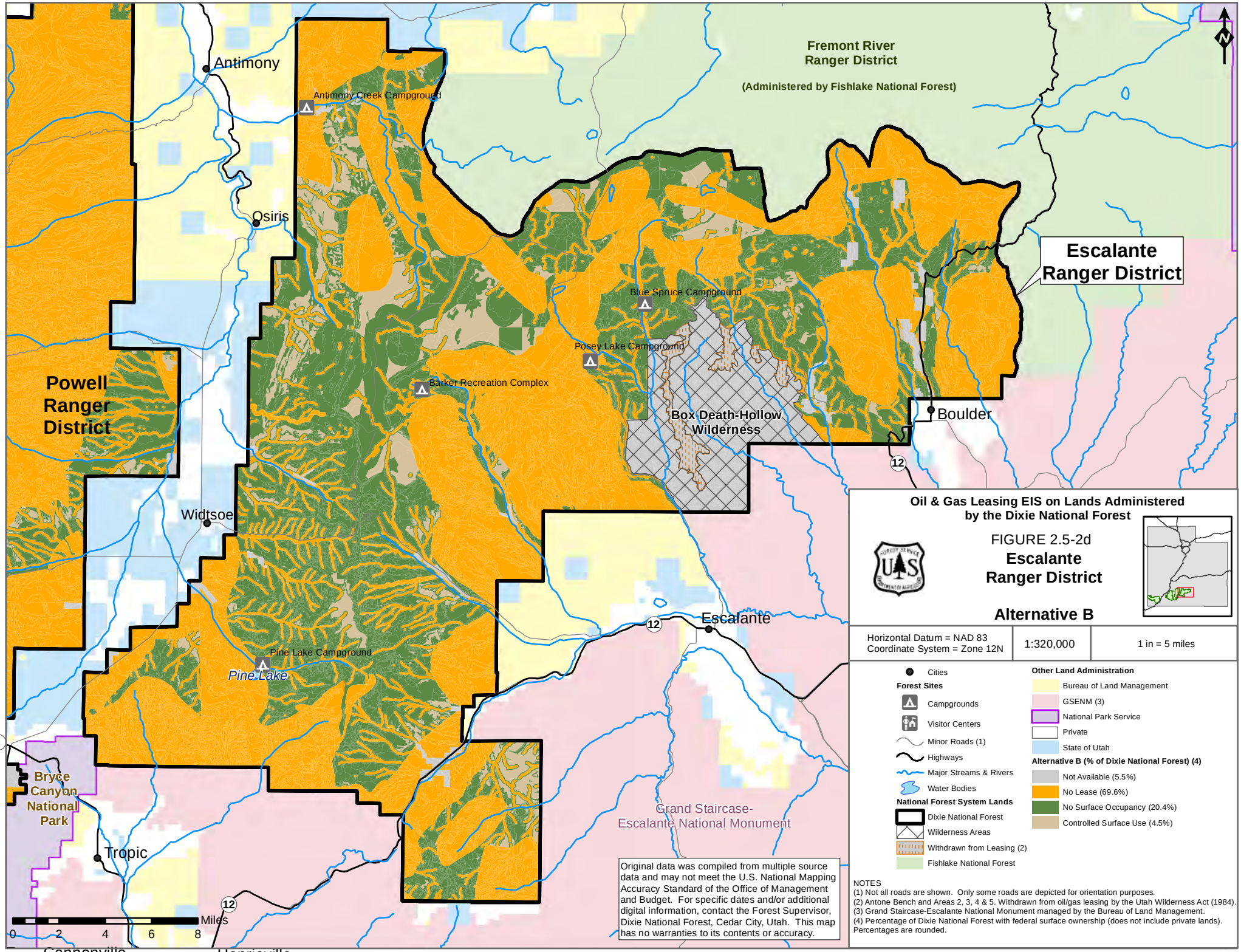
Other Land Administration

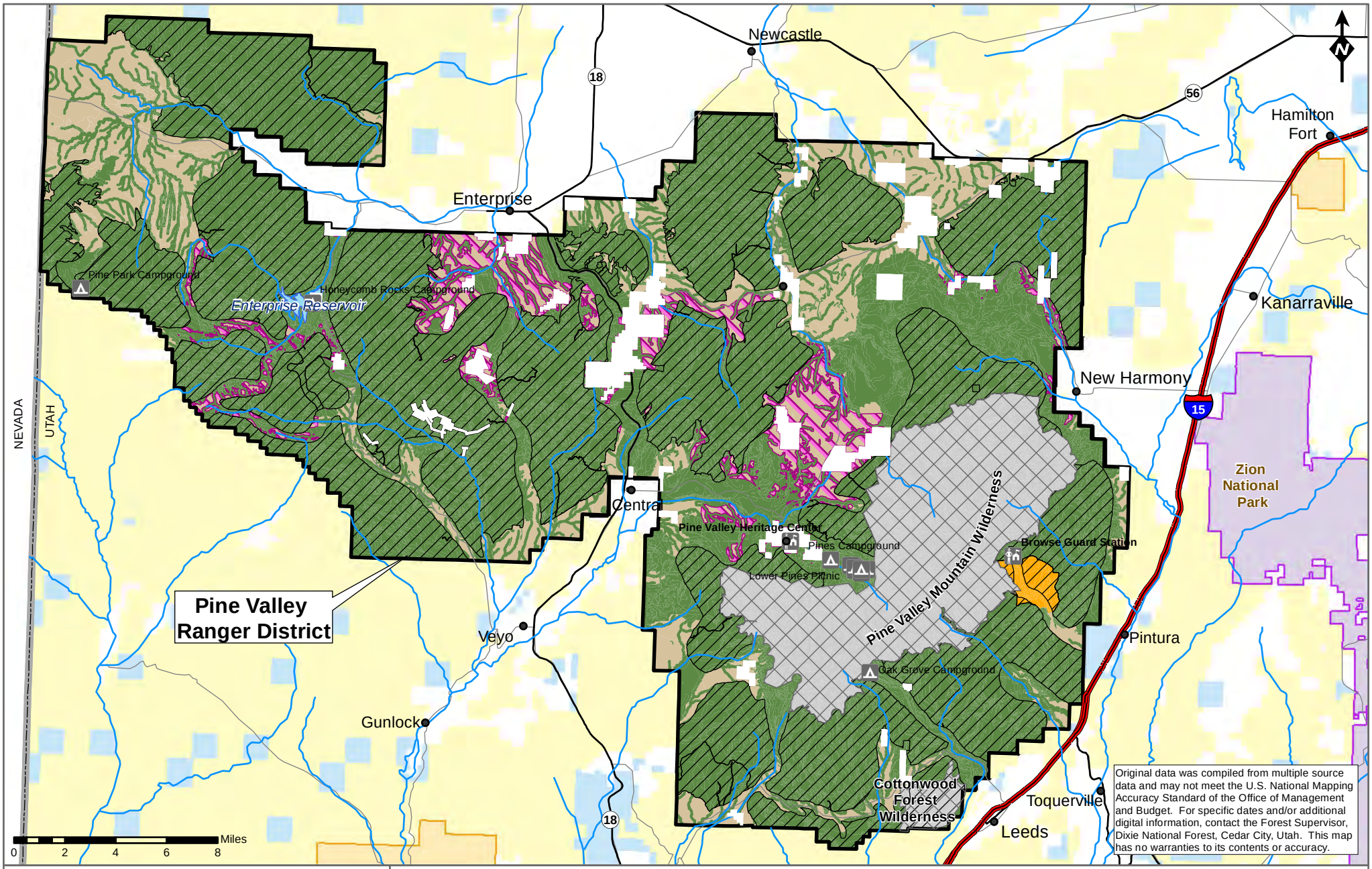
- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative B (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Lease (69.6%)
- No Surface Occupancy (20.4%)
- Controlled Surface Use (4.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
0 2 4 6 8 Miles
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-2d
Escalante
Ranger District
Alternative B
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative B (% of Dixie National Forest) (4)
Not Available (5.5%)
No Lease (69.6%)
No Surface Occupancy (20.4%)
Controlled Surface Use (4.5%)
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-3a

Pine Valley Ranger District

Alternative C

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Inventoried Roadless Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

Tribal

Alternative C (% of Dixie National Forest) (2)

Not Available (5.5%)

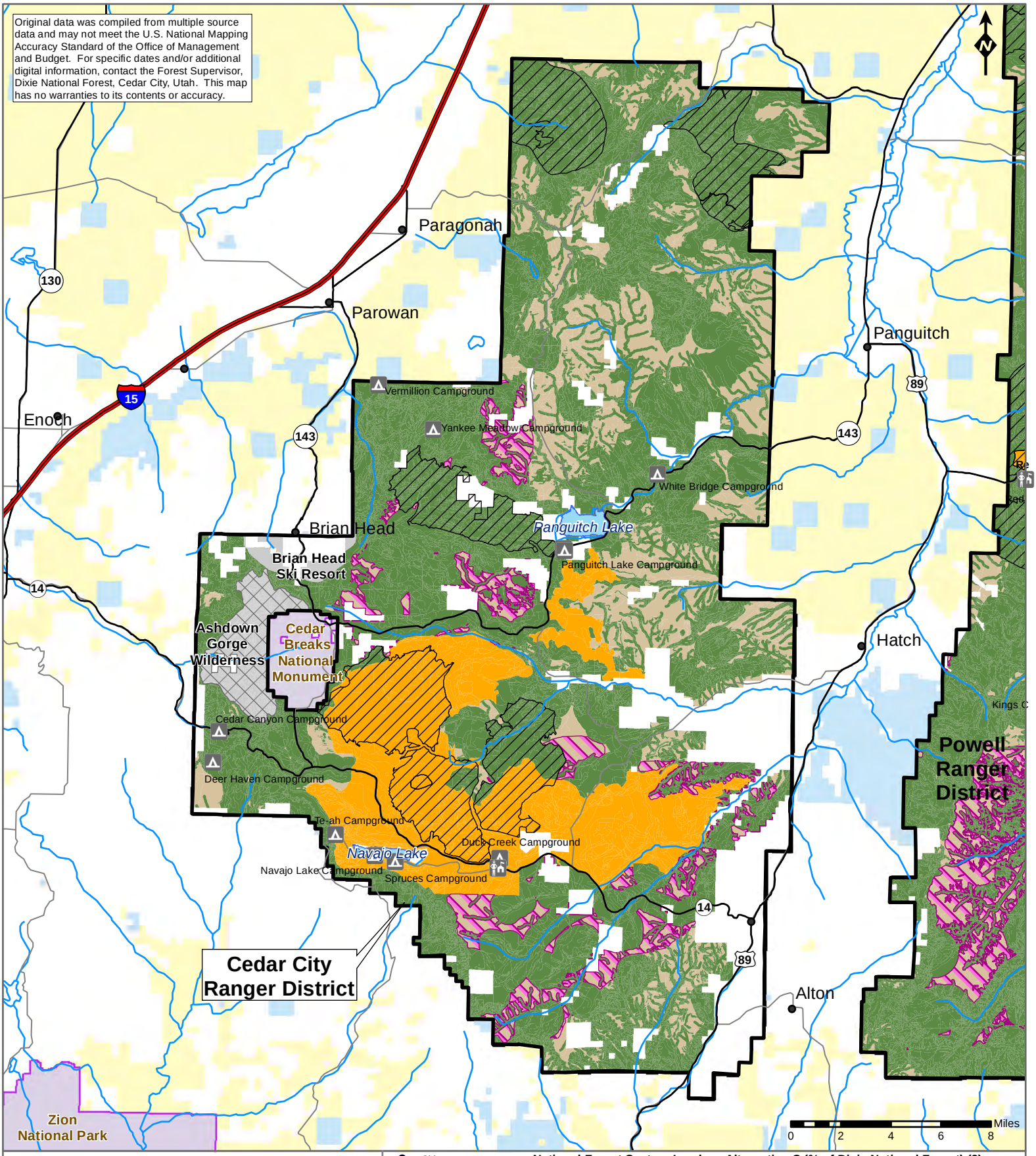
No Lease (3.8%)

No Surface Occupancy (76.4%)

Controlled Surface Use (14.2%)

Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-3b

Cedar City Ranger District

Alternative C

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Minor Roads (1)
- Highways
- Freeways
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Brian Head Ski Resort

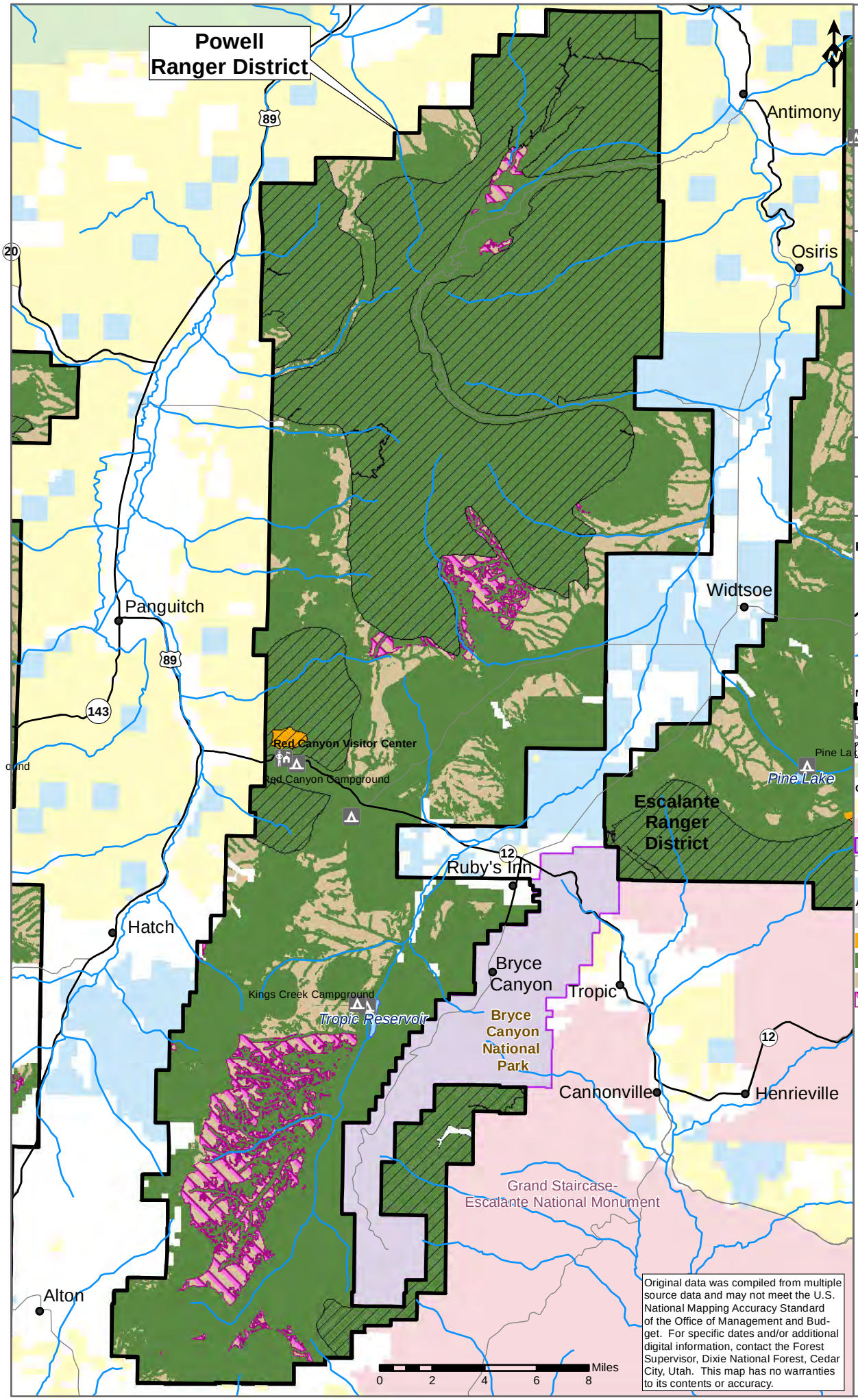
Other Land Administration

- Bureau of Land Management
- National Park Service
- Private
- State of Utah

Alternative C (% of Dixie National Forest) (2)

- Not Available (5.5%)
- No Lease (3.8%)
- No Surface Occupancy (76.4%)
- Controlled Surface Use (14.2%)
- Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



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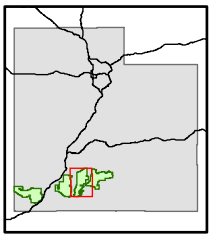
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-3c

Powell Ranger District

Alternative C



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Fishlake National Forest

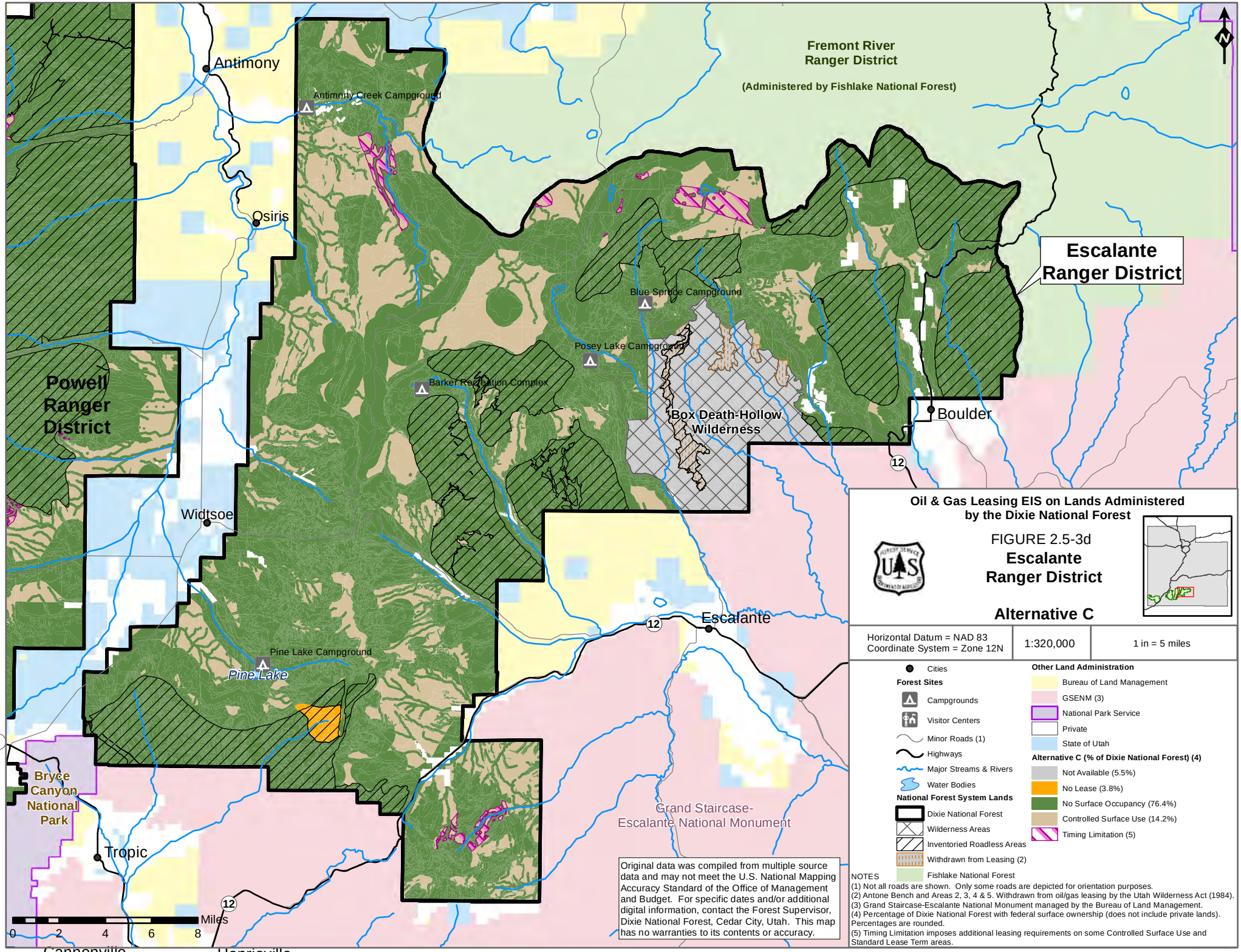
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative C (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Lease (3.8%)
- No Surface Occupancy (76.4%)
- Controlled Surface Use (14.2%)
- Timing Limitation (4)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(4) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
12
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
0 2 4 6 8 Miles
N
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-3d
Escalante
Ranger District
Alternative C
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Inventoried Roadless Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative C (% of Dixie National Forest) (4)
Not Available (5.5%)
No Lease (3.8%)
No Surface Occupancy (76.4%)
Controlled Surface Use (14.2%)
Timing Limitation (5)
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(5) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

In addition, under dual analysis (see Section 2.3.2), Alternative D will be evaluated as two separate sub-alternatives: D1 and D2. Under Alternative D1, NSO would be applied to all IRAs to meet the intent of the 2001 Roadless Area Conservation Rule. Under Alternative D2, a less restrictive CSU leasing option would apply to IRAs. The CSU stipulation applied to IRAs under Alternative D2 would allow travel along existing roads (i.e., roads open to the public following the Motorized Travel Plan, 2009) within IRAs, which may be cleared of vegetation to allow passage of equipment. However, no mechanical road construction or reconstruction would be allowed and no new temporary or permanent roads could be created.

A CSU leasing option would be applied to the identified suitable Wild and Scenic River segments and the area within ¼ mile of each bank. This leasing option would allow only activities that would be compatible with the free-flowing character and outstandingly remarkable values of the identified segment. This is less restrictive than B, but more restrictive than E.

Table 2.5-1 shows the leasing options applied under all alternatives. The percentage of land available under the various leasing options can be compared by ranger district in Table 2.5-4. Appendix B provides a more detailed summary of the number of acres under each leasing option with leasing allowed in IRAs under both NSO and a CSU, by resource component and ranger district. Figure 2.5-4 (a-d) shows the most restrictive leasing options that would be applied under Alternative D with NSO in IRAs (D1) and with CSU in IRAs (D2), by ranger district.

Table 2.5-4 Alternative D (D1 and D2): Area by Leasing Option for Each Ranger District

Ranger District	Sub-Alternative	Acres[1]/Percent[2] By Leasing Option					Additional TL Overlay[4]
		NA[3]	NL	NSO	CSU	SLT	
Pine Valley	D1	52,864 (11%)		253,883 (55%)	150,418 (32%)	5,855 (01%)	74,596
	D2	52,864 (11%)		18,624 (04%)	385,676 (83%)	5,855 (01%)	175,937
Cedar City	D1	8,709 (02%)		98,629 (28%)	246,084 (70%)	1 (0%)	111,808
	D2	8,709 (02%)		69,878 (20%)	274,835 (78%)	1 (0%)	125,615
Powell	D1			200,630 (52%)	183,265 (48%)	4 (0%)	116,984
	D2			37,274 (10%)	346,622 (90%)	4 (0%)	227,385
Escalante	D1	28,826 (07%)		113,358 (26%)	288,706 (67%)	7 (03%)	74,595
	D2	28,826 (07%)		16,413 (04%)	385,651 (89%)	7 (0%)	243,596
Total	D1	90,399 (06%)		666,500 (41%)	868,473 (53%)	5,867 (0%)	377,983
	D2	90,399 (06%)		142,189 (09%)	1,392,784 (85%)	5,867 (0%)	772,533

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Percentages and totals are approximate due to rounding
[3] Areas not legally available for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis
[4] Areas of CSU and SLT that have additional Timing Limitations.

2.5.5 Alternative E: Standard Lease Terms and Conditions

2.5.5.1 General Description

Alternative E would open the majority of the Dixie National Forest to leasing under the standard lease terms and conditions contained on BLM Lease Form 3100-11, with the exception of IRAs with the 2001 Roadless Area Conservation Rule (see Section 2.3.2 for an explanation of the dual analysis). This is the least restrictive alternative in regard to oil and gas development.

2.5.5.2 Leasing Options

Under dual analysis, Alternative E would be evaluated as two separate sub-alternatives: E1 and E2. Under Alternative E1, NSO would be applied to all IRAs under the 2001 Roadless Area Conservation Rule. All resource components other than IRAs would be protected to the extent required by SLT. Figure 2.5-5 (a-d) shows the areas of the Dixie National Forest that would be under NSO. Alternative E2 would allow leasing in IRAs under a less restrictive leasing option, and all areas of the Dixie National Forest would be open to leasing under SLT. The percentage of land available under each leasing option can be compared by ranger district in Table 2.5-5. Appendix B provides a more detailed summary of the number of acres under each leasing option for both scenarios by resource component and ranger district.

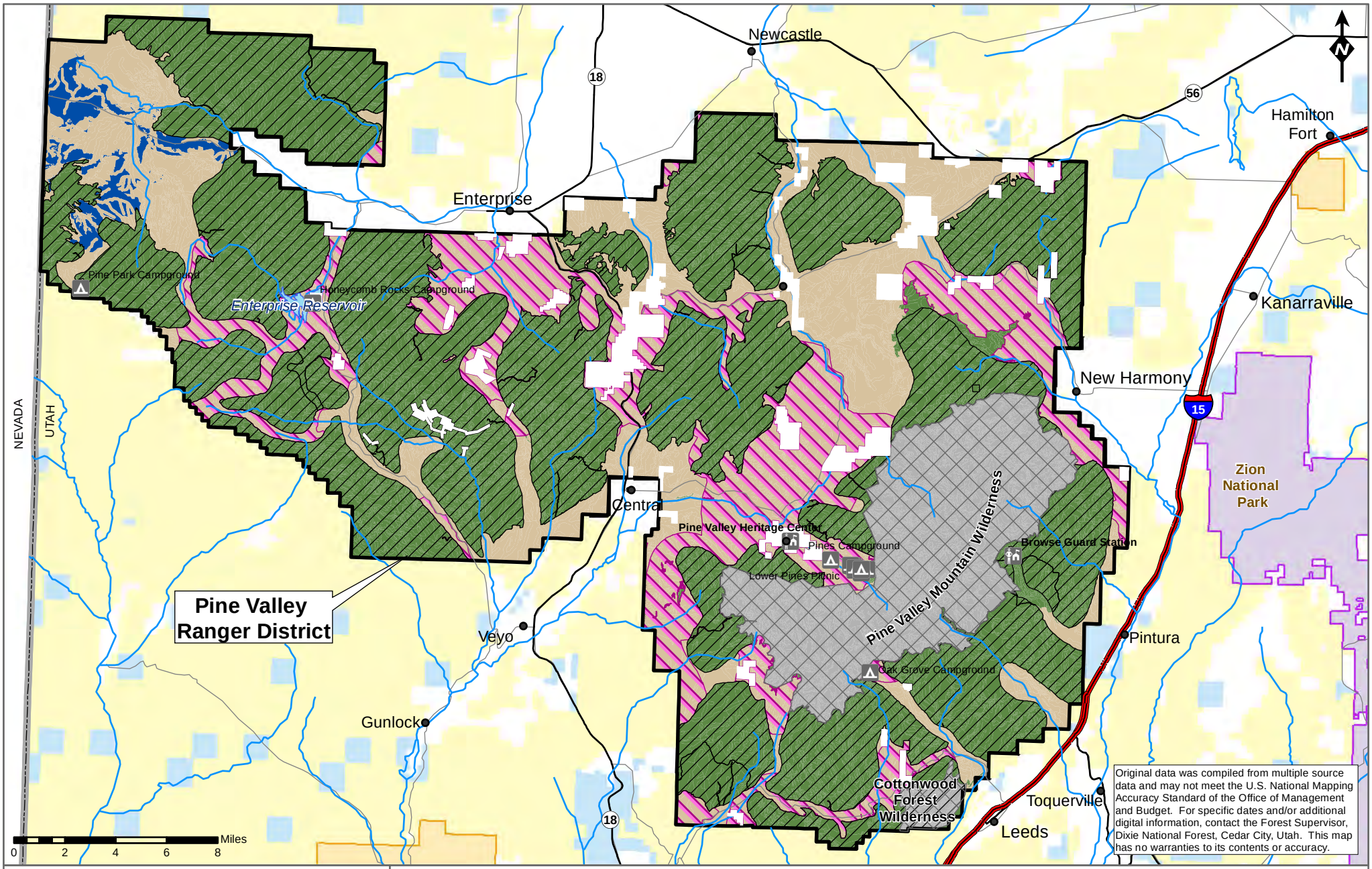
Table 2.5-5 Alternative E (E1 and E2): Area by Leasing Option for Each Ranger District

Ranger District	Sub-Alternative	Acres[1]/Percent[2] By Leasing Option				
		NA[3]	NL	NSO	CSU	SLT
Pine Valley	E1	52,864 (11%)		253,342 (54%)		156,814 (34%)
	E2	52,864 (11%)				410,156 (89%)
Cedar City	E1	8,709 (02%)		47,842 (14%)		296,873 (84%)
	E2	8,709 (02%)				344,715 (98%)
Powell	E1	0		167,418 (44%)		216,481 (56%)
	E2	0				383,899 (100%)
Escalante	E1	28,826 (07%)		99,877 (23%)		302,194 (70%)
	E2	28, 826 (07%)				402,071 (93%)
Total	E1	90,399 (06%)		565,922 (35%)		974,919 (60%)
	E2	90,399 (06%)				1,540,841 (94%)

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Percentages and totals are approximate due to rounding
[3] Areas not legally available for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis

2.6 Environmental Protection Measures Common to All Alternatives

Specific Environmental Protection Measures were not developed for each alternative. Rather, the development of a lease would be expected to adhere to the standards and guidelines contained in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007), BLM Onshore Oil and Gas Orders, Forest Service Region 4 Oil and Gas Roading Guidelines, and any Dixie National Forest BMPs in place at the time of lease approval. Further, the Dixie National Forest has developed additional operating standards and well site design requirements that supplement those already contained in the documents mentioned above. These supplemental guidelines are contained in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C). Copies of this document will be made available to potential lessees at the time lands are offered for lease. Further, as each project would undergo additional NEPA analysis, site-specific BMPs, Environmental Protection Measures, and potential mitigation would be developed at that time.



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Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4a(1)

Pine Valley Ranger District

Alternative D1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Inventoried Roadless Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

Tribal

Alternative D1 (% of Dixie National Forest) (2)

Not Available (5.5%)

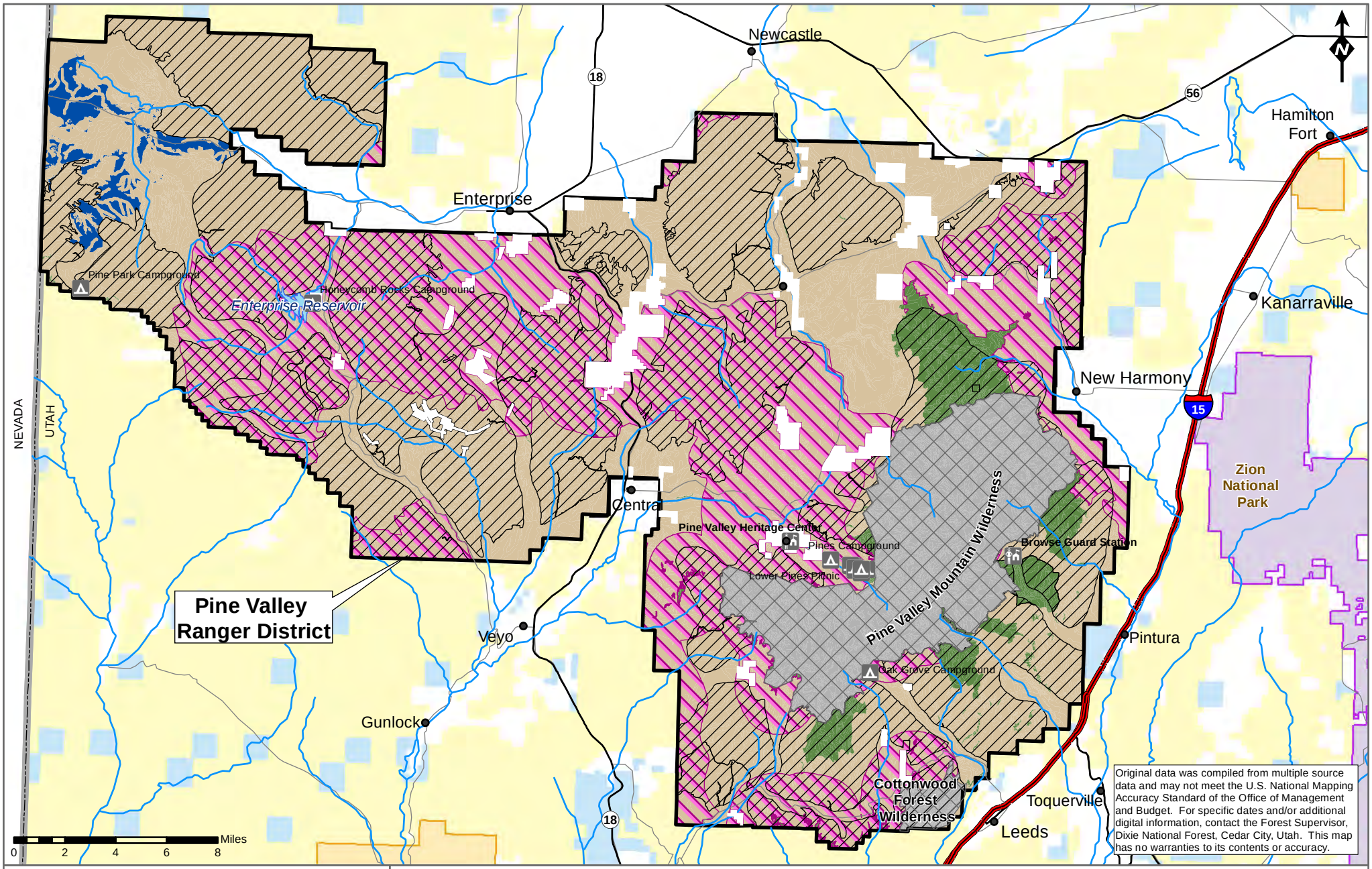
No Surface Occupancy (40.9%)

Controlled Surface Use (53.2%)

Standard Lease Term (0.4%)

Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



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Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4a(2)

Pine Valley Ranger District

Alternative D2*

*Inventoried Roadless Areas analyzed as Controlled Surface Use

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Inventoried Roadless Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

Tribal

Alternative D2 (% of Dixie National Forest) (2)

Not Available (5.5%)

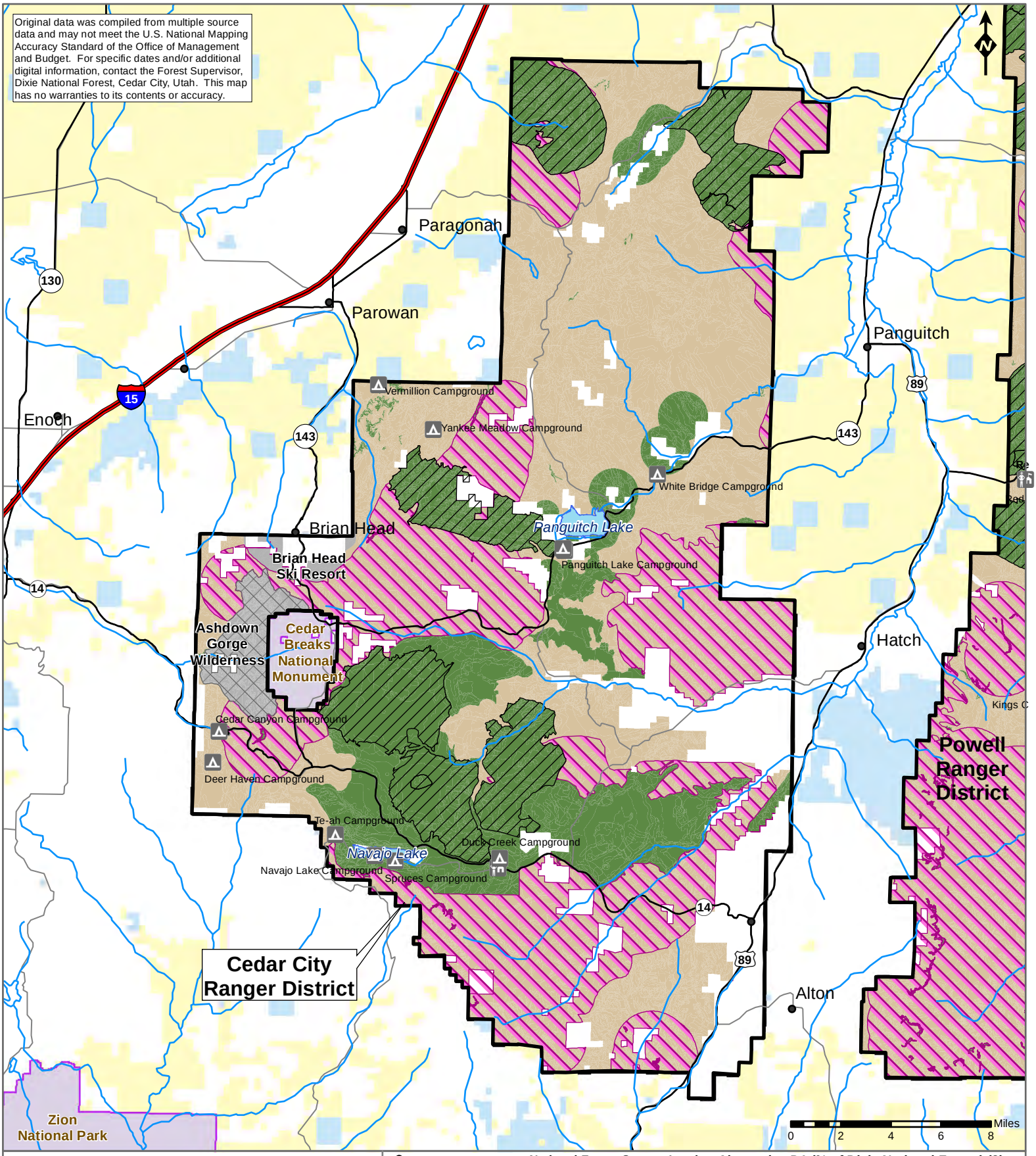
No Surface Occupancy (8.7%)

Controlled Surface Use (85.4%)

Standard Lease Term (0.4%)

Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4b(1)

Cedar City Ranger District

Alternative D1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Minor Roads (1)
- Highways
- Freeways
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Brian Head Ski Resort

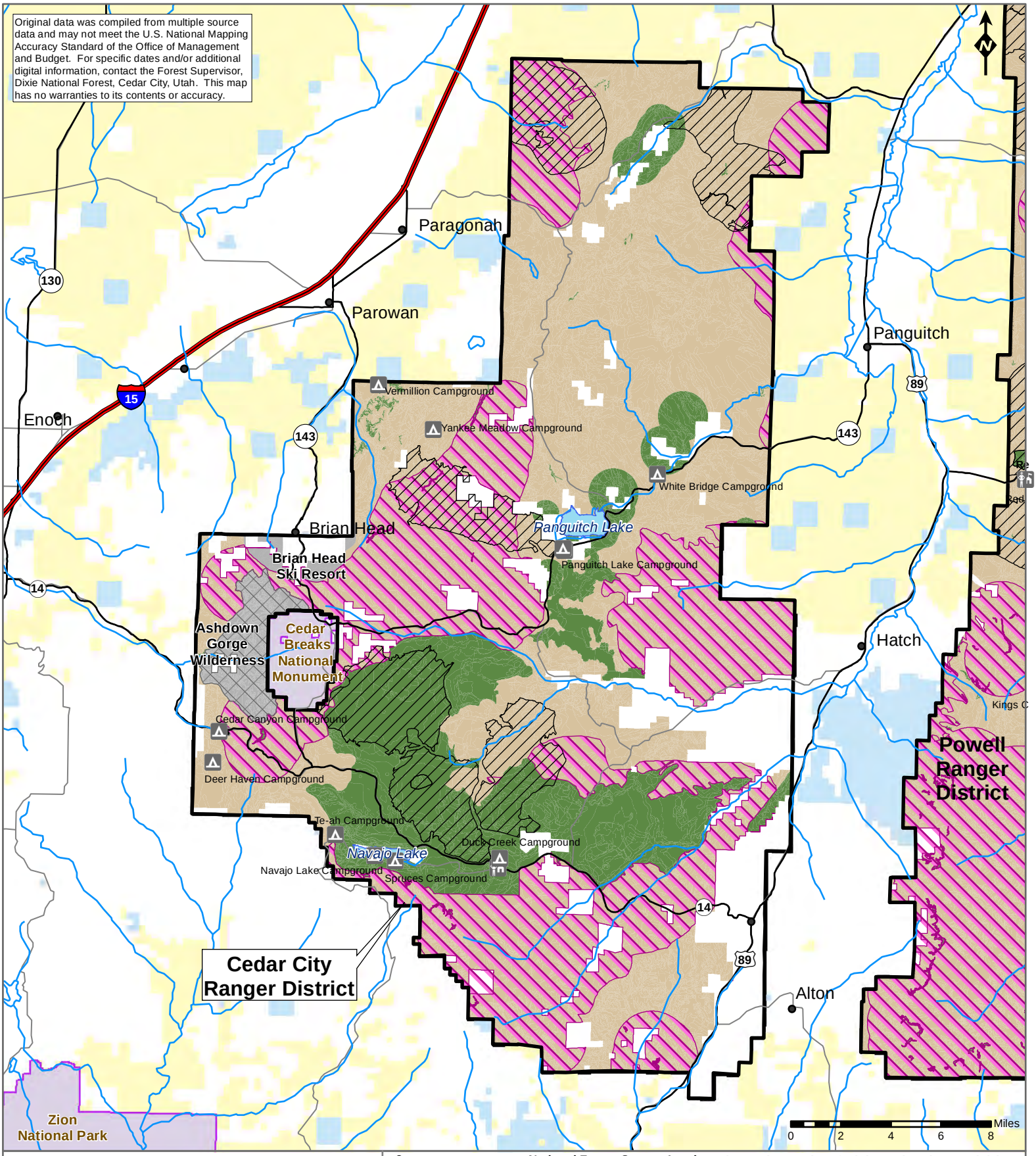
Other Land Administration

- Bureau of Land Management
- National Park Service
- Private
- State of Utah

Alternative D1 (% of Dixie National Forest) (2)

- Not Available (5.5%)
- No Surface Occupancy (40.9%)
- Controlled Surface Use (53.2%)
- Standard Lease Term (0.4%)
- Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



Zion

Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4b(2)

Cedar City Ranger District

Alternative D2*

*Inventoried Roadless Areas analyzed as Controlled Surface Use

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Minor Roads (1)
- Highways
- Freeways
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Brian Head Ski Resort

Glendale

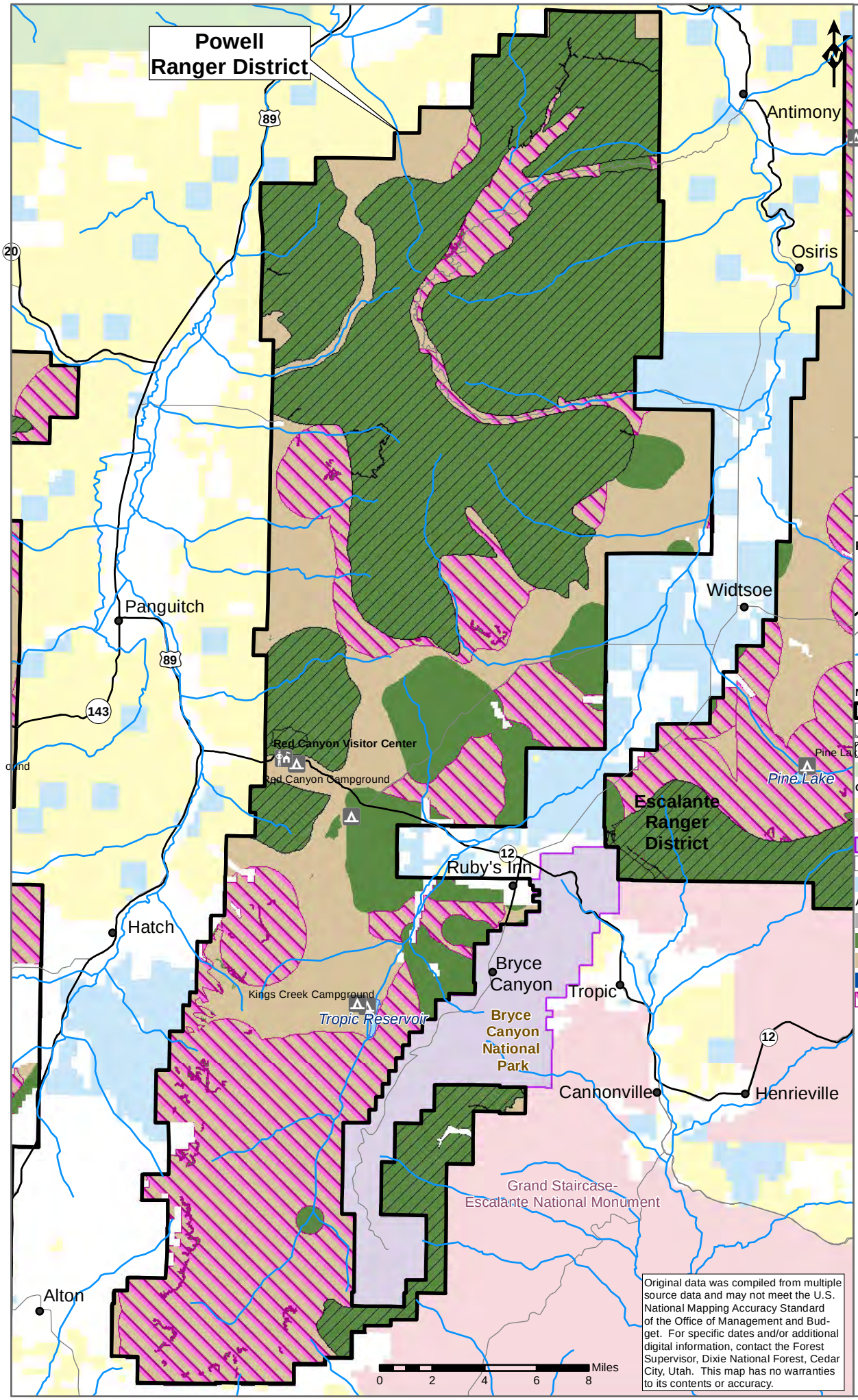
Other Land Administration

- Bureau of Land Management
- National Park Service
- Private
- State of Utah

Alternative D2 (% of Dixie National Forest) (2)

- Not Available (5.5%)
- No Surface Occupancy (8.7%)
- Controlled Surface Use (85.4%)
- Standard Lease Term (0.4%)
- Timing Limitation (3)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(3) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



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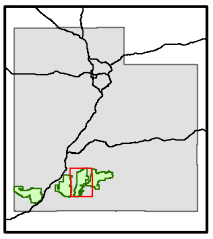
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4c(1)

Powell Ranger District Alternative D1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Fishlake National Forest

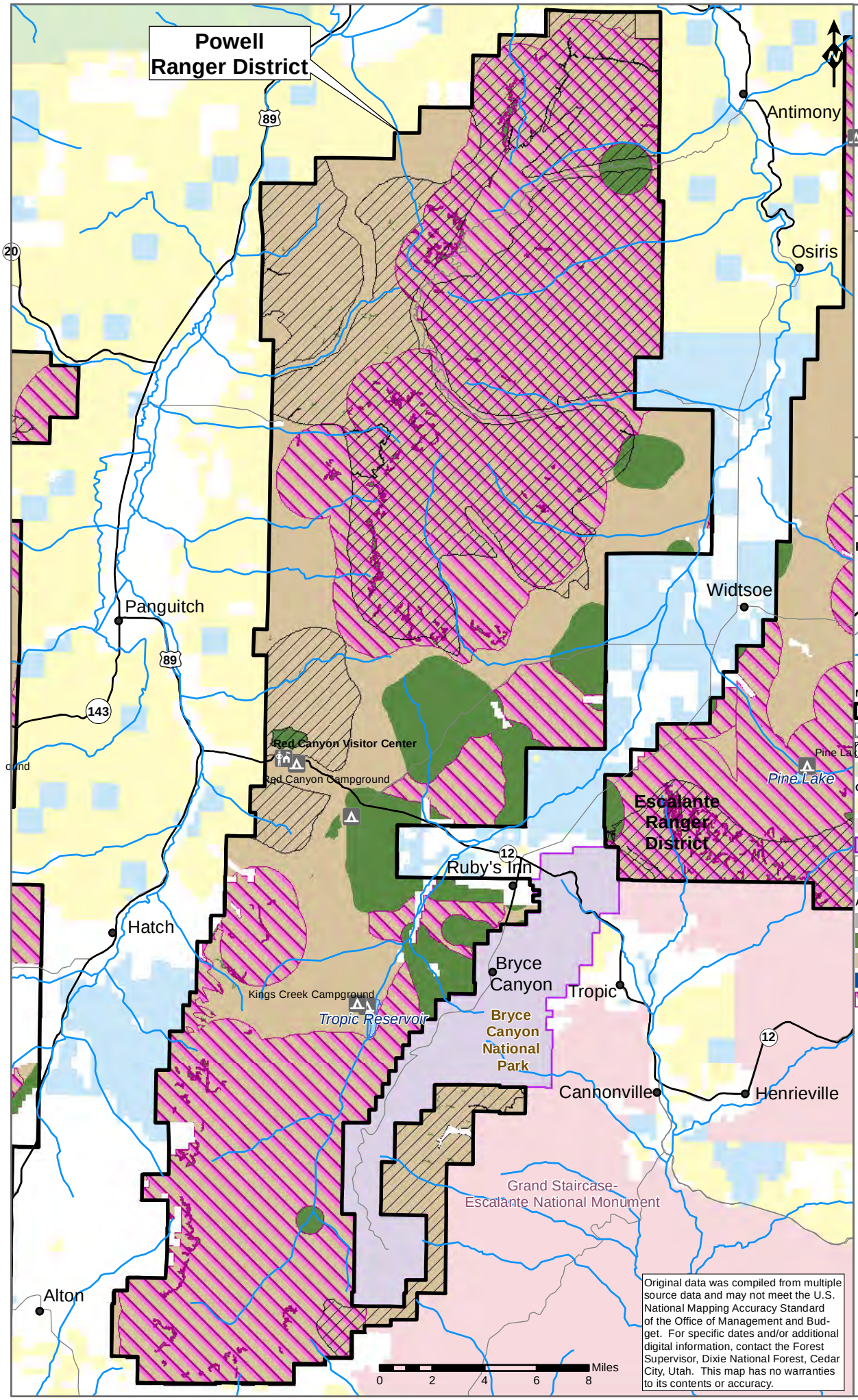
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative D1 (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Surface Occupancy (40.9%)
- Controlled Surface Use (53.2%)
- Standard Lease Term (0.4%)
- Timing Limitation (4)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(4) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



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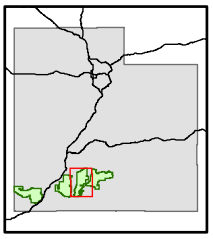
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-4c(2)

Powell Ranger District Alternative D2*

*Inventoried Roadless Areas analyzed as Controlled Surface Use



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Fishlake National Forest

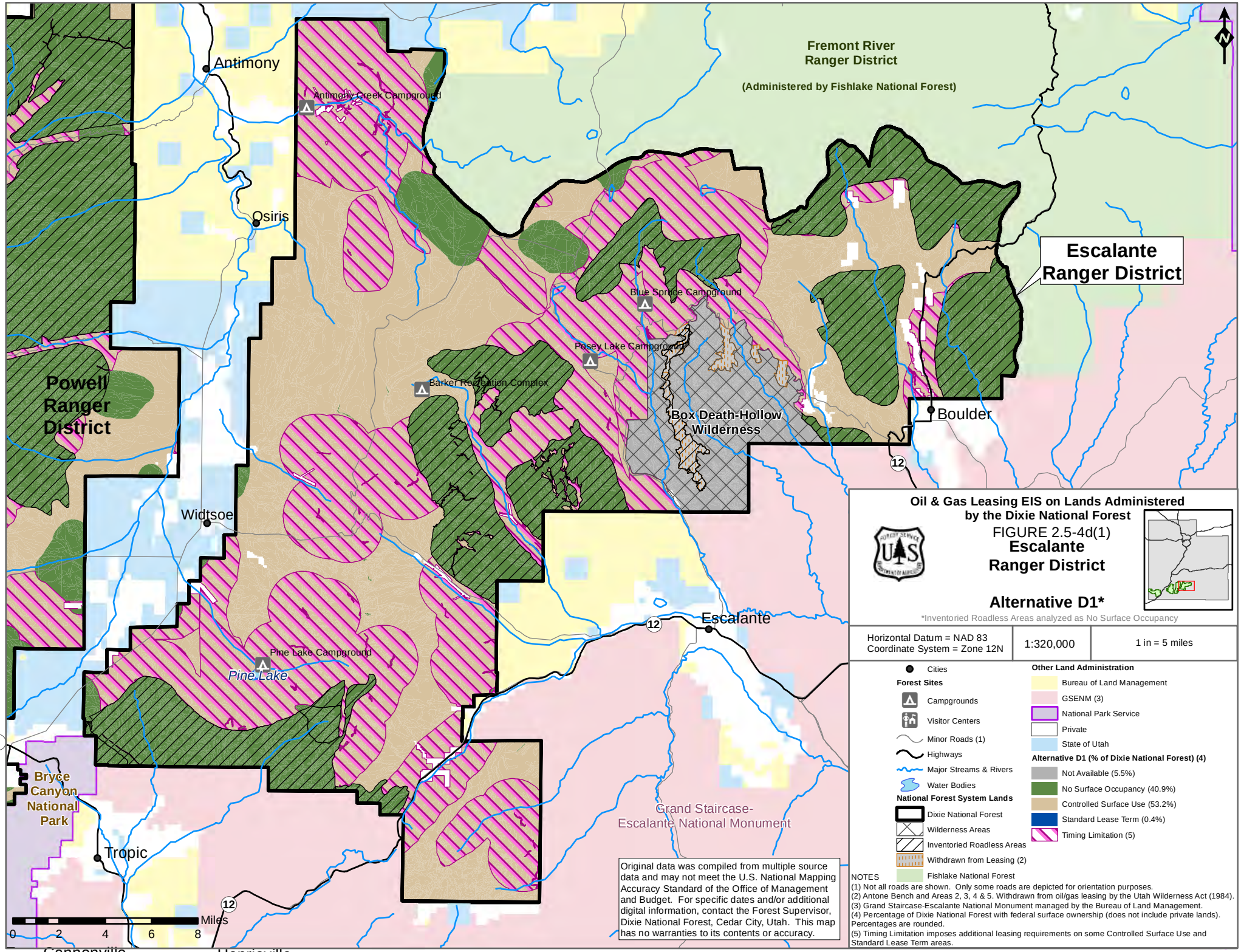
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative D2 (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Surface Occupancy (8.7%)
- Controlled Surface Use (85.4%)
- Standard Lease Term (0.4%)
- Timing Limitation (4)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(4) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
Miles
0 2 4 6 8
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-4d(1)
Escalante
Ranger District
Alternative D1*
*Inventoried Roadless Areas analyzed as No Surface Occupancy
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Inventoried Roadless Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative D1 (% of Dixie National Forest) (4)
Not Available (5.5%)
No Surface Occupancy (40.9%)
Controlled Surface Use (53.2%)
Standard Lease Term (0.4%)
Timing Limitation (5)
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(5) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.
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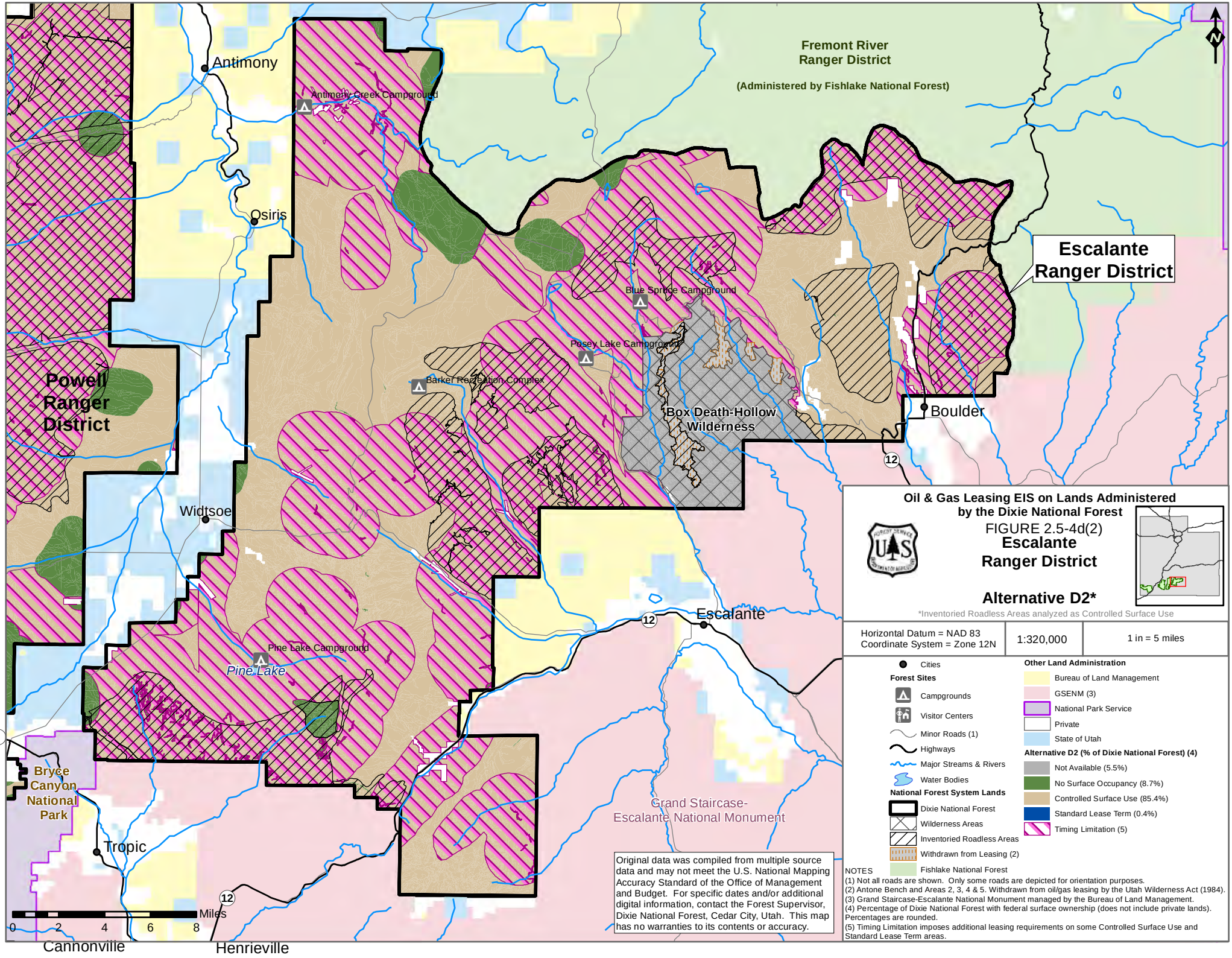
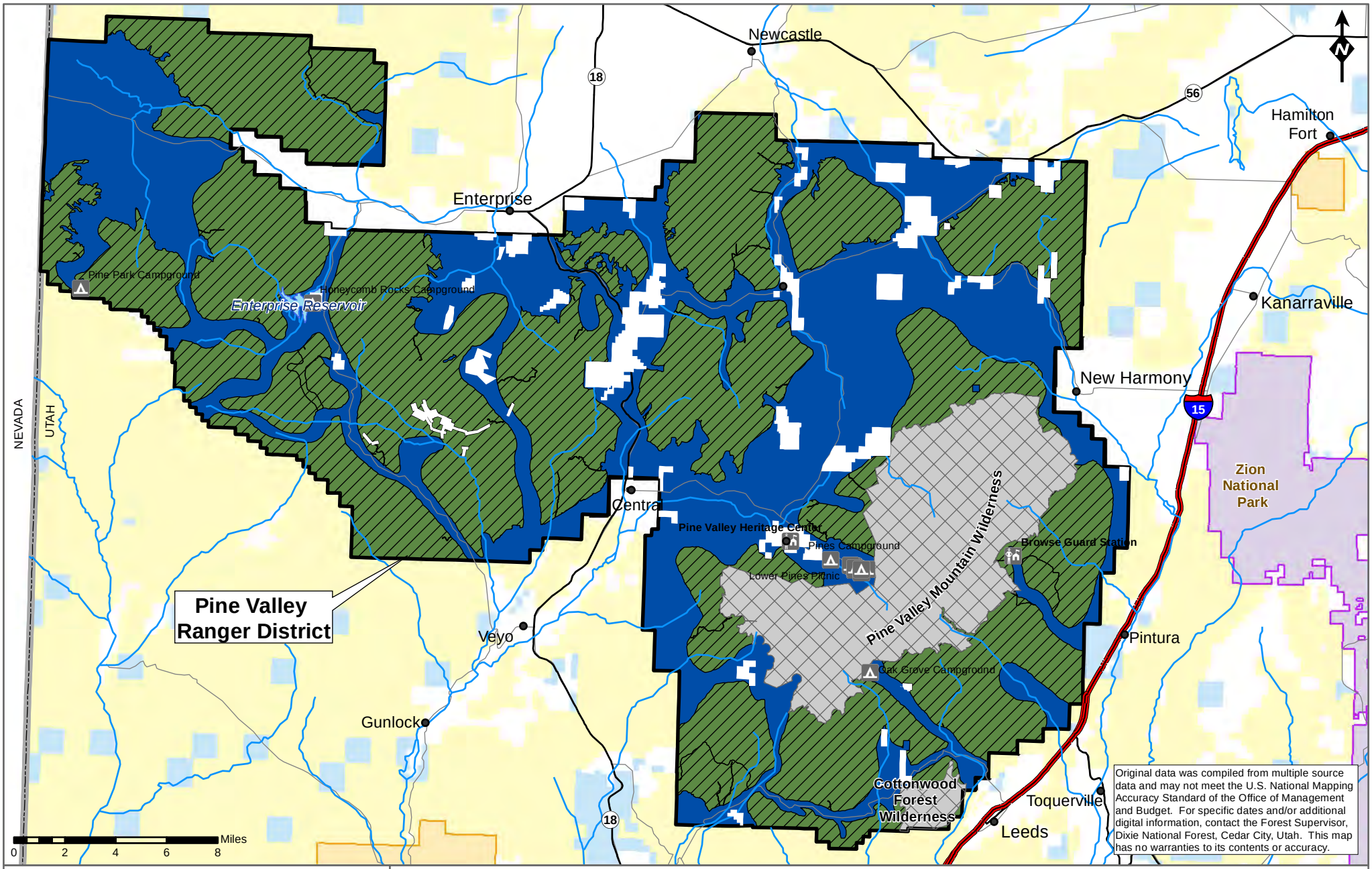

Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
0 2 4 6 8 Miles
N
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-4d(2)
Escalante
Ranger District
Alternative D2*
*Inventoried Roadless Areas analyzed as Controlled Surface Use
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Inventoried Roadless Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative D2 (% of Dixie National Forest) (4)
Not Available (5.5%)
No Surface Occupancy (8.7%)
Controlled Surface Use (85.4%)
Standard Lease Term (0.4%)
Timing Limitation (5)
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.
(5) Timing Limitation imposes additional leasing requirements on some Controlled Surface Use and Standard Lease Term areas.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5a(1)

Pine Valley Ranger District Alternative E1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Inventoried Roadless Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

Tribal

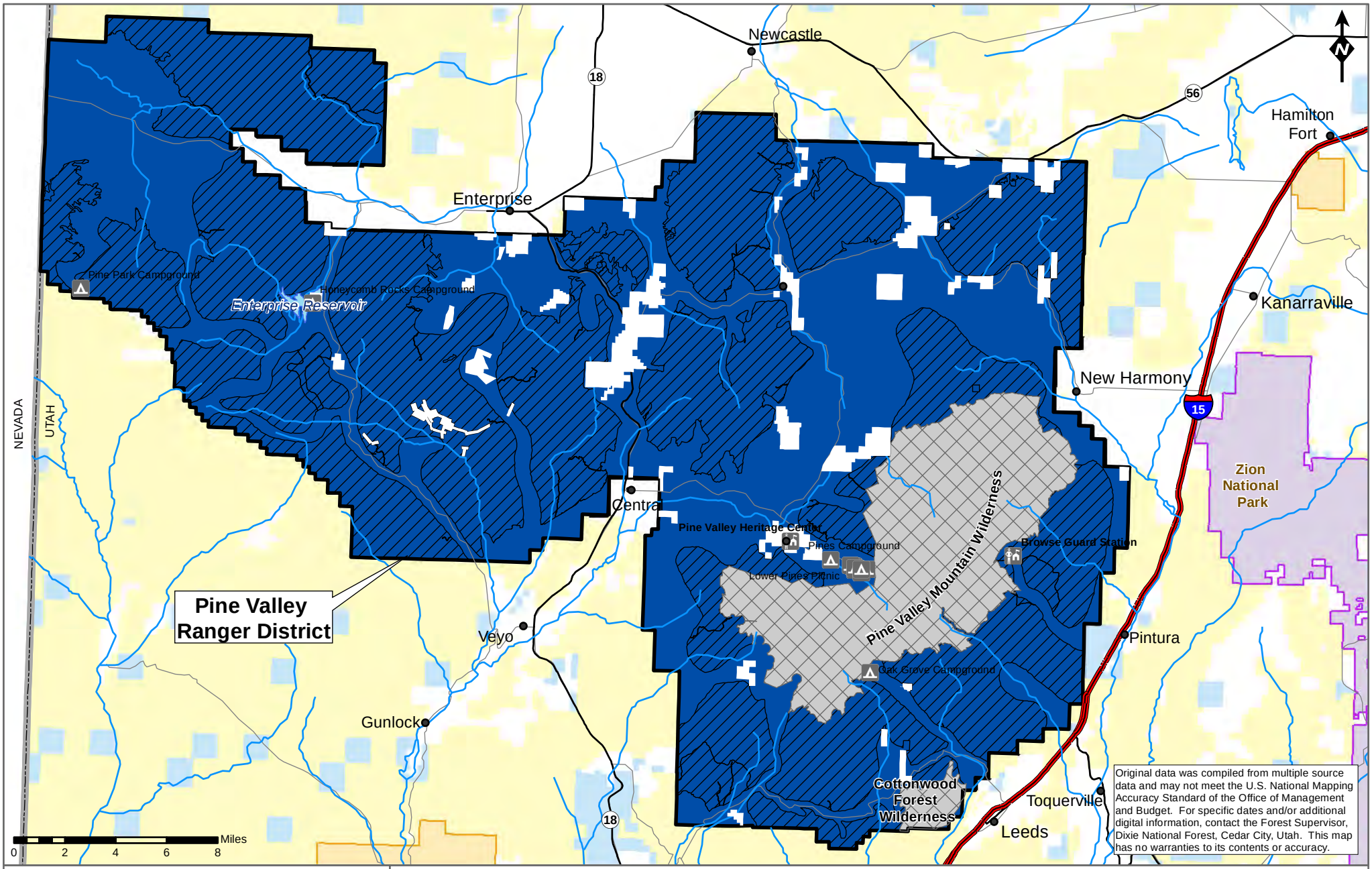
Alternative E1 (% of Dixie National Forest) (2)

Not Available (5.5%)

No Surface Occupancy (34.7%)

Standard Lease Term (59.8%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5a(2)

Pine Valley Ranger District Alternative E2*

*Inventoried Roadless Areas analyzed as Standard Lease Term

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 in = 5 miles

Cities

Forest Sites

Campgrounds

Visitor Centers

Minor Roads (1)

Highways

Interstates

Major Streams & Rivers

Water Bodies

State Boundaries

National Forest System Lands

Dixie National Forest

Wilderness Areas

Inventoried Roadless Areas

Other Land Administration

Bureau of Land Management

National Park Service

Private

State of Utah

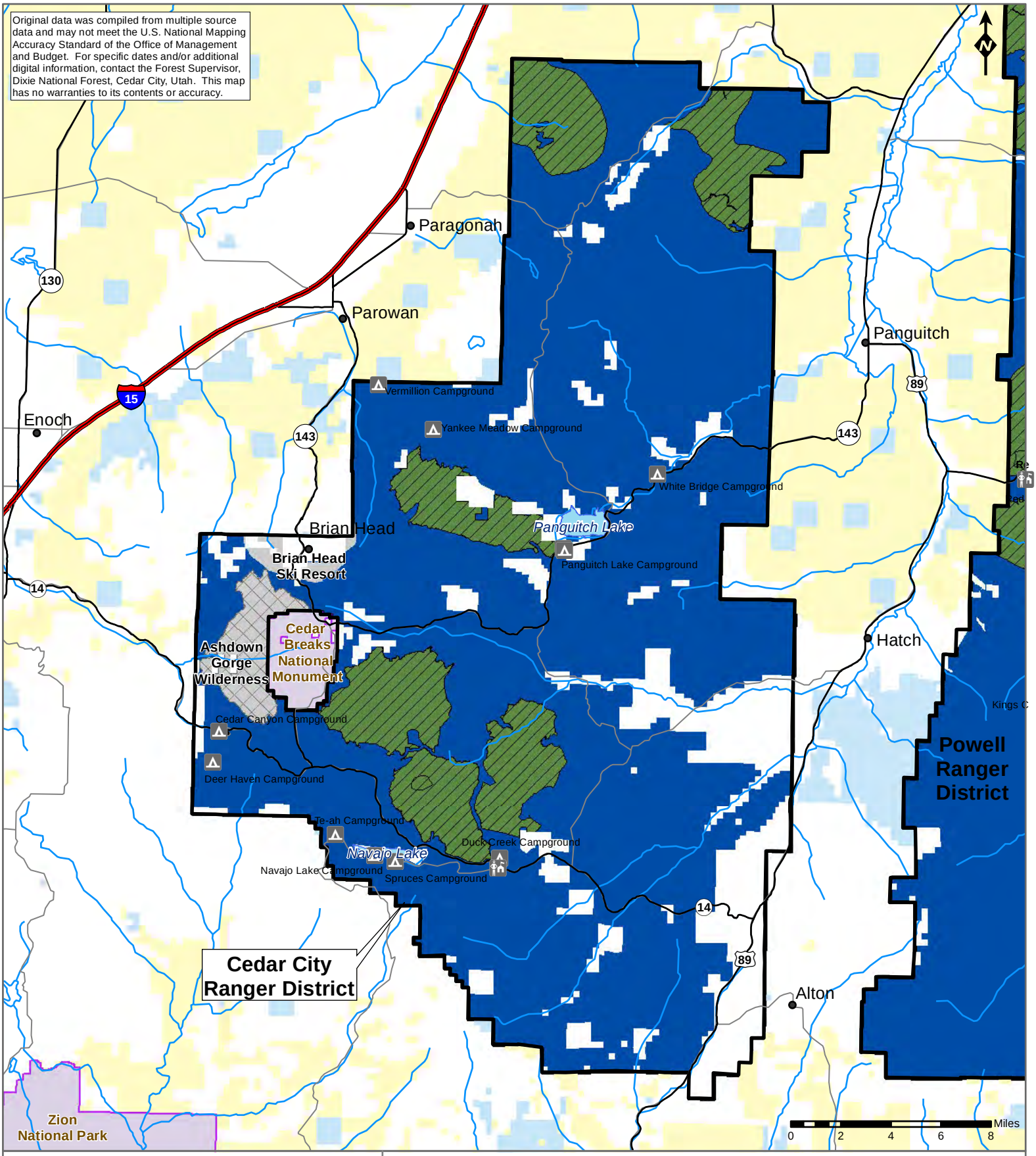
Tribal

Alternative E2 (% of Dixie National Forest) (2)

Not Available (5.5%)

Standard Lease Term (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5b(1)
Cedar City Ranger District

Alternative E1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 inch = 5 miles

Cities

Forest Sites
- Campgrounds
- Visitor Centers

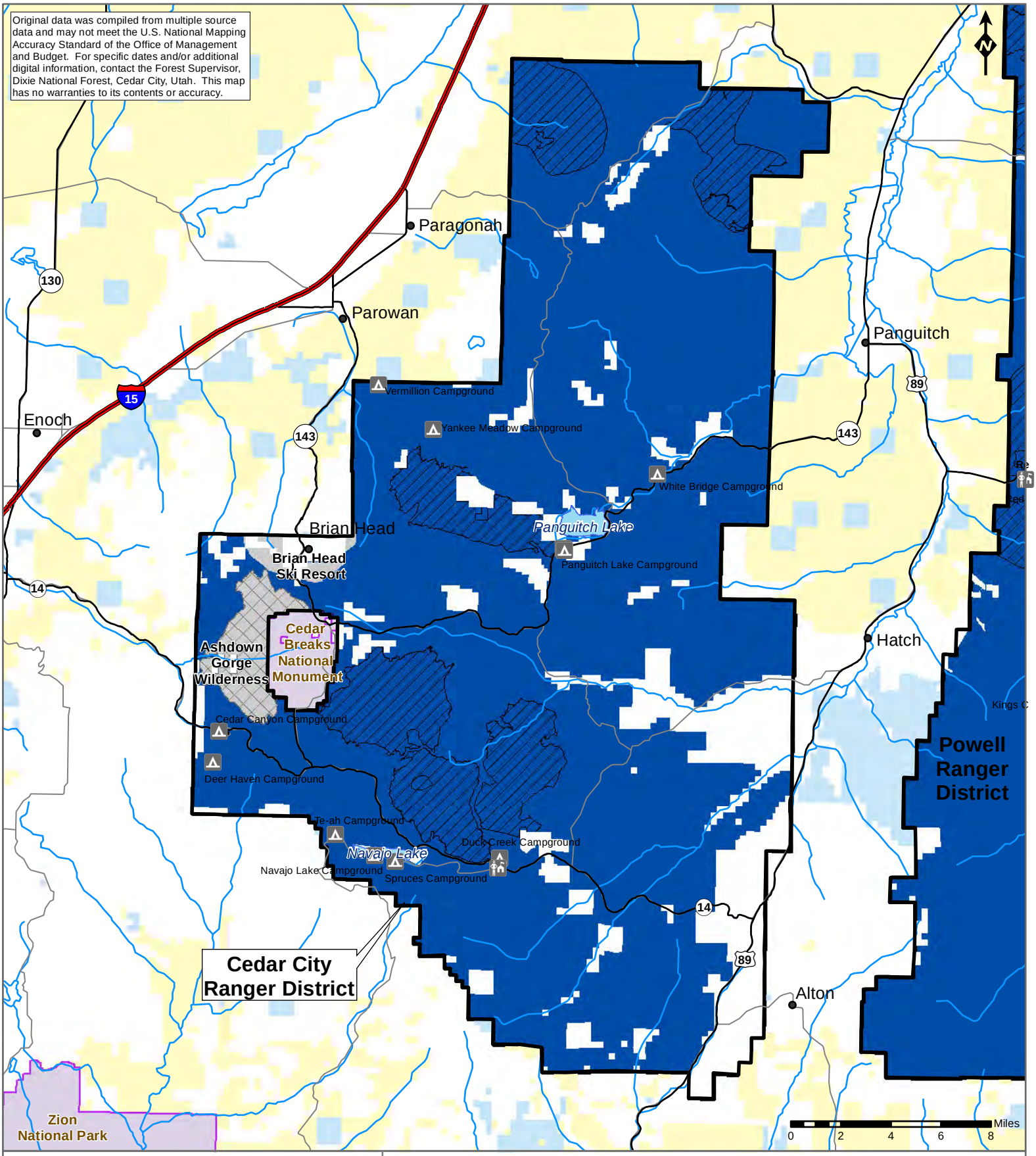
Minor Roads (1)
Highways
Interstates
Major Streams & Rivers
Water Bodies

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- National Park Service
- Private
- State of Utah

Alternative E1 (% of Dixie National Forest) (2)
- Not Available (5.5%)
- Standard Lease Term (59.8%)
- No Surface Occupancy (34.7%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5b(2)
Cedar City Ranger District

Alternative E2*

*Inventoried Roadless Areas analyzed as Controlled Surface Use

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 inch = 5 miles

Cities

Forest Sites
- Campgrounds
- Visitor Centers

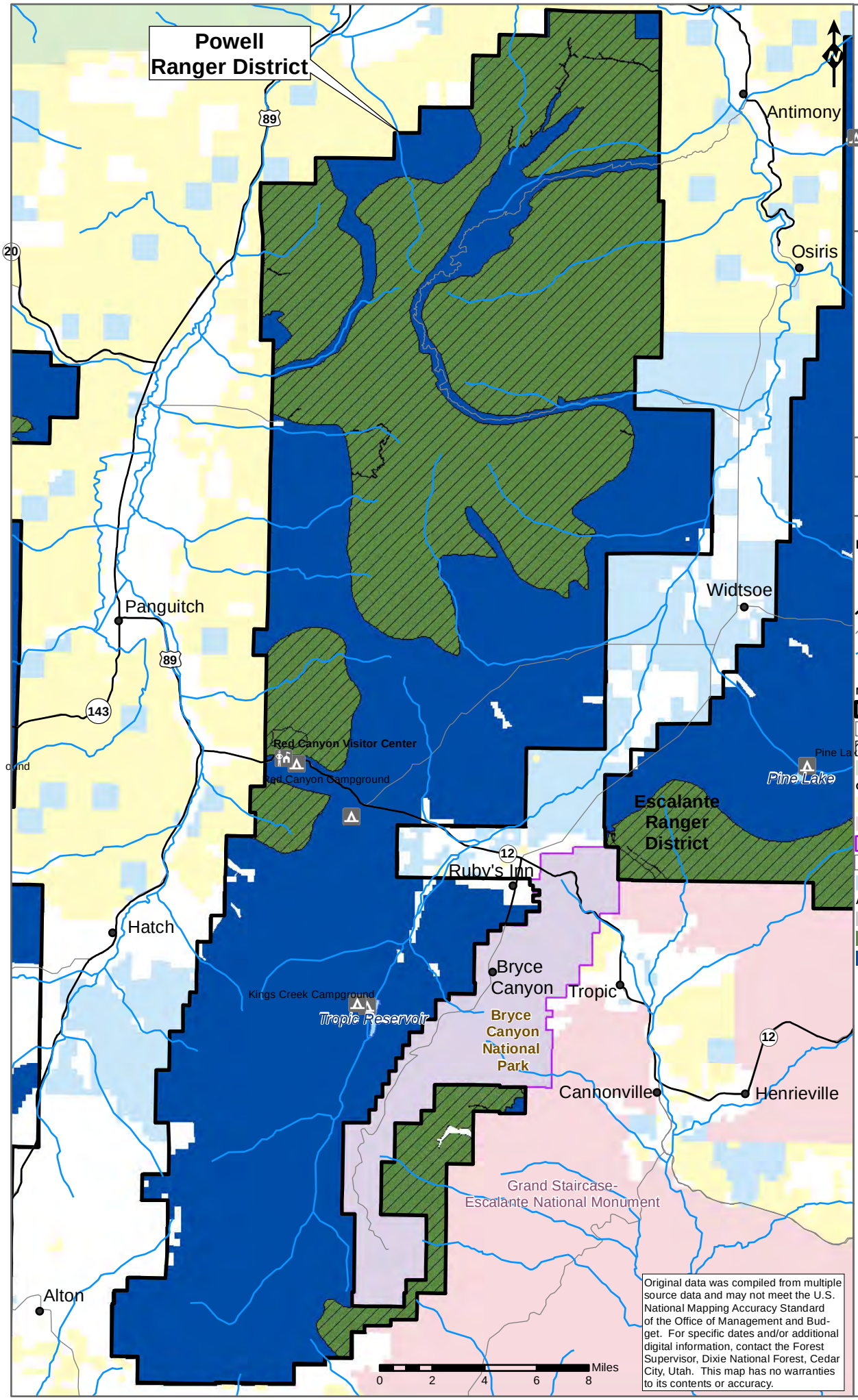
Minor Roads (1)
Highways
Interstates
Major Streams & Rivers
Water Bodies

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- National Park Service
- Private
- State of Utah

Alternative E2 (% of Dixie National Forest) (2)
- Not Available (5.5%)
- Standard Lease Term (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



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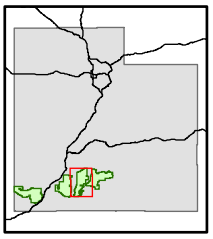
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5c(1)

Powell Ranger District Alternative E1*

*Inventoried Roadless Areas analyzed as No Surface Occupancy



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Fishlake National Forest

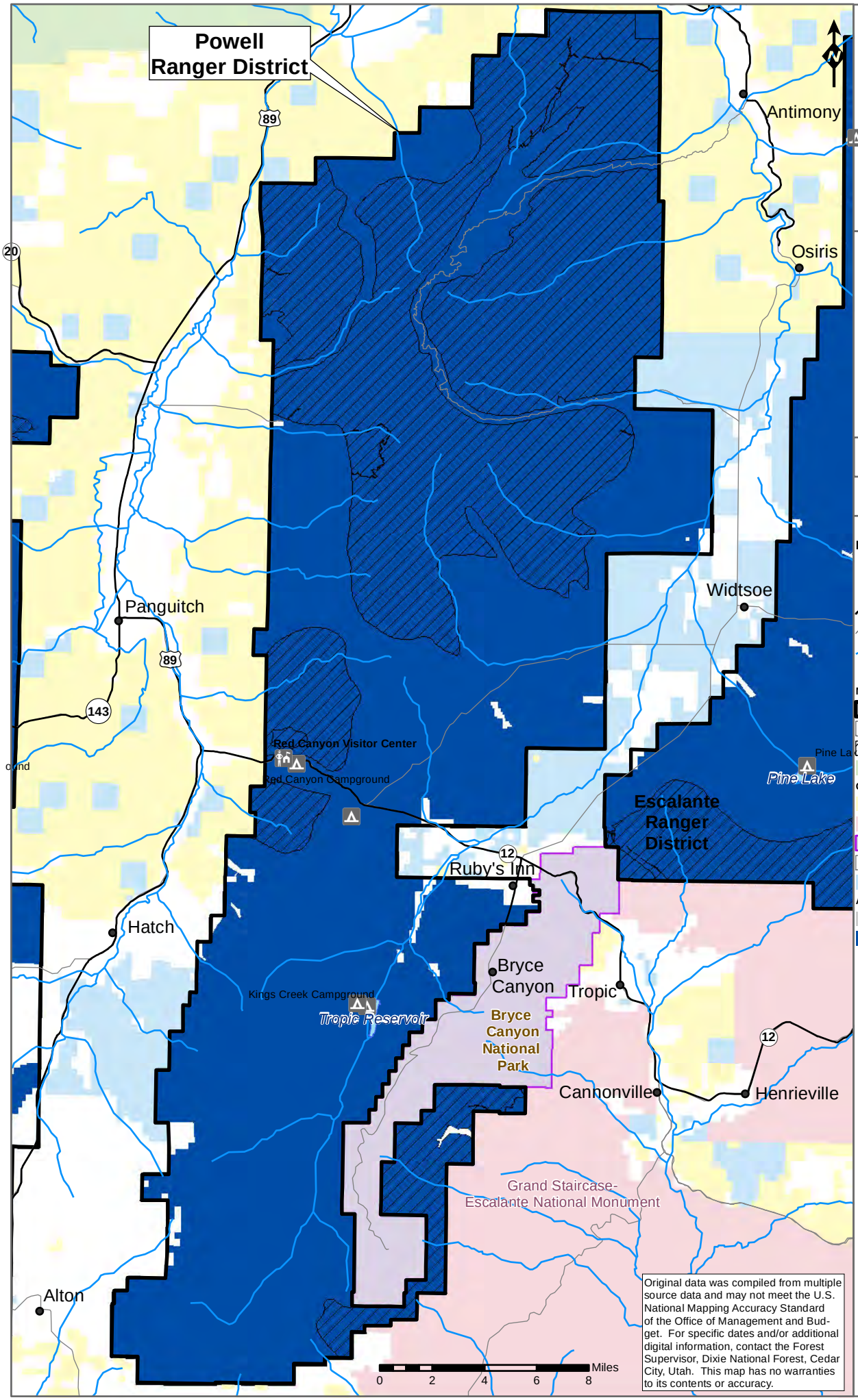
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative E1 (% of Dixie National Forest) (3)

- Not Available (5.5%)
- No Surface Occupancy (34.7%)
- Standard Lease Term (59.8%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.



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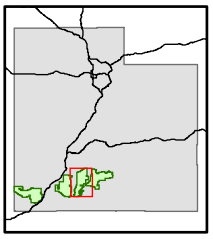
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 2.5-5c(2)

Powell Ranger District Alternative E2*

*Inventoried Roadless Areas analyzed as Standard Lease Term



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

- Cities

Forest Sites

- Campgrounds
- Visitor Centers
- Highways
- Minor Roads (1)
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Inventoried Roadless Areas
- Fishlake National Forest

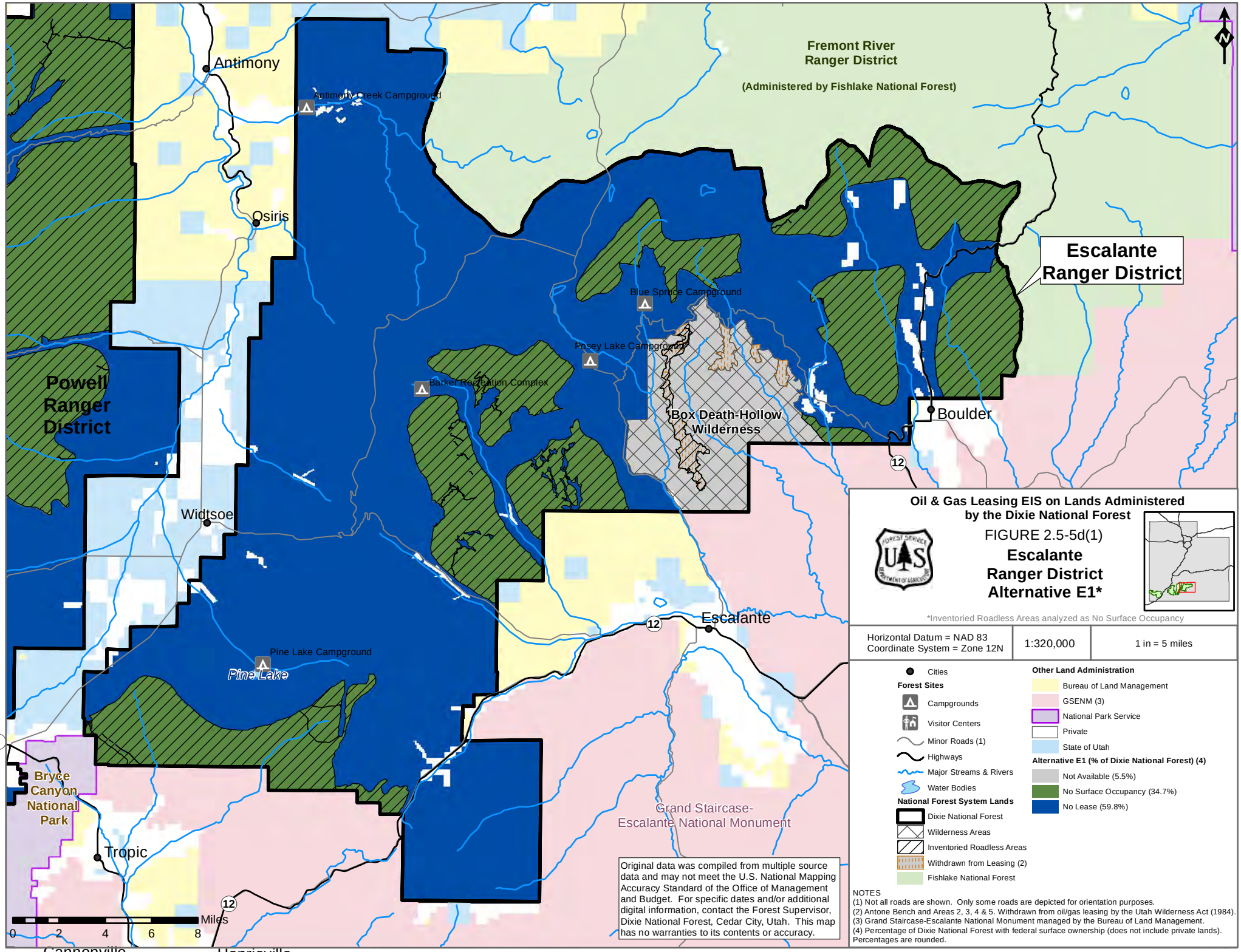
Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah

Alternative E2 (% of Dixie National Forest) (3)

- Not Available (5.5%)
- Standard Lease Term (94.5%)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.
(3) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
Miles
0 2 4 6 8
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-5d(1)
Escalante
Ranger District
Alternative E1*
*Inventoried Roadless Areas analyzed as No Surface Occupancy
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Inventoried Roadless Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative E1 (% of Dixie National Forest) (4)
Not Available (5.5%)
No Surface Occupancy (34.7%)
No Lease (59.8%)
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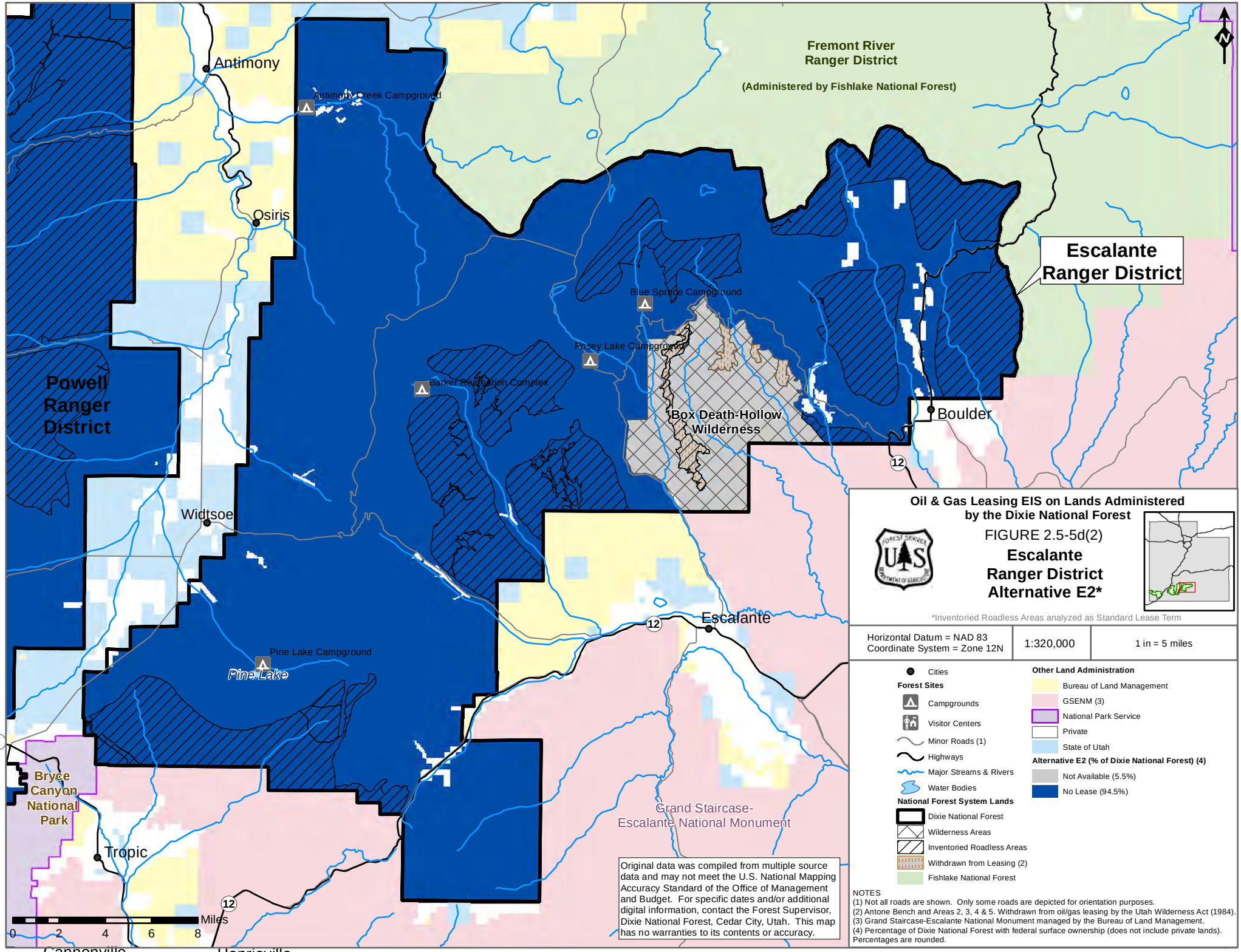
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.


Fremont River
Ranger District
(Administered by Fishlake National Forest)
Escalante
Ranger District
Powell
Ranger
District
Antimony
Antimony Creek Campground
Osiris
Blue Spruce Campground
Posey Lake Campground
Barker Recreation Complex
Box Death-Hollow
Wilderness
Boulder
Widtsoe
Escalante
Pine Lake Campground
Pine Lake
Bryce
Canyon
National
Park
Tropic
Grand Staircase-
Escalante National Monument
Cannonville
Henrieville
12
Miles
0 2 4 6 8
Oil & Gas Leasing EIS on Lands Administered
by the Dixie National Forest
FIGURE 2.5-5d(2)
Escalante
Ranger District
Alternative E2*
*Inventoried Roadless Areas analyzed as Standard Lease Term
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Cities
Forest Sites
Campgrounds
Visitor Centers
Minor Roads (1)
Highways
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Inventoried Roadless Areas
Withdrawn from Leasing (2)
Fishlake National Forest
Other Land Administration
Bureau of Land Management
GSENM (3)
National Park Service
Private
State of Utah
Alternative E2 (% of Dixie National Forest) (4)
Not Available (5.5%)
No Lease (94.5%)
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Antone Bench and Areas 2, 3, 4 & 5. Withdrawn from oil/gas leasing by the Utah Wilderness Act (1984).
(3) Grand Staircase-Escalante National Monument managed by the Bureau of Land Management.
(4) Percentage of Dixie National Forest with federal surface ownership (does not include private lands). Percentages are rounded.

2.7 Comparison of Alternatives

This section presents the environmental consequences of the alternatives in comparative form. This is done in order to better define the resource issues and clearly display the potential impacts of each alternative. Table 2.7-1 presents the total acres on the Dixie National Forest and the percentage of the total Analysis Area covered by each leasing option, by alternative. The acres and percentage under each leasing option for each resource component are presented by alternative in Tables 2.7-2 and 2.7-3, respectively. Table 2.7-4 summarizes the intensity and duration of the direct impacts to each resource component. A full discussion of impacts, including indirect and cumulative, is contained in Chapters 4 and 5, respectively.

Table 2.7-1 Area by Leasing Option for the Dixie National Forest, by Alternative

Alternative	Acres[1]/Percent[2] By Leasing Option					Additional TL Overlay[4]
	NA[3]	NL	NSO	CSU	SLT	
A	90,399 (6%)	1,540,841 (94%)				
B	90,399 (6%)	1,135,658 (70%)	332,182 (20%)	73,001 (4%)	0	
C	90,399 (6%)	62,614 (4%)	1,246,714 (76%)	231,513 (14%)	0	48,696
D1	90,399 (6%)		666,500 (41%)	868,473 (53%)	5,867 (<1%)	936,550
D2	90,399 (6%)		142,189 (9%)	1,392,784 (85%)	5,867 (<1%)	788,297
E1	90,399 (6%)		565,922 (35%)		974,919 (60%)	
E2	90,399 (6%)				1,540,841 (94%)	

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Percentages and totals are approximate due to rounding
[3] Areas not legally available for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis
[4] Areas of CSU and SLT that have additional Timing Limitations.

Table 2.7-2 Total Acres of each Resource Component by Leasing Option and Alternative

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
VISUAL RESOURCES	Retention/SIO Very High (Some overlap with designated wilderness)	A	85,707	4,213				89,920
		B	85,707	4,195	19			89,920
		C	85,707	4,088	126			89,920
		D1	85,707		4,213			89,920
		D2	85,707		4,213			89,920
		E1	85,707		3,217		997	89,920
		E2	85,707				4,213	89,920
	Retention/SIO High	A	1,548	400,567				402,115
		B	1,548	297,588	102,979			402,115
		C	1,548	35,132	365,435			402,115
		D1	1,548		171,335	229,232		402,115
		D2	1,548		67,769	332,798		402,115
		E1	1,548		128,426		272,141	402,115
		E2	1,548				400,567	402,115
	Partial Retention/SIO Moderate	A	2,829	536,313				539,142
		B	2,829	369,250	116,844	50,220		539,142
		C	2,829	10,317	378,330	147,666		539,142
		D1	2,829		179,484	350,980	5,849	539,142
		D2	2,829		40,447	490,017	5,849	539,142
		E1	2,829		142,064		394,249	539,142
		E2	2,829				536,313	539,142
	Modification/ SIO Low	A	130	293,050				293180
		B	130	239,900	43,821	9,284		293180
		C	130	9,562	239,350	44,093		293180
		D1	130		173,603	119,403		293,180
		D2	130		23,622	269,383		293,180
		E1	130		159,384		133,621	293,180
		E2	130				293,050	293,180
	SIO Unassigned	A	154	305,153				305,307
		B	154	223,580	68,228	13,346		305,307
		C	154	3,429	262,418	39,306		305,307
		D1	154		137,775	167,378		305,307
		D2	154		6,069	299,084		305,307
		E1	154		132,814		172,339	305,307

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
		E2	154				305,153	305,307
	NPS Park Protective Measure	A		1,285				1,285
		B		1,285				1,285
		C			1,926			1,926
		D1				1,926		1,926
		D2				1,926		1,926
		E1					1,926	1,926
		E2					1,926	1,926
Inventoried Roadless Areas		A	4,637	565,922				570,559
		B	4,637	565,922				570,559
		C	4,637	22,040	543,883			570,559
		D1	4,637		565,922			570,559
		D2	4,637		41,616	524,306		570,559
		E1	4,637		565,922			570,559
		E2	4,637				565,922	570,559
Unroaded-Undeveloped Areas[2]		A	88,327	815,102				903,429
		B	88,327	686,025	109,479	19,598		903,429
		C	88,327	23,364	740,442	51,297		903,429
		D1	88,327		542,192	272,466	444	903,429
		D2	88,327		55,319	759,339	444	903,429
		E1	88,327		526,802		288,300	903,429
		E2	88,327				815,102	903,429
Suitable Wild and Scenic Rivers		A	5,733	279				6,012
		B	5,733	279				6,012
		C	5,733	7	273			6,012
		D1	5,733		7	273		6,012
		D2	5,733		7	273		6,012
		E1	5,733				279	6,012
		E2	5,733				279	6,012
RECREATION RESOURCES	Developed Sites (with buffer): Recreation Sites, Camp Grounds, Guard Stations, etc.	A	1	4,923				4,924
		B	1	3,988	935			4,924
		C	1	506	4,417			4,924
		D1	1		1,023	3,900		4,924
		D2	1		978	3,945		4,924
		E1	1		52		4,871	4,924
		E2	1				4,923	4,924
	ROS: Primitive	A	84,607	19,317				103,924

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
		B	84,607	19,317				103,924
		C	84,607	4,246	15,071			103,924
		D1	84,607		19,317			103,924
		D2	84,607		19,317			103,924
		E1	84,607		16,443		2,874	103,924
		E2	84,607				19,317	103,924
	ROS: Semi-Primitive Non-Motorized	A	4,138	696,851				700,989
		B	4,138	566,851	130,000			700,989
		C	4,138	12,955	683,896			700,989
		D1	4,138		449,877	246,974		700,989
		D2	4,138		25,622	671,229		700,989
		E1	4,138		441,281		255,570	700,989
		E2	4,138				696,851	700,989
	ROS: Semi-Primitive Motorized	A	907	559,144				560,051
		B	907	366,337	136,533	56,274		560,051
		C	907	22,805	357,708	178,630		560,051
		D1	907		138,114	421,030		560,051
		D2	907		47,974	511,170		560,051
		E1	907		96,994		462,151	560,051
		E2	907				559,144	560,051
	ROS: Roaded Natural	A	703	263,731				264,434
		B	703	181,880	65,297	16,554		264,434
		C	703	22,519	188,883	52,328		264,434
		D1	703		58,914	198,958	5,859	264,434
		D2	703		49,020	208,851	5,859	264,434
		E1	703		11,185		252,546	264,434
		E2	703				263,731	264,434
	Administrative Sites	A		848				848
		B		772	76			848
		C		14	834			848
		D1			455	392		848
		D2			454	393		848
		E1			2		846	848
		E2					848	848
	Recreation Residences (with	A	42	777				819
		B	42	766	11			819

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
	0.25-mile buffer)	C	42	567	210			819
		D1	42		777			819
		D2	42		777			819
		E1	42				777	819
		E2	42				777	819
SPECIAL STATUS SPECIES	Sage Grouse Leks (with buffer)	A		42,816				42,816
		B		42,816				42,816
		C			42,816			42,816
		D1[3]			16,529			16,529
		D2[3]			16,529			16,529
		E1[3]			1,609		14,920	16,529
		E2[3]					16,529	16,529
	Sage Grouse Brood Rearing Habitat	A		12,977				12,977
		B		12,977				12,977
		C			8,874	4,103		12,977
		D1			4,551			12,977
		D2			4,363			12,977
		E1			188		12,789	12,977
		E2					12,977	12,977
	Crucial and Substantial Deer and Elk Winter Range	A	553	169,915				170,468
		B	553	169,915				170,468
		C	553	130	139,100	30,685		170,468
		D1	553		67,408	102,507 (TL)		170,468
		D2	553		19,417	150,498 (TL)		170,468
		E1	553		49,776		120,139	170,468
		E2	553				169,915	170,468
	Crucial Deer and Elk Summer Range	A	874	402,344				403,218
		B	874	402,344				403,218
		C	874	25,963	327,684	48,696 (TL)		403,218
		D1	874		197,949	188,757 (TL)	15,636	403,218
		D2	874		34,895	349,473 (TL)	17,974	403,218
		E1	874		171,168		231,175	403,218
		E2	874				402,344	403,218
	Goshawk Nest Areas	A	1,055	62,276				63,331
		B	1,055	45,527	19,749			63,331
		C	1,055	4,575	57,702			63,331
		D1[3]	207		5,483	13,895		19,585

Resource Component	Alt[1]	Leasing Option					Total Acres
		NA	NL	NSO	CSU/TL	SLT	
	D2[3]	207		2,261	17,118		19,585
	E1[3]	207		3,512		15,866	19,585
	E2[3]	207				19,378	19,585
Goshawk PFA	A	1,720	82,617				84,337
	B	1,720	58,248	24,180	190		84,337
	C	1,720	5,626	75,575	1,416		84,337
	D1	1,720		26,174	56,443		84,337
	D2	1,720		9,463	73,154		84,337
	E1	1,720		18,435		64,182	84,337
	E2	1,720				82,617	84,337
Designated Critical Mexican Spotted Owl Habitat	A		18,048				18,048
	B		18,048				18,048
	C			16,653	1,395		18,048
	D1			12,014	6,033		18,048
	D2			929	17,119		18,048
	E1			11,923		6,124	18,048
	E2					18,048	18,048
Potential Mexican Spotted Owl Habitat (40% slope and mixed conifers)	A	23,819	23,713				47,532
	B	23,819	14,188	9,518	7		47,532
	C	23,819	1,000	22,000	713		47,532
	D1	23,819		4,960	18,754		47,532
	D2	23,819		2,178	21,536		47,532
	E1	23,819		3,834		19,879	47,532
	E2	23,819				23,713	47,532
Utah Prairie Dog Colonies (with 0.5-mile buffer from colony edge)	A		49,628				49,628
	B		38,263	11,365			49,628
	C		88	49,540			49,628
	D1			49,628			49,628
	D2			49,628			49,628
	E1			753		48,875	49,628
	E2					49,628	49,628
Mexican Spotted Owl Protected Activity Centers (PAC)	A		732				732
	B		732				732
	C			732			732
	D1			731	2		732
	D2			72	660		732
	E1			730		2	732

Resource Component	Alt[1]	Leasing Option					Total Acres
		NA	NL	NSO	CSU/TL	SLT	
	E2					732	732
Bald Eagle Winter Concentration Areas	A		11,265				11,265
	B		9,844	1,421			11,265
	C		2,616	8,648			11,265
	D1			4,937	6,328		11,265
	D2			3,719	7,546		11,265
	E1			1,226		10,038	11,265
	E2					11,265	11,265
Peregrine Falcon Nests (with 0.5-mile buffer)	A	2,259	15,596				17,855
	B	2,259	10,411	5,184			17,855
	C	2,259	629	14,967			17,855
	D1	2,259		3,356	12,239		17,855
	D2	2,259		955	14,640		17,855
	E1	2,259		2,408		13,188	17,855
	E2	2,259				15,596	17,855
Pygmy Rabbit Habitat	A	180	50,571				50,751
	B	180	33,235	17,336			50,751
	C	180	190	36,205	14,176		50,751
	D1	180		13,924	36,646		50,751
	D2	180		9,018	41,553		50,751
	E1	180		5,474		45,097	50,751
	E2	180				50,571	50,751
Sensitive Bat Habitat	A	1,115	1,336				2,451
	B	1,115	1,096	239			2,451
	C	1,115	154	1,177	4		2,451
	D1	1,115		1,194	142		2,451
	D2	1,115		971	395		2,451
	E1	1,115		694		642	2,451
	E2	1,115				1,336	2,451
Flammulated Owl Habitat	A	43,361	377,180				420,541
	B	43,361	250,111	127,069			420,541
	C	43,361	28,192	280,980	68,008		420,541
	D1	43,361		86,268	290,912		420,541
	D2	43,361		38,385	338,795		420,541
	E1	43,361		55,038		322,143	420,541
	E2	43,361				377,180	420,541
Fisheries Habitat	A	1,264	22,201				23,465

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
		B	1,264	22,201				23,465
		C	1,264	484	21,717			23,465
		D1[3]	1,264		4,317	9,222		14,803
		D2[3]	1,264		817	12,721		14,803
		E1[3]	1,264		3,731		9,807	14,803
		E2[3]	1,264				13,539	14,803
	Boreal Toad Habitat	A		50,166				50,166
		B		47,191	2,976			50,166
		C			38,147	12,020		50,166
		D1			599	49,567		50,166
		D2			589	49,577		50,166
		E1			10		50,156	50,166
		E2					50,166	50,166
	California Condor (Exp/Nonessential) and Peregrine Falcon Rim Habitat	A	68,710	372,588				441,298
		B	68,710	258,580	102,673	11,335		441,298
		C	68,710	7,395	324,373	40,820		441,298
		D1	68,710		139,342	233,246 (TL)		441,298
		D2	68,710		15,373	357,215 (TL)		441,298
		E1	68,710		130,639		241,949	441,298
		E2	68,710				372,588	441,298
WATER AND WATERSHED	Lava Fields over Sensitive Aquifers	A		58,585				58,585
		B		58,585				58,585
		C		58,585				58,585
		D1			58,585			58,585
		D2			58,585			58,585
		E1			18,821		39,765	58,585
		E2					58,585	58,585
	Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas (including riparian veg.)	A	23,496	387,256				410,752
		B[4]	38,243	545,700	79,658			663,601
		C	23,496	7,845	379,411			410,752
		D1	23,496		167,052	220,203		410,752
		D2	23,496		27,431	359,824		410,752
		E1	23,496		146,332		240,923	410,752
		E2	23,496				387,256	410,752
	Municipal Watersheds	A	7,589	45,816				53,405
		B	7,589		45,816			53,405

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
		C	7,589		45,816			53,405
		D1	7,589		23,548	22,268		53,405
		D2	7,589		5,901	39,915		53,405
		E1	7,589		22,594		23,222	53,405
		E2	7,589				45,816	53,405
SOILS AND GEOLOGIC HAZARDS	Active Rockfall and Landslide Areas	A	9,340	7,813				17,153
		B	9,340	6,097	1,716			17,153
		C	9,340	190	7,623			17,153
		D1	9,340		7,813			17,153
		D2	9,340		7,813			17,153
		E1	9,340		4,400		3,413	17,153
		E2	9,340				7,813	17,153
	Slopes > 35 percent	A	64,759	317,718				382,477
		B	64,759	245,189	72,529			382,477
		C	64,759	3,256	314,462			382,477
		D1	64,759		176,851	140,868		382,477
		D2	64,759		17,261	300,458		382,477
		E1	64,759		169,821		147,897	382,477
		E2	64,759				317,718	382,477
	Areas of High Erosion Potential	A	12,260	83,704				95,964
		B	12,260	58,559	25,145			95,964
		C	12,260	1,628	82,076			95,964
		D1	12,260		39,734	43,971		95,964
		D2	12,260		5,590	78,114		95,964
		E1	12,260		37,696		46,008	95,964
		E2	12,260				83,704	95,964
	Marginally Unstable Slopes	A	772	43,216				43,988
		B	772	33,423	9,371	422		43,988
		C	772	577	40,785	1,855		43,988
		D1	772		21,086	22,130		43,988
		D2	772		2,300	40,916		43,988
		E1	772		19		23,244	43,988
		E2	772				43,216	43,988

Resource Component		Alt[1]	Leasing Option					Total Acres
			NA	NL	NSO	CSU/TL	SLT	
VEGETATION RESOURCES	Research Natural Area (RNA)	A	542	4,253				4,795
		B	542	4,253				4,795
		C	542	4,253				4,795
		D1	542		4,253			4,795
		D2	542		4,253			4,795
		E1	542		3,219		1,034	4,795
		E2	542				4,253	4,795
	Botanical and Geological Areas (Red Canyon)	A		230				203
		B		79	124			203
		C			203			203
		D1			203			203
		D2			203			203
		E1					203	203
		E2					203	203
	Side Hollow Ponderosa Pine Provenance Study	A		4.5				4.5
		B		4.5				4.5
		C			4.5			4.5
		D1			4.5			4.5
		D2			4.5			4.5
		E1			4.5			4.5
		E2					4.5	4.5
	Sensitive Plant Species and Suitable Plant Habitat	A	14,757	110,251				125,008
		B	14,757	72,194	38,058			125,008
		C	14,757	4,628	91,207	14,417		125,008
		D1	14,757		40,623	69,628		125,008
		D2	14,757		18,189	92,062		125,008
		E1	14,757		25,145		85,106	125,008
		E2	14,757				110,251	125,008

[1] The dual analyses for Alternatives D and E represent a range of alternatives with or without application of the 2001 Roadless Area Conservation Rule to IRAs. Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives.
[2] Those areas indentified on the 2005 Draft Inventory Map of Unroaded-Undeveloped areas
[3] The buffer area for goshawk nests, sage-grouse leks, and Fisheries Habitat is smaller under Alternative D and Alternative E; therefore the total acreage is less than for other alternatives.
[4] Includes a 500-foot buffer under Alternative B; all other buffers are 300 feet and therefore less total acreage.
D1 denotes Alternative D with a NSO leasing option applied to IRAs.
D2 denotes Alternative D with a CSU leasing option applied to IRAs.
E1 denotes Alternative E with a NSO leasing option applied to IRAs.
E2 denotes Alternative E with leasing allowing in IRAs under SLT.

Table 2.7-3 Percentage of each Resource Component under each Leasing Option, by Alternative

Resource Component		Alt[1]	Leasing Option				
			NA	NL	NSO	CSU/TL	SLT
VISUAL RESOURCES	Retention/SIO Very High	A	95	5			
		B	95	5			
		C	95	5			
		D1	95		5		
		D2	95		5		
		E1	95		4		1
		E2	95				5
	Retention/SIO High	A		100			
		B		74	26		
		C		9	91		
		D1			43	57	
		D2			17	83	
		E1			32		68
		E2					100
	Partial Retention/SIO Moderate	A	1	99			
		B	1	68	22	9	
		C	1	2	70	27	
		D1	1		33	65	1
		D2	1		8	91	1
		E1	1		26		73
		E2	1				99
	Modification/ SIO Low	A		100			
		B		82	15	3	
		C		3	82	15	
		D1			59	41	
		D2			8	92	
		E1			54		46
		E2					100
	SIO Unassigned	A		100			
		B		73	22		
		C		1	86	13	
		D1			45	55	
		D2			2	98	
		E1			44		56
		E2					100
	NPS Park Protective Measure	A		100			
		B		100			
		C			100		
		D1				100	
		D2				100	
		E1					100
		E2					100

Resource Component		Alt[1]	Leasing Option				
			NA	NL	NSO	CSU/TL	SLT
Inventoried Roadless Areas		A	1	99			
		B	1	99			
		C	1	4	95		
		D1	1		99		
		D2	1		7	92	
		E1	1		99		
		E2	1				99
Unroaded-Undeveloped Areas		A	10	90			
		B	10	76	12	2	
		C	10	3	82	6	
		D1	10		60	30	
		D2	10		6	84	
		E1	10		58		32
		E2	10				90
Suitable Wild and Scenic Rivers		A	95	5			
		B	95	5			
		C	95		5		
		D1	95			5	
		D2	95			5	
		E1	95				5
		E2	95				5
RECREATION RESOURCES	Developed Sites (with buffer): Recreation Sites, Camp Grounds, Guard Stations, etc.	A		100			
		B		81	19		
		C		10	90		
		D1			21	79	
		D2			20	80	
		E1			1		99
		E2					100
	ROS: Primitive	A	81	19			
		B	81	19			
		C	81	4	15		
		D1	81		19		
		D2	81		19		
		E1	81		16		3
		E2	81				19
	ROS: Semi-Primitive Non-Motorized	A	1	99			
		B	1	81	19		
		C	1	2	98		
		D1	1		64	35	
		D2	1		4	96	
		E1	1		63		36
		E2	1				99
	ROS: Semi-Primitive Motorized	A		100			
		B		65	24	10	
		C		4	64	32	

Resource Component		Alt[1]	Leasing Option				
			NA	NL	NSO	CSU/TL	SLT
		D1			25	75	
		D2			9	91	
		E1			17		83
		E2					100
	ROS: Roaded Natural	A		100			
		B		69	25	6	
		C		9	71	20	
		D1			22	75	2
		D2			19	79	2
		E1			4		96
		E2					100
	Administrative Sites	A		100			
		B		91	9		
		C		2	98		
		D1			54	46	
		D2			54	46	
		E1					100
		E2					100
	Recreation Residences (with 0.25-mile buffer)	A	5	95			
		B	5	94	1		
		C	5	69	26		
		D1	5		95		
		D2	5		95		
		E1	5				95
		E2	5				95
SPECIAL STATUS SPECIES	Sage Grouse Leks	A		100			
		B		100			
		C			100		
		D1			100		
		D2			100		
		E1			10		90
		E2					100
	Sage Grouse Summer, Nesting, and Brood Rearing Habitat	A		100			
		B		100			
		C			68	32	
		D1			35	65 (TL)	
		D2			34	66 (TL)	
		E1			1		99
		E2					100
	Crucial and Substantial Deer and Elk Winter Range	A		100			
		B		100			
		C			82	18	
		D1			40	60 (TL)	
		D2			11	88 (TL)	
		E1			29		70

Resource Component	Alt[1]	Leasing Option				
		NA	NL	NSO	CSU/TL	SLT
	E2					100
Crucial Deer and Elk Summer Range	A		100			
	B		100			
	C		6	81	12 (TL)	
	D1			53	47 (TL)	
	D2			7	93 (TL)	
	E1			42		57
	E2					100
Goshawk Nest Areas	A	2	98			
	B	2	72	31		
	C	2	7	91		
	D1	1		28	71	
	D2	1		12	87	
	E1	1		18		81
	E2	1				99
Goshawk PFA	A	2	98			
	B	2	69	29		
	C	2	7	90	2	
	D1	2		31	67	
	D2	2		11	87	
	E1	2		22		76
	E2	2				98
Designated Critical Mexican Spotted Owl Habitat	A		100			
	B		100			
	C			92	8	
	D1			67	33	
	D2			5	95	
	E1			66		34
	E2					100
Potential Mexican Spotted Owl Habitat (40% slope and mixed conifers)	A	50	50			
	B	50	30	20		
	C	50	2	46	2	
	D1	50		10	39	
	D2	50			45	
	E1	50				42
	E2	50				50
Utah Prairie Dog Colonies (with 0.5-mile buffer from colony edge)	A		100			
	B		77	23		
	C			100		
	D1			100		
	D2			100		
	E1			2		98
	E2					100
Mexican Spotted Owl Protected Activity Centers (PAC)	A		100			
	B		100			
	C			100		

Resource Component	Alt[1]	Leasing Option				
		NA	NL	NSO	CSU/TL	SLT
	D1			100		
	D2			10	90	
	E1			100		
	E2					100
Bald Eagle Winter Concentration Areas	A		100			
	B		87	13		
	C		23	77		
	D1			44	56	
	D2			33	67	
	E1			11		89
	E2					100
Peregrine Falcon Nests (with 0.5-mile buffer)	A	13	87			
	B	13	58	29		
	C	13	4	84		
	D1	13		19	69	
	D2	13		5	82	
	E1	13		13		74
	E2	13				87
Pygmy Rabbit Habitat	A		100			
	B		65	34		
	C			71	28	
	D1			27	72	
	D2			18	82	
	E1			11		89
	E2					100
Sensitive Bat Habitat	A	45	55			
	B	45	45	10		
	C	45	6	48		
	D1	45		49	6	
	D2	45		39	16	
	E1	45		28		26
	E2	45				55
Flammulated Owl Habitat	A	10	90			
	B	10	59	30		
	C	10	7	67	16	
	D1	10		21	69	
	D2	10		9	81	
	E1	10		13		77
	E2	10				90
Fisheries Habitat	A	5	95			
	B	5	95			
	C	1		99		
	D1	9		29	62	
	D2	9		6	86	
	E1	9		25		66

Resource Component		Alt[1]	Leasing Option				
			NA	NL	NSO	CSU/TL	SLT
		E2	9				91
	Boreal Toad Habitat	A		100			
		B		94	6		
		C			76	24	
		D1			1	99	
		D2			1	99	
		E1					100
		E2					100
	California Condor (Exp/Nonessential) and Peregrine Falcon Rim Habitat	A	16	84			
		B	16	59	23	3	
		C	16	2	74	9	
		D1	16		32	53 (TL)	
		D2	16		3	81 (TL)	
		E1	16		30		55
		E2	16				84
WATER AND WATERSHED	Lava Fields over Sensitive Aquifers	A		100			
		B		100			
		C		100			
		D1			100		
		D2			100		
		E1			32		68
		E2					100
	Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas (including riparian veg.)	A	6	94			
		B	6	82	12		
		C	6	2	92		
		D1	6		41	54	
		D2	6		7	88	
		E1	6		36		59
		E2	6				94
	Municipal Watersheds	A	14	86			
		B	14	86			
		C	14		86		
		D1	14		44	42	
		D2	14		11	75	
		E1	14		42		43
		E2	14				86

Resource Component		Alt[1]	Leasing Option				
			NA	NL	NSO	CSU	SLT
SOILS AND GEOLOGIC HAZARDS	Active Rockfall and Landslide Areas	A	54	46			
		B	54	36	10		
		C	54	1	44		
		D1	54		46		
		D2	54		46		
		E1	54		26		20
		E2	54				46
	Slopes > 35 percent	A	17	83			
		B	17	64	19		
		C	17	1	82		
		D1	17		46	37	
		D2	17		5	79	
		E1	17		44		39
		E2	17				83
	Areas of High Erosion Potential	A	13	87			
		B	13	61	26		
		C	13	2	86		
		D1	13		41	46	
		D2	13		6	81	
		E1	13		39		48
		E2	13				87
	Marginally Unstable Slopes	A	2	98			
		B	2	76	21	1	
		C	2	1	93	4	
		D1	2		48	50	
		D2	2		5	93	
		E1	2		45		53
		E2	2				98
VEGETATION RESOURCES	Research Natural Area (RNA)	A	11	89			
		B	11	89			
		C	11	89			
		D1	11		89		
		D2	11		89		
		E1	11		67		22
		E2	11				89
	Botanical and Geological Areas (Red Canyon)	A		100			
		B		39	61		
		C			100		
		D1			100		
		D2			100		
		E1					100
		E2					100

Resource Component	Alt[1]	Leasing Option				
		NA	NL	NSO	CSU	SLT
Side Hollow Ponderosa Pine Provenance Study	A		100			
	B		100			
	C			100		
	D1			100		
	D2			100		
	E1			100		
	E2					100
Sensitive Plant Species and Suitable Plant Habitat	A	12	88			
	B	12	58	30		
	C	12	4	73	12	
	D1	12		32	56	
	D2	12		15	74	
	E1	12		20		68
	E2	12				88

[1] The dual analyses for Alternatives D and E represent a range of alternatives with or without application of the 2001 Roadless Area Conservation Rule to IRAs.
D1 denotes Alternative D with a NSO leasing option applied to IRAs.
D2 denotes Alternative D with a CSU leasing option applied to IRAs.
E1 denotes Alternative E with a NSO leasing option applied to IRAs.
E2 denotes Alternative E with leasing allowing in IRAs under SLT.

Table 2.7-4 Intensity and Duration of Direct Impacts to each Resource Component, by Alternative

Resource Component			Alternative[1,2]						
			A	B	C	D_1	D_2	E_1	E_2
VISUAL RESOURCES	Retention/SIO Very High		NO EFFECT	NEG-MIN TEMP	NEG-MIN TEMP	NEG-MAJ TEMP-ST	NEG-MAJ TEMP-ST	NEG-MAJ TEMP-ST	NEG-MAJ TEMP-ST
	Retention/SIO High			NEG	NEG	MIN-MAJ ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT	MOD-MAJ ST-LT
	Partial Retention/SIO Moderate			MINOR ST-LT	MIN-MOD ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT	MOD-MAJ ST-LT
	Modification/ SIO Low			MINOR ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	SIO Unassigned			MINOR ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	Night Skies surrounding Bryce Canyon NP			NO EFFECT	NEG	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	MIN-MOD ST-LT
Inventoried Roadless Areas			NO EFFECT	NO EFFECT	NEG-MOD ST	NEG-MOD ST	NEG-MOD ST-LT	NEG-MOD ST	NEG-MAJ ST-LT
Unroaded-Undeveloped Areas			NO EFFECT	NEG	NEG-MOD ST	NEG-MOD ST	NEG-MOD ST-LT	NEG-MOD ST	NEG-MAJ ST-LT
Suitable Wild and Scenic Rivers			NO EFFECT	NO EFFECT	NEG-MIN ST-LT	NEG-MIN ST-LT	NEG-MIN ST-LT	MOD-MAJ ST-LT	MOD-MAJ ST-LT
RECREATION RESOURCES	Developed Sites: Recreation Sites, Camp Grounds, Guard Stations, etc.		NO EFFECT	NEG	NEG	MINOR ST	MINOR ST	MOD-MAJ ST	MOD-MAJ ST
	ROS: Primitive			NO EFFECT	NEG-MIN ST	NEG-MIN ST	NEG-MIN ST	MOD ST-LT	MOD-MAJ ST-LT
	ROS: Semi-Primitive Non-Motorized			NEG-MIN ST	NEG-MIN ST	MINOR ST-LT	MIN-MOD ST-LT	MOD ST-LT	MOD-MAJ ST-LT
	ROS: Semi-Primitive Motorized			NEG-MIN ST-LT	NEG-MIN ST-LT	MINOR ST-LT	MINOR ST-LT	MOD ST-LT	MOD ST-LT
	ROS: Roaded Natural			NEG-MIN ST-LT	NEG-MIN ST-LT	MINOR ST-LT	MINOR ST-LT	MINOR ST-LT	MINOR ST-LT
	Recreation Residences			NEG	NEG	NEG	NEG	MOD-MAJ ST	MOD-MAJ ST
FISH AND WILDLIFE	All Wildlife (no leasing options)		NO EFFECT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	Migratory Birds, including raptors			NEG-MIN ST-LT	NEG-MIN ST-LT	NEG-MIN ST-LT	NEG-MIN ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	Aquatic Species			NEG	NEG-MIN ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT
SPECIAL STATUS SPECIES	Endangered Fish		NO EFFECT	NEG	NEG	NEG	NEG	MIN-MOD LT	MIN-MOD LT
	California Condor			NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT
	Mexican Spotted Owl	Designated Critical Habitat		NO EFFECT	MIN-MOD ST-LT	MIN-MOD ST-LT	MOD ST-LT	MIN-MOD ST-LT	MOD-MAJ LT
		Potential Habitat		NEG-MIN ST	MIN-MOD ST	MIN-MOD ST	MIN-MOD ST	MIN-MOD ST	MIN-MOD ST

Resource Component			Alternative[1,2]						
			A	B	C	D_1	D_2	E_1	E_2
		Protected Activity Centers (PAC)		NO EFFECT	NEG-MOD ST	NEG-MOD ST	MIN-MOD ST-LT	NEG-MOD ST	MOD-MAJ LT
	Utah Prairie Dog			NEG-MAJ ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT
	Western Yellow-Billed Cuckoo			NEG	MINOR LT	MINOR LT	MINOR LT	MINOR LT	MINOR LT
	MIS and USFS-Sensitive Fishes			NO EFFECT	NEG-MOD LT	MOD-MAJ LT	MOD-MAJ LT	MOD-MAJ LT	MOD-MAJ LT
	Boreal Toad			NEG-MIN ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	Sage Grouse	Summer, Nesting, and Brood Rearing Habitat		NO EFFECT	NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	MOD-MAJ ST-LT	MOD-MAJ ST-LT
		Leks		NO EFFECT	NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	MOD-MAJ LT	MOD-MAJ LT
	Big game: Deer and Elk			NO EFFECT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	MIN- MAJ ST-LT	MIN- MAJ ST-LT
	USFS-Sensitive Raptors: Goshawk, Bald Eagle, Flammulated Owl, Peregrine Falcon			NEG-MIN ST-LT	NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
	Pygmy Rabbit			NEG-MIN ST-LT	NEG-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN- MAJ ST-LT	MIN- MAJ ST-LT
	USFS-Sensitive Bats			NEG-MIN ST-LT	NEG-MIN ST-LT	MINOR ST-LT	MINOR ST-LT	MIN-MAJ ST-LT	MIN-MAJ ST-LT
	USFS-Sensitive Plants			NEG-MOD LT	MIN-MOD LT	MIN-MOD LT	MIN-MOD LT	MIN-MOD LT	MIN-MOD LT
WATER AND WATERSHED	Lava Fields over Sensitive Aquifers		NO EFFECT	NO EFFECT	NEG	MOD-MAJ LT	MOD-MAJ LT	MOD-MAJ LT	MOD-MAJ LT
	Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas			NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
	Municipal Watersheds			NO EFFECT	NEG	NEG-MOD ST	NEG-MOD ST	NEG-MAJ ST	NEG-MAJ ST
SOILS/GEOLOGIC HAZARDS	Active Rockfall and Landslide Areas		NO EFFECT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
	Slopes > 35 percent			NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
	Areas of High Erosion Potential			NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
	Marginally Unstable Slopes			NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
	Cave Resources			NEG-MIN ST-LT	NEG-MIN ST-LT	NEG-MOD ST-LT	NEG-MOD ST-LT	NEG-MAJ ST-LT	NEG-MAJ ST-LT
VEGETATION	Research Natural Area (RNA)		NO EFFECT	NO EFFECT	NO EFFECT	NEG-MAJ LT	NEG-MAJ LT	NEG-MAJ LT	NEG-MAJ LT
	Botanical and Geological Areas (Red Canyon)			NEG-MIN LT	MINOR LT	MINOR LT	MINOR LT	MAJOR LT	MAJOR LT
	Side Hollow Ponderosa Pine Provenance Study			NEG	NEG-MIN LT	NEG-MIN LT	NEG-MIN LT	NEG-MIN LT	MAJOR LT

Resource Component	Alternative[1,2]						
	A	B	C	D_1	D_2	E_1	E_2
Biological Soil Crusts		MINOR LT	MINOR LT	MINOR LT	MINOR LT	MINOR LT	MINOR LT
Major Vegetation Types		MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT	MIN-MOD ST-LT
Invasive Plants (Impact on Native Plant Communities		MOD LT	MOD LT	MOD LT	MOD LT	MOD LT	MOD LT

[1] The dual analyses for Alternatives D and E represent a range of alternatives with or without application of the 2001 Roadless Area Conservation Rule to IRAs.
[2] For many resource components, the intensity and duration of impacts may cover a broad range from negligible to major and short term to long term. This is due to the difficulty in predicting the exact level of impacts when the actual location of potential oil and gas activity is unknown.
D_1 denotes Alternative D with a NSO leasing option applied to IRAs.
D_2 denotes Alternative D with a CSU leasing option applied to IRAs.
E_1 denotes Alternative E with a NSO leasing option applied to IRAs.
E_2 denotes Alternative E with leasing allowing in IRAs under SLT.
NEG = Negligible Impact
MOD = Moderate Impact
MAJ = Major Impact
ST = Short-term Impact
LT = Long-term Impact

2.8 Agency Preferred Alternative

The Forest Supervisor for the Dixie National Forest has identified Alternative C as the agency preferred alternative. The impacts of the connected actions under Alternative C are summarized and compared to the impacts of the other alternatives in the previous section (Section 2.7). A complete discussion of the impacts under Alternative C is in Chapter 4.

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3.1 Introduction

This chapter presents the existing condition of the physical, biological, social, and economic resources of the human environment that may be affected by the implementation of any of the alternatives. This chapter provides the baseline for comparison of the environmental impacts/consequences described in Chapter 4. The discussion is organized according to the order of the key resource issues identified during the scoping process (Section 1.9.2.2) and is as follows:

- Visual Resources
- Inventoried Roadless Areas, Unroaded-Undeveloped, and Suitable Wild and Scenic Rivers
- Recreation
- Fish and Wildlife
- Special Status Species (which includes threatened, endangered, proposed, candidate, Forest Service sensitive, and management indicator species)
- Water and Watershed Resources
- Soils and Geologic Hazards
- Vegetation
- Transportation
- Socioeconomic Resources
- Air Resources

A discussion of special areas (Resource Issue #13) is included in each section in which special areas occur. For example, national recreation trails are discussed in Section 3.4 (Recreation) and the Side Hollow Ponderosa Pine Provenance Study Area is discussed in Section 3.9 (Vegetation).

3.2 Visual Resources

3.2.1 Introduction

The Dixie National Forest occupies approximately 2 million acres across nearly 170 miles in southern Utah. Elevations vary from 2,800 feet near St. George to 11,307 at Brian Head Peak, Cedar City Ranger District. High altitude forests in gently rolling hills characterize the Markagunt, Paunsaugunt, and Aquarius Plateaus within the Forest boundary. Vegetation varies from sparse desert plants at low elevations, to pinyon pine and juniper forest at mid-elevations. At higher elevations, aspen, pine, spruce, and fir predominate (USFS 2000a).

The scenic beauty of the Dixie National Forest is one of the major attractions of this area. Zion National Park, Bryce Canyon National Park, Capitol Reef National Park, and The Grand Staircase-Escalante National Monument are adjacent to the Forest, while Cedar Breaks National Monument lies within the Forest boundaries (USFS 2000a). These parks and monuments include scenic overlooks that include views of Dixie National Forest lands.

Scenic resources are a composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify an area and influence the visual appeal that area may have to people. The opportunity to experience the landscape and interpret scenery and visual change is dependent upon the degree of public access and use of an area (JBR 2004).

Five scenic byways and four scenic backways have been formally designated within the Dixie National Forest since 1986. The Utah State and National Forest Scenic Byways include Highway 14, Highway 143, Highway 148, and Highway 12. Highway 89 from Panguitch to Kanab has been designated a Utah State Scenic Byway. The four Utah State Scenic Backways include Posey Lake Road, Griffin Top Road, the Dry Lakes/Summit Canyon Road, and the East Fork of the Sevier Road (USFS 2000a).

Scenic Byway Highway 12 is also part of the National System of America's Byways, a collection of 126 diverse routes designated by the US Secretary of Transportation representing the depth and breadth of scenery in America. Utah's Scenic Byway 12 – A Journey Through Time – received the All-American Road designation from the Federal Highway Administration in 2002. According to the National Scenic Byways Program website, Scenic Byway 12 is an exceptional 124-mile route, which "negotiates an isolated landscape of canyons, plateaus, and valleys ranging from 4,000 feet to 9,000 feet above sea level...a showcase of sandstone sculpted by nature (USDOT 2007)."

It has been shown that high-quality scenery can enhance people's lives and benefit society, particularly natural scenery such as is associated with National Forests (USFS 1995h). It is primarily through their visual sense that most visitors perceive the Forest and its interrelated components. Benefits derived from scenic settings include identity, self-image of communities and individuals, and enhanced quality of life. Sightseeing, driving for pleasure, and outdoor photography are among the nation's leading recreational activities and as demand continues, the need to preserve high quality visual resources will also increase (USFS 2003a).

3.2.2 Visual Resources Management on the Dixie National Forest

The National Forest Scenery Management System (SMS) is the process used for planning and design of the visual elements of multiple use land management. Scenery management is based on the criteria and guidelines in the Landscape Aesthetics Handbook for Scenery Management, US Department of Agriculture (USDA) Handbook Number 701 (USFS 1995h). This system was implemented in 1996, superseding the Visual Management System (VMS). The Visual Management System was first published as a handbook in 1974 - National Forest Landscape Management, Vol. 2, USFS Handbook Number 462 (USFS 1974) and provided the direction for the management of scenic resources on National Forests for over 20 years. The Visual Management System was based on a series of Visual Quality Objectives (VQOs) ranging from Preservation to Maximum Modification, according to the mechanics of viewing landscapes, and the importance of aesthetics.

The Scenery Management System began with the basic premises established in the Visual Management System, but has been expanded to better accommodate ecosystem management and the realistic time frames of natural systems. This system also places greater importance on establishing which scenic elements Forest users value most, and identifying ways to maintain or improve on those qualities.

Full implementation of the new Scenery Management System was intended to occur with Forest Plan revision, although case by case application on the project level was directed for instances where a plan revision was years out. Because the Visual Management System was the basis for the 1986 Dixie National Forest Land and Resource Management Plan (USFS 1986), the Land and Resource Management Plan required an update in order to efficiently apply the Scenery Management System. The Dixie National Forest prepared an amendment to the Land and Resource Management Plan in April 2000 to apply the Scenery Management System Scenic Integrity Objectives (SIOs) "within the context of the goals, objectives, and management direction of the current Forest Plan." The Environmental Assessment (USFS 2000a) prepared to analyze this plan amendment provides a detailed comparison of the Visual Management System and Scenery Management System. Scenery Management System values were preliminarily assigned to Dixie National Forest lands based upon the soils database, bridging to Forest Plan direction. Scenery Management System values include buffers on Concern Level 1 and 2 roads (See Section 3.2.5).

The Scenery Management System Amendment to the Land and Resource Management Plan provides specific direction on SIO in all management areas except for Management Area 1, General Direction. For most of Management Area 1, SIO is unassigned. The Amendment states that, when a specific project is proposed in Management Area 1 with unassigned SIO, a visual analysis will be completed and the project will comply with the SIO that results from this analysis.

Specific Management Areas ranging from '1A – Developed Recreation' to '10B – Municipal Watersheds' (see Table 3.2-2) are assigned a Landscape Theme, and SIO. The General Management Areas fall into the category listed below in Table 3.2-1 as 'SIO Unassigned'. In these areas, if outside of Concern Level 1 and 2 travelways and use areas, the SIOs are designated during project planning according to the following scenario: Class A scenic attractiveness (distinctive) – minimum of High SIO; Class B scenic attractiveness (common or typical) – minimum of Moderate SIO; Class C scenic attractiveness (indistinctive) – minimum of Low SIO (USFS 2000a). In essence, the label of 'SIO Unassigned' does not indicate a lack of scenic quality; it merely indicates that SIO will be determined when a specific project is proposed.

3.2.3 Scenic Integrity Objectives

Scenic integrity indicates the current status of a landscape – the degree of intactness and wholeness of the landscape character (USFS 1995h). It is determined on the basis of visual changes that detract from the scenic quality of the area (USFS 1995h). The SIO refers to the degree of acceptable change or alteration of the valued Landscape Theme (USFS 2000a). Under the Scenery Management System, higher SIOs represent highly valued natural landscapes where management activities would result in little or no deviation from those values. Greater modification to the landscape is acceptable in low SIO landscapes. According to the 1986 Land and Resource Management Plan, the Dixie National Forest is divided into the visual management categories shown in Table 3.2-1 below. The original VQOs are generally comparable to the SIOs, as noted. The SIOs for the Dixie National Forest are shown on Figure 3.2-1.

Very High Scenic Integrity (Very High SIO) is generally reserved for designated Wilderness and Research Natural Areas, but may apply to additional areas of the Forest as well, where the valued landscape character is intact, and there is no evidence of apparent modification. High Scenic Integrity (High SIO) applies to an area that appears unaltered; where the valued

landscape character appears intact, and any structures or surface effects are designed to blend with the natural landscape. Moderate Scenic Integrity (Moderate SIO) may appear slightly altered but alterations are visually subordinate to the overall landscape. In Low Scenic Integrity (Low SIO) areas, deviations may begin to dominate the landscape view.

Table 3.2-1 Acres of SIO categories on the Dixie National Forest

Ranger District	SIO Very High	SIO High	SIO Moderate	SIO Low	SIO Unassigned	TOTAL
	VQO Preservation	VQO Retention	VQO Partial Retention	VQO Modification		
Pine Valley	Pine Valley Wilderness: 49,994 Other 1,974 **Total: 51,969**	54,003	160,747	60,179	135,815	462,712
Cedar City	Ashdown Gorge Wilderness: 6,932 Other: 264 **Total: 7,195**	Brian Head 1,457 Other: 109,069 **Total: 110,527**	99,165	Brian Head: 74 Other: 36,370 **Total 36,444**	99,091	352,423
Powell	Red Canyon Natural Area: 531	88,725	138,701	130,341	25,480	383,778
Escalante	Box-Death Hollow Wilderness: 25,557 Antone Bench & Areas 2, 3, 4 & 5: 3,224 Other: 1,444 **Total: 30,226**	148,860	140,529	66,171	45,921	430,706
Total Acres Per SIO Percent of Forest lands	89,921 6 %	402,115 25 %	539,142 33%	293,135 18 %	305,307 19%	1,629,619

3.2.4 Landscape Theme

The landscapes of the Dixie National Forest are described according to Landscape Themes. **Developed Recreation** is a Landscape Theme characteristic of areas with developed recreation facilities such as campgrounds and picnic areas. In these areas, the recreation facilities are a dominant feature in the landscape. The **Natural Appearing** Landscape Theme applies to areas where the existing landscape character has been influenced by human activities, but appears natural to the majority of viewers. Natural elements such as native trees, rock outcrops, and streams or lakes dominate the views. In a **Natural Evolving** Landscape Theme, the natural landscape character originates primarily from natural disturbances and ecological succession, with only subtle changes due to indirect human activities. In these areas, natural events such as forest fires, drought, or deforestation due to insect infestations may dramatically change the views (USFS 2000a). The Land and Resource Management Plan Management Areas and associated Landscape Themes and SIOs are listed in Table 3.2-2.

3.2.5 Concern Levels

Concern Levels categorize the importance to forest visitors of landscapes viewed from travelways and use areas. Concern Level 1 roads and use areas are primary public travel routes through the National Forest including designated scenic highways and byways, or primary recreational areas such as campgrounds, visitor centers, vista points, and others. Highway 12 through the towns of Escalante and Boulder, and through portions of the Dixie National Forest has been formally designated a National Scenic Byway and thus qualifies as a Concern Level 1 road. Concern Level 1 viewsheds adopt the Landscape Theme of the Management Area in which they occur. Outside of Concern Level 1 areas, assignment of SIOs is based upon the Landscape Theme.

Travelways on the Dixie National Forest have been assigned a Concern Level according to the criteria in the Scenery Management System. Concern Level 1 and 2 travelways adopt the Landscape Theme of the management area in which they occur. Concern Level 1 travelways are managed at a level of at least high scenic integrity. Concern Level 2 travelways are managed at a level of at least moderate scenic integrity. The guideline for specific management areas including those listed above states that resource management activities should not be permitted to reduce the scenic integrity levels below the prescribed objectives (JBR 2004).

Concern Level 1 viewsheds include areas seen from: Honeycomb Rocks, Upper and Lower Enterprise Reservoirs, Pine Valley community, Pine Valley Recreation Area, Cedar Breaks National Monument, Brian Head Peak, Panguitch Lake, Navajo Lake, Bryce Canyon National Park, Powell Point, Tropic Reservoir, Hell's Backbone Bridge, Highway 12 overlooks between Teasdale and Boulder, and Capitol Reef National Park. Critical viewsheds are listed as such because they receive intensive recreation use that is sustained in nature and/or there is a very high concern for scenic resources (USFS 2000a).

3.2.6 Night Skies

The night sky views in the vast expanse of southern Utah are recognized as an invaluable resource to many residents and visitors. Under ideal conditions a viewer might observe a night sky with more than 15,000 visible stars plus the Milky Way, which itself contains billions of stars (NPS 2004). The National Park Service has a Night Sky Team that is working in National Parks across the country to measure the effects of light pollution. Several southeastern Utah National Parks are included in the study and were some of the first to be visited by the Night Sky Team. "The amount of light pollution is measured with a camera that is capable of precisely measuring light levels. Mounted on a robotic Meade LX 200GPS telescope, the camera takes 104 images to capture the entire sky. These images are stitched together, and by subtracting the light emitted by known individual stars, researchers generate a value for night sky darkness (NPS 2006a)." Data has been collected since 2001 (NPS 2007a). An observation point at Canyonlands National Park is the site closest to the Dixie National Forest. Bryce Canyon National Park includes overlooks with expansive views, and it shares borders on both sides with the Dixie National Forest. The value of most units administered by the National Park Service lies in their continued naturalness, especially as humans increasingly develop lands outside the parks (NPS 2004).

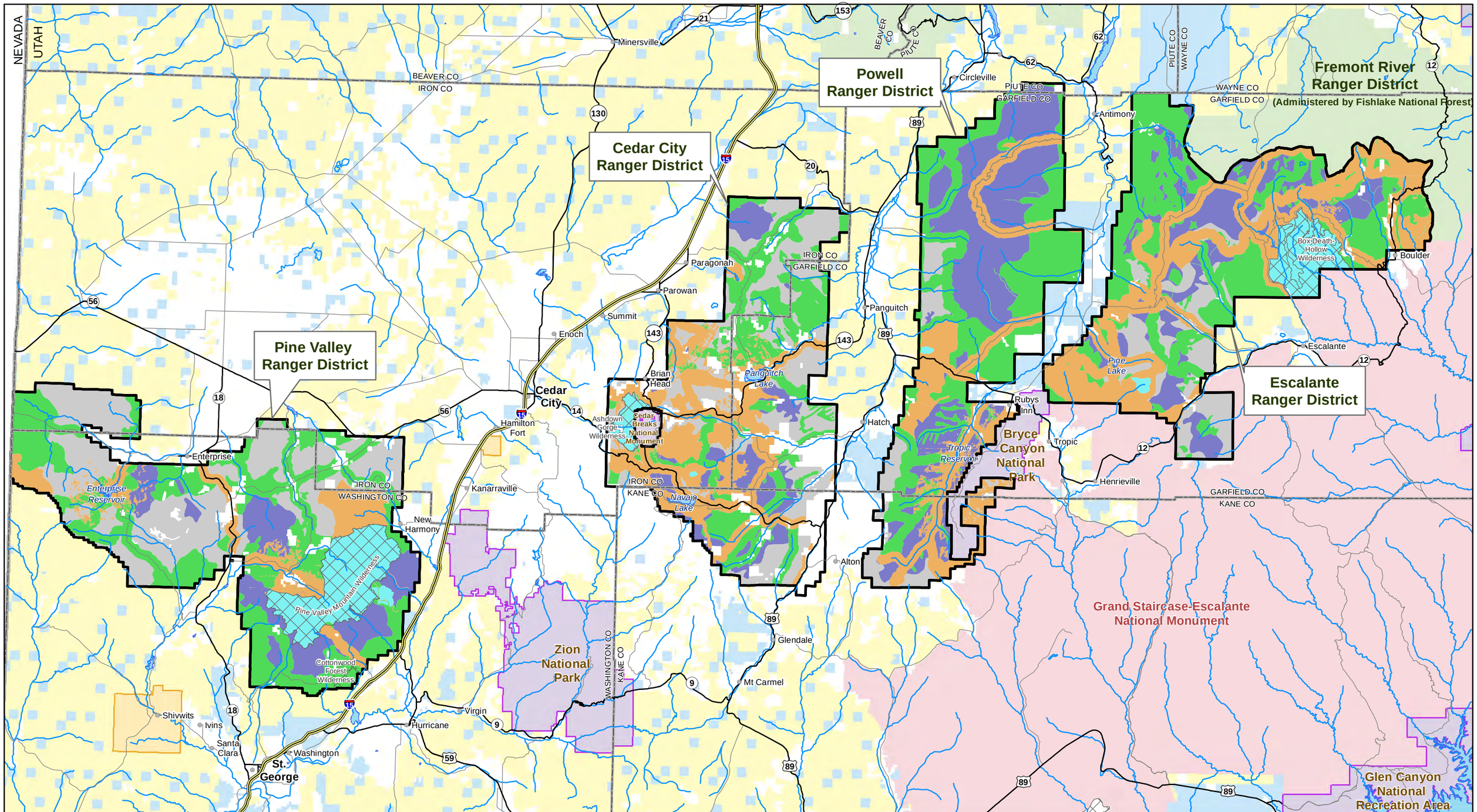
At every park surveyed by the Night Sky Team, artificial light was detected, said Chad Moore, co-investigator and manager of the NPS Night Sky Team. Pristine night skies were once commonplace just a few decades ago, but have become increasingly rare under the advance of glary lights. Visitors are increasingly seeking out dark skies in places like national parks to rediscover the beauty of the night sky. By sharing our telescopes and enthusiasm for the night,

we help them celebrate that beauty, said Kevin Poe, Park Ranger at Bryce Canyon National Park, where stargazing programs were attended by 27,000 people last year (NPS 2006b). The Bryce Canyon National Park Management Plan reiterates the concern about night sky conservation, stating that minor increases in artificial light and air pollution can seriously jeopardize the night skies, and that continued increases in air pollution and artificial lights could have a serious negative impact on visitors' experience (NPS 1987).

3.2.7 Visitor Use and Access to the Forest

The value and enjoyment of scenic resources is intricately tied to access and use. Levels and types of use may in turn affect visitor experiences. The above described scenic backways and byways are highly accessible. Other scenic areas of the forest are accessible by unimproved roads available to motorized vehicles, or by non-motorized traffic, or by foot or pack animal only.

During 2006, the Dixie National Forest monitored 19 non-motorized trails and 5 motorized trails for use. Of the 19 non-motorized sites, 9 indicated increased use, 3 had decreased use, and 1 had no change; the remaining 3 were in first year monitoring. Of the motorized trail sites, 2 indicated increased use, 2 had decreased use, and 1 had no change. Most of the high use trails tend to be either scenic and/or mechanized. Across the Forest, use numbers remain stable: however, increased use is expected due to proximity to the fast growing city of Las Vegas, Nevada. In addition, the Forest provides many opportunities for motorized recreation, which is the fastest growing sport in the United States (USFS 2009a). The Recreation Specialist Report (3.0) further describes recreation uses on the Dixie National Forest. The Transportation Specialist Report (11.0) further describes road systems, traffic, and travel restrictions in place on the Forest.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.2-1
Visual Resources
Scenery Management System

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Scenery Management System

- Unassigned
- Low
- Moderate
- High
- Very High

0 4 8 12 16 Miles

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

3.2.8 Pine Valley Ranger District

The Pine Valley Ranger District occupies approximately 481,264 acres in Iron and Washington Counties. It is north of the city of St. George, and borders near the communities of Enterprise, Central, Leeds, New Harmony, and Newcastle. Included in this area are the Pine Valley Mountain Wilderness Area, Enterprise Reservoirs, the Bull Valley Mountains, and Pine Park. Rising above the communities of Enterprise and St. George, Utah, the Pine Valley Mountains are a striking compliment to the area's dramatic red rock scenery. There are three physiographic regions that meet in the Pine Valley Mountain area – the Mojave Desert, Basin and Range, and the Colorado Plateau region. The area features sage steppe and mountain brush, pinyon-juniper woodland, and isolated stands of coniferous forest on the wetter north-facing aspects. Scattered patches of ponderosa pine are found in the area. The unique volcanic and rugged scenery provides striking contrasts to the surrounding redrock country.

Several significant geological conditions are found within the Pine Valley Ranger District. A striking formation found in the district, known as the Racer Canyon Tuff, has created dramatic and fascinating white and gray-hued features. Wind and water erosion sculpted the formation in a series of scenic hoodoos, domes, and goblins. The Racer Canyon Tuff feature is most prevalent in the Bull Valley subsection in areas known as Pine Park, Racer Canyon, and Honeycomb Rocks (Utah Forests 2008).

On the south end of the district, landforms fall away to dramatic red, orange, and white sandstone outcrops and canyons, providing a striking contrast to the volcanic features of the main range. Scenic peaks and canyons give visitors a palpable feeling of solitude (Utah Forests 2008). The area contains a Forest Service Research Natural Area (RNA), known as Browse RNA. The entire region is well suited to horseback riding, hiking, backpacking, bird and wildlife watching, photography, and historical tourism.

Within this ranger district, 135,815 acres have not been assigned SIOs. The majority (about 50 percent) of the remaining SIO-assigned acreage in the Pine Valley Ranger District is designated Moderate SIO (See Table 3.2-1). The High SIO areas on this District include areas within ½ mile of Forest Service Road 006 (including the Upper Enterprise Reservoir and Honeycomb Campground), Forest Service Road 035 (road to Pine Valley Recreation Area), Cottonwood Road (Forest Service Roads 031 and 033), and Forest Service Road 032 to Oak Grove Campground (USFS 1995g, see Figure 3.2-1).

3.2.9 Cedar City Ranger District

The Cedar City Ranger District occupies approximately 404,283 acres in Iron, Garfield, and Kane Counties. This District lies just east of Cedar City and west of the communities of Panguitch, Hatch, and Alton. It includes Panguitch Lake, Ashdown Gorge Wilderness, the Markagunt Plateau, Navajo Lake, and the Duck/Swains area. Cedar Breaks National Monument is located within the District boundary.

The Cedar City Ranger District is located on the Markagunt Plateau, a gently sloping, eastward tilted earth block that has been modified by erosion, volcanism, and some glaciations. The plateau has many dead spruce trees - trees that have been killed by an epidemic of spruce bark beetles. Bordered by the beautiful pink limestone of the Wasatch formation (the same formation that forms the spires and landscape of Bryce Canyon National Park and Cedar Breaks National Monument), the District has some of the more spectacular scenery in the West. This panoramic tapestry becomes even more spectacular during the splendor of autumn's colors. Elevations

range from approximately 6,000 feet to 11,307 feet at Brian Head Peak. Volcanic knolls rise up to 800 feet above the plateau, and lava flows occupy the surface in numerous locations (USFS 2008a). Vegetation transitions from pinyon-juniper and sagebrush at the lower elevations, through ponderosa pine, mixed conifer, and aspen at the mid elevations, climaxing in spruce-fir, aspen and high alpine meadows.

Sharing the western and northern borders of the desert like Cedar Breaks National Monument, the 7,022-acre Ashdown Gorge Wilderness (Very High SIO) displays eroded, multicolored Wasatch limestone, meadows, and forestland including a significant stand of bristlecone pine, known as the Twisted Forest, in the northern corner. Bristlecone pines are among the oldest living life forms,

Within this ranger district, 99,091 acres have not been assigned SIOs. About 44 percent of the remaining acreage in the Cedar City Ranger District is designated High SIO, and 39 percent is Moderate SIO (see Table 3.2-1). The High SIO areas on the Cedar City Ranger District include areas within ½ mile of Scenic Byways 143, 148, 14, and 89, and Forest Service Roads 064 and 068 (between Scenic Byways 143 and 14), Forest Service Road 053 (road along south side of Navajo Lake), Forest Service Road 060 adjacent to Swains Creek and dispersed recreation areas around Brian Head Ski Area and areas surrounding the Ashdown Gorge Wilderness (USFS 1995g).

3.2.10 Powell Ranger District

The Powell Ranger District occupies approximately 388,603 acres in Garfield, Kane, and Piute Counties. It lies south of the communities of Circleville and Kingston, and east of Panguitch and Hatch, and is bordered by Bryce Canyon National Park on the southeast. The northern part of the Ranger District includes the Sevier Plateau, and the Paunsaugunt Plateau is to the south. The highly scenic Red Canyon, which contains several unique endemic plants, can be viewed from Scenic Byway 12. Perhaps the inspiration for the term "red rock," Red Canyon is one of the most scenic areas of the Claron Formation. Red limestone formations of Red Canyon rival those of Bryce Canyon National Park. Carved by wind and water, this colorful limestone formation is a popular spot for sightseers, photographers, hikers, horseback riders and bicyclists alike.

In 2006, the Powell Ranger District designated a series of dispersed campsites along the East Fork of the Sevier River south of Tropic Reservoir.

Within this ranger district, 25,480 acres have not been assigned SIOs. The majority of the remaining lands in the Powell Ranger District are assigned Moderate (30 percent) or Low (37 percent) SIOs, and about 25 percent are assigned High SIOs (See Table 3.2-1).

High SIO areas on the Powell Ranger District include those areas within ½ mile of Scenic Byway 12 to Bryce Canyon National Park including the Forest Service Red Canyon Campground and surrounding area, Scenic Backway – East Fork of the Sevier River (Forest Road 087) and dispersed recreation areas beyond the East Fork of the Sevier River Scenic Backway (USFS 1995g).

3.2.11 Escalante Ranger District

The Escalante Ranger District occupies approximately 436,610 acres in Garfield County. This ranger district shares most of its southern border with the Grand Staircase-Escalante National Monument and its northern border with the Fremont River Ranger District of the Fishlake

National Forest. Highway 12 Scenic Byway (Forest Concern Level 1 travel way) passes through this ranger district for a few miles south of Escalante and north of Boulder for 25 miles. This highly scenic area includes Boulder Mountain area, Griffin Top area, the Aquarius Plateau, Box Death Hollow Wilderness Area, and many miles of roads and trails.

Boulder Mountain is the name applied to the high plateau area, including the Aquarius Plateau, between Highway 24 (Loa/Torrey) and Highway 12 (Escalante/Boulder). The Boulder Mountain area is one of two major high-elevation lake areas in Utah; the other is the Uinta Mountains, in northeastern Utah. From the top of Powell Point, it is possible to see for miles into three different states. Boulder Mountain area and the many different lakes provide opportunities for hiking, fishing, and viewing outstanding scenery.

The Box Death Hollow Wilderness Area has Very High SIOs. High SIOs are applied to 39 percent of the Escalante Ranger District, with Moderate SIOs applied to 36 percent of those lands designated with SIOs. Within this ranger district, 44,921 acres have not been assigned SIOs.

High SIO areas include areas within ½ mile of Scenic Byway 12, Forest Service Road 153 (Hell's Backbone), Forest Service Road 140 (Backcountry Byway – Griffin Top Road), Forest Service Road 132 including the access road to Pine Lake and Pine Lake Campground, Forest Service Road 153 and 154 (Backcountry Byway – Posey Lake Road), Forest Service Road 149 (Barker Reservoir and surrounding area), and popular dispersed recreation areas including the trails and primitive roads and recreation areas including: Lower Reservoir, Round Lake, Green Lake, Deer Creek Lake, Chriss Lake, and Lake McGath (USFS 1995g).

Table 3.2-2 Landscape Theme and SIOs for Management Areas of the Dixie National Forest

Code	Forest Plan Management Area	Landscape Theme	SIO
1	General Forest Management	Natural Appearing	Outside of Concern Level 1&2 areas, assigned based upon scenic attractiveness which is assigned according to scenery inventory during project planning
1A	Developed Recreation	Developed Recreation	High
1B	Winter Sports	Developed Recreation – Rural Interface (except for some areas visible from Cedar Breaks National Monument where Landscape Theme is Natural Appearing)	High
2A	Semi Primitive Recreation	Natural Appearing	High
2B	Rural/Roaded Recreation	Natural Appearing	Moderate
4A	Fish and Aquatic	Natural Appearing	High
4A	Fish and Aquatic (areas with developments for water-related recreation: Tropic Reservoir, Navajo Lake, Panguitch Lake)	Developed Recreation	High
4B	Wildlife Habitat, Management Indicator Species	Natural Appearing	Low
4C	Wildlife Habitat, Brush	Natural Appearing	Low
4D	Aspen	Natural Appearing	Low
5A	Big Game Winter Range	Natural Appearing	Moderate
5B	Big Game Winter Range	Natural Appearing	Moderate
6A	Livestock Grazing	Natural Appearing	Moderate
7A	Wood Production	Natural Appearing	Low
8A	Wilderness	Natural Evolving	Very High
8A1/8A2	Antone Bench, Box Death Hollow (adjacent to designated wilderness areas)	Natural Appearing	Very High (High if existing CO_2 leases are developed)
9A	Riparian	Natural Appearing	Moderate
9B	Intensive Riparian	Natural Appearing	High
10A	Research Natural Areas	Natural Appearing	Very High
10B	Municipal Watersheds	Natural Appearing	Low

3.3 Inventoried Roadless Areas, Unroaded-Undeveloped areas, and Suitable Wild and Scenic Rivers

3.3.1 Introduction

This section describes the Inventoried Roadless Areas (IRAs) and Unroaded-Undeveloped Areas on the Dixie National Forest and the general roadless characteristics and wilderness attributes of IRAs that could be affected by implementation of the alternatives described in Chapter 2. This section and the corresponding section in Chapter 4 do not present detailed information on the IRAs or analyze their suitability. Rather this section just presents the information necessary to understand the potential impacts of oil and gas leasing, which are described in Chapter 4. In addition to IRAs and Unroaded-Undeveloped Areas, this section also summarizes the process by which the Forest Service evaluates potential Wild and Scenic Rivers and describes the four streams on the Dixie National Forest suitable for inclusion in the National Wild and Scenic River System. Additional information on the 2001 Roadless Area Conservation Rule and the Wild and Scenic River Suitability Study for National Forest System Lands in Utah is available in Chapter 1 (Sections 1.8.2 and 1.8.3, respectively).

3.3.2 Inventoried Roadless Areas

On January 12, 2001, the Roadless Area Conservation Rule was issued. This rule provided protections for inventoried roadless areas (IRA). IRAs are those areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps.

In an increasingly developed and fragmented landscape, IRAs represent some of the largest and most extensive tracts of undeveloped land. To be classified as an IRA, areas must not contain constructed roads and generally are at least 5,000 acres. Areas containing less than 5,000 acres can also be classified as IRAs if they do not contain constructed roads and meet one of the following criteria: (1) areas can be preserved due to physical terrain and natural conditions, (2) they are self-contained ecosystems, such as islands, that can be managed as an individual unit of wilderness, or; (3) they are contiguous to existing wilderness, primitive areas, recommended wilderness, or potential wilderness in other federal ownership. The definition for a constructed road is a road where there has been mechanical surface grading and cut and fill slopes are present along with drainage structures. Two-track roads are permissible within an IRA if there is no evidence of mechanical construction.

There are 38 IRAs covering a total of approximately 570,559 acres, which represents approximately 35 percent of the analysis area (the Dixie National Forest) for this EIS. Seven of the IRAs are smaller than 5,000 acres, but were included in the initial Roadless Area Review and Evaluation process and later received protection under the 2001 Roadless Area Conservation Rule. Some of these IRAs are adjacent to larger tracts of wilderness, other IRAs, or adjacent to potential wilderness on land administered by the Bureau of Land Management (BLM). Table 3.3-1 lists the IRAs on the Dixie National Forest by ranger district and the total acreage associated with each. Figure 3.3-1 shows the IRAs on each ranger district

In addition to the general absence of constructed roads, IRAs contain other important environmental values that warrant protection. These values include nine values or features

identified in the Roadless Area Conservation Rule that characterize IRAs, as well as seven attributes that characterize wilderness potential. Given the large number of IRAs on the Dixie National Forest and the inability to predict where potential oil and gas activity may occur, detailed information on the characteristics and attributes of each individual IRA is not presented in this EIS. Rather, the characteristics and attributes are described in general in this section and any unique characteristics known to be present within a specific IRA are discussed within the individual ranger district sections. Further, since IRAs cover such a large percentage of the analysis area, it is assumed that they contain a full range of the physical and biological characteristics found on each ranger district.

Table 3.3-1 Inventoried Roadless Areas on the Dixie National Forest, by Ranger District

Ranger District	IRA Name	Acres
Pine Valley	Atchinson	17,663
	Bull Valley	10,907
	Cave Canyon	5,661
	Cedar Bench	8,917
	Cottonwood	6,752
	Cove Mountain	16,634
	Dixie	109
	Gum Hill	3,181
	Headwaters/Pine Park Bench/Pine Park	10,949
	Kane Mountain	8,016
	Lost Peak	4,144
	Mogotsu	16,771
	Moody Wash	31,853
	North Hills	24,485
	Pine Valley Mountains	57,683
	Rock Canyon	16,463
	Stoddard Mountain	13,155
	Total	253,342
Cedar City	Bear Valley Peak	7,419
	Bunker Creek	7,286
	Hancock	9,806
	Lava Beds	14,940
	Mineral Canyon	8,392
	Total	47,842
Powell	Casto Bluff	87,416
	Deer Creek	39,784
	Fishhook	12,921
	Horse Valley	13,603
	Red Canyon North	9,964
	Red Canyon South	3,730
	Total	167,418

Ranger District	IRA Name	Acres
Escalante	Boulder Mtn/Boulder Top/Deer Lake	14,888
	Box-Death Hollow	3,171
	Hog Ranch	17,114
	Jake Hollow	15,135
	Long Neck Mesa/Steep Creek/Oak Creek – Steep Creek/Oak Creek	11,139
	McGath Lake – Auger Hole	8,328
	New Home Bench	10,505
	Shakespeare Point	750
	South Rim	1,367
	Table Cliffs – Henderson Canyon	19,561
	Total	101,958
Forest Total		570,559

3.3.2.1 Roadless Characteristics

High quality or undisturbed soil, water, and air: These three resources are the foundation upon which other resource values and outputs depend. Healthy watersheds provide clean water for domestic, agricultural, and industrial uses; maintain fish and wildlife populations; and provide recreational opportunities.

Sources of public drinking water: National Forest System lands contain watersheds that are important sources of public drinking water. Maintaining these areas in a relatively undisturbed condition is crucial to maintain the flow and affordability of clean water to a growing population.

Diversity of plant and animal communities: IRAs are more likely than roaded areas to support greater ecosystem health, including the diversity of native and desired nonnative plant and animal communities. These areas serve as a buffer against the spread of nonnative invasive species.

Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land: IRAs function as biological strongholds and refuges for many species including 25% and 13% of federally listed animal and plant species, respectively. In addition, 65% of all Forest Service sensitive species are directly or indirectly supported by IRAs (36 CFR 294).

Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation: IRAs often provide outstanding dispersed recreation opportunities in areas with wilderness-like attributes. These areas reduce recreation pressure on designated Wilderness, and unlike Wilderness, the use of mountain bikes and other mechanized means of travel is permitted.

Reference landscapes: Reference landscapes of relatively undisturbed areas serve as a barometer to measure the effect of development on other parts of the landscape.

Natural appearing landscapes with high scenic quality: High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate. In

addition, quality scenery contributes directly to real estate values in nearby communities and residential areas.

Traditional cultural properties and sacred sites: Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group. Sacred sites are places that have special religious significance to a group. Many of these sites may be eligible for protection under the National Historic Preservation Act; however, many of these areas have not been inventoried.

Other locally identified unique characteristics: IRAs may offer other locally identified unique characteristics and values such as, uncommon geological formations, unique wetland complexes, or social, cultural, or historical characteristics.

3.3.2.2 Wilderness Attributes

Natural Integrity: Natural integrity is the extent to which long-term ecological processes are intact and operating. It describes the extent to which human influences have altered natural processes.

Apparent Naturalness: Apparent naturalness means that the environment looks natural to most people using the area.

Solitude and Primitive Recreation: Solitude is defined as isolation from the sights, sounds, and presence of others as well as human development. Opportunities for primitive recreation is a measure of the experiences available to be isolated from the evidence of man, to feel a part of nature, to have a vastness of scale, and a high degree of challenge and risk while using outdoor skills. Physical factors that can create primitive recreation opportunities include topography; vegetative screening; distance form human impacts such as roads, motorized vehicles, and logging operation; and difficulty of travel.

Challenging Experience: A challenging experience is one that requires self-reliance through application of outdoor skills.

Special Features/Special Places/Special Values: These consist of unique geological, biological, ecological, cultural, or scenic features.

Wilderness Manageability and Boundaries: To be evaluated for wilderness, an area generally must comprise a minimum of 5,000 acres. The boundaries of these areas should be manageable without conflicts to existing developments and uses. The shape of an area and changes to the shape can influence how it can be managed.

3.3.3 Unroaded-Undeveloped Areas

Unroaded-Undeveloped Areas are all those classified as such within the Dixie National Forest GIS database and indentified on the 2005 Draft Inventory map of Unroaded/Undeveloped Areas. The inventory of Unroaded-Undeveloped Areas was conducted jointly with the Fishlake National Forest while planning for Forest Plan Revisions, it was based on direction in the Intermountain Region Planning Desk Guide: A Protocol for Identifying and Evaluating Areas for Potential Wilderness" (cited in USFS 2009a). Unroaded-Undeveloped Areas identified according to this protocol only exclude classified Forest-system roads as of 2004, and thus still contained numerous "constructed" (unclassified) roads and trails, as well as timbered areas, powerlines, and other infrastructure. After the inventory of Unroaded-Undeveloped Areas, the Fishlake and

Dixie National Forests began an evaluation of the suitability of each Unroaded-Undeveloped Area for wilderness recommendation. The purpose of this evaluation was to determine which areas met the definition of wilderness found in the 1964 Wilderness Act, and as such "meet the criteria for wilderness suitability and possibly recommendation to Congress for wilderness study or designation." (Forest Service Handbook 1909.12: Chapter 70).

About sixty (59%) percent of the total Unroaded-Undeveloped Area on the Dixie National Forest overlaps with IRAs. Table 3.3-2 lists the Unroaded-Undeveloped Areas in each Ranger District, their size, and the extent of overlap with IRAs.

Table 3.3-2 Unroaded-Undeveloped Areas on the Dixie National Forest, by Ranger District

Ranger District	Name	Total Acres	Acres within IRAs
Pine Valley	Atchinson	24,306	17,617
	Bull Valley	13,372	10,882
	Cave Canyon	8,136	5,660
	Cedar Bench	10,002	8,900
	Cottonwood[1]	8,845	6,752
	Cove Mountain	15,678	15,017
	Kane Mountain	9,632	7,955
	Lost Peak	6,053	4,143
	Moody Wash / Mogotsu	58,978	48,043
	North Hills	24,864	24,483
	Pine Park	31,550	16,367
	Pine Valley Mountain[1]	154,495	57,376
	Stoddard Mountain	14,196	12,981
	TOTAL	380,108	246,578 (65%)
Cedar City	Ashdown Gorge[1]	12,148	0
	Bear Valley Peak	11,379	6,136
	Bunker Creek	12,333	4,448
	Hancock	10,140	9,439
	Lava Beds #1	7,058	6,434
	Lava Beds #2	8,643	7,146
	Little Creek Peak	19,345	0
	Mineral Canyon	13,409	7,238
	Wagon Box	5,671	0
	TOTAL	100,125	40,840 (41%)
Powell	Big Hollow	7,791	0
	Blind Springs	9,917	0
	Casto Bluff	86,408	84,966
	Deep Creek	41,984	39,499
	Fishhook	11,437	11,326
	Horse Valley	14,588	12,760
	Lower Hoodle	10,254	9,398
	Red Canyon North	15,131	9,363
	Red Canyon South	5,597	2,642
	TOTAL	203,106	160,555 (79%)
Escalante	Antimony	20,604	0
	Barker	16,337	9,094
	Birch Creek	6,105	3
	Boulder Top	37,364	22,105
	Box-Death Hollow[1]	32,922	2,886

	Canaan Mountain	7,683	0
	Dry Lake	9,268	0
	Heaps Canyon	6,622	0
	Henderson Canyon	23,113	18,613
	Hog Ranch	5,924	3,761
	Jake Hollow	11,812	8,891
	Long Neck	12,711	10,903
	Pacer Lake	16,328	0
	Pretty Tree Bench	12,021	5,702
	Shakespeare Point	1,109	1,108
	TOTAL	219,923	83,067 (38%)
Forest Total		**903,262**	**531,040 (59%)**

[1] Partially within a Wilderness Area (see Table 1.5-1).

There is no policy, law, or directive guiding the management of Unroaded-Undeveloped Areas that lie outside of IRAs or wilderness areas. Currently, the only guidance for these areas is general forest or management area direction. It is the intent of the Dixie National Forest to manage these Unroaded-Undeveloped Areas for multiple resource benefits while maintaining their undeveloped character to the extent possible.

3.3.4 Suitable Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 established a National Wild and Scenic Rivers System to preserve free-flowing rivers that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Section 5(d) of the Act requires the Forest Service to evaluate rivers within its jurisdiction for their potential for inclusion in the National Wild and Scenic Rivers System. The Forest Service does not have the authority to designate Wild and Scenic Rivers. Rather, the Forest Service can only evaluate potential river segments and determine suitability, the US Congress then has the ability to designate suitable segments. The Forest Service evaluation of potential Wild and Scenic Rivers consists of a 3-step process.

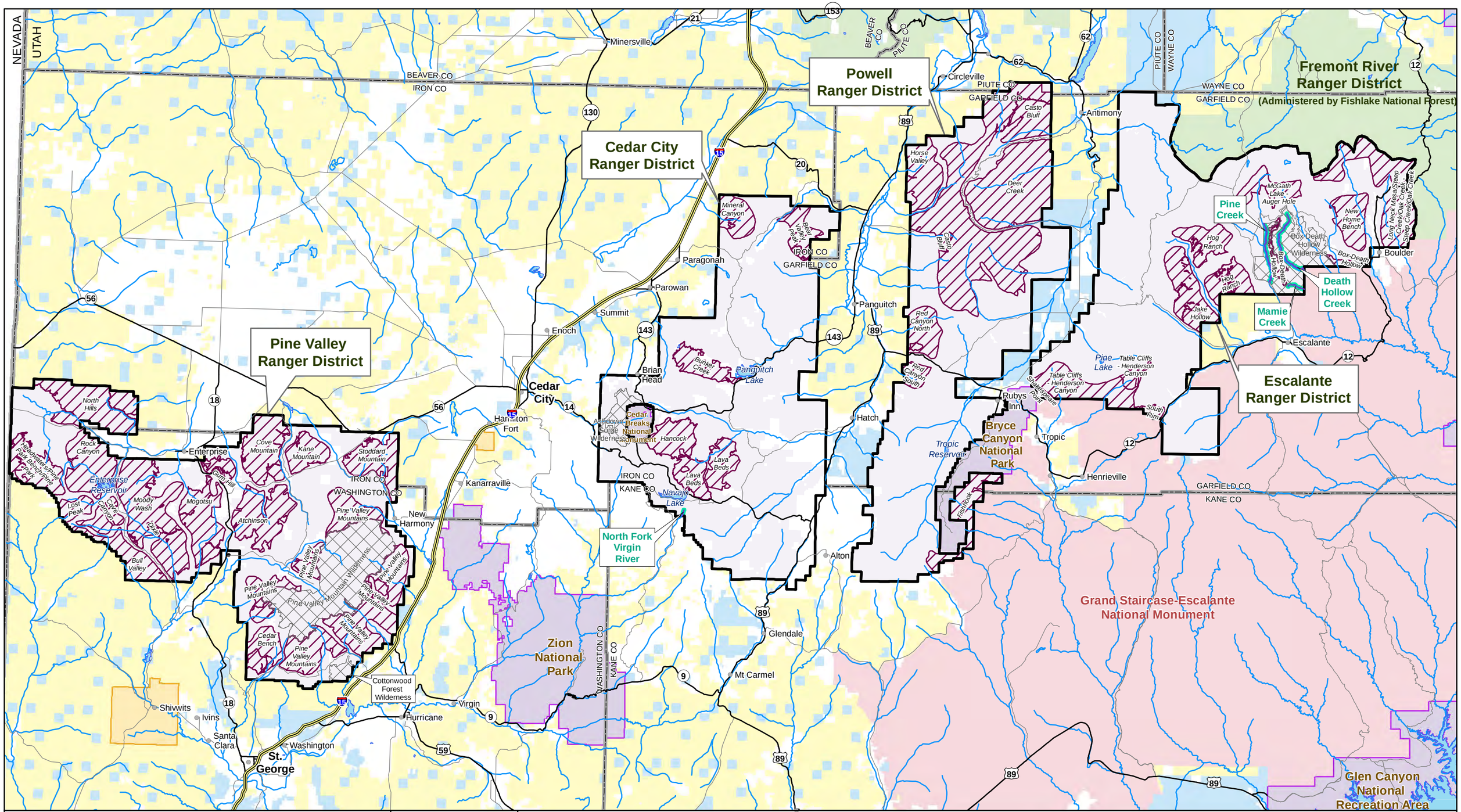
(1) Determination of eligibility (inventory)

(2) Potential classification as wild, scenic, or recreational (inventory)

(3) Determination of suitability (decision)

Following completion of this three-step process, suitable segments are recommended to the US Congress, which makes final decisions on designation of rivers as part of the National System.
To be eligible for Wild and Scenic River status, a river or segment of a river must be free flowing and possess at least one or more river-related outstandingly remarkable values. Eligible segments are tentatively classified as wild, scenic, or recreational depending upon the degree of development and access along the river. Rivers or river segments tentatively classified as wild are generally inaccessible, except by trail, with unpolluted water and watersheds or shorelines that are essentially primitive. A scenic tentative classification indicates that watersheds or shorelines are generally still primitive and undeveloped; however, the river may be accessible in some places by roads. Rivers that are readily accessible by road or railroad and have development along their shorelines are classified as recreational.

The Forest Service evaluated all rivers and streams on the Dixie National Forest to determine which river segments meet eligibility criteria for inclusion in the National Wild and Scenic Rivers System. Segments of six different streams on the Dixie National Forest were determined to be



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.3-1
Inventoried Roadless Areas & Suitable Wild & Scenic Rivers

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Wild & Scenic Rivers
- Wild & Scenic River Corridors (0.5-mi wide)
- Inventoried Roadless Areas

0 4 8 12 16 Miles

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

eligible for inclusion. Four of these river segments were then found suitable for inclusion into the National Wild and Scenic Rivers System (Table 3.3-3). A summary of the characteristics of each suitable stream segment is presented below. The location of the streams is shown in Figure 3.3-1.

Table 3.3-3 Suitable Wild and Scenic Rivers on the Dixie National Forest

River	Classification	Segment Length (miles)	Acres within Buffer (at least ½-mile wide)
Cedar City RD			
North Fork of the Virgin River	Scenic	0.7	279
Escalante RD			
Death Hollow Creek	Wild	9.6	2,801
Mamie Creek	Wild	2.0	697
Pine Creek	Wild	7.8	2,234

Management guidelines in Section 10(a) of the Wild and Scenic Rivers Act dictates that designated Wild and Scenic Rivers should be administered in a manner that will protect and enhance the values that caused them to be designated. Specific direction for oil and gas development in Section 9 of the Act prohibits mining claims and mineral leases within ¼ mile of a designated Wild and Scenic River (¼ mile measured from each bank, for a total width of at least ½ mile around each stream). However, these management guidelines only apply to designated Wild and Scenic Rivers, or to legislatively mandated study rivers (defined in Section 5(a) of the Wild and Scenic Rivers Act). These guidelines do not apply directly to river segments determined to be eligible or suitable by the Forest Service under Section 5(d) of the Act. Protection for those river segments identified as suitableis provided through a forest plan amendment at II-48a (ROD for Wild and Scenic River Suitablity Study, Nov 2008) and Forest Service Handbook 1909.12 at chapter 80, section 82.

The guidelines state that protection of Forest Service identified rivers is derived from existing authorities such as the Clean Water Act, the Endangered Species Act, the Archeological Resources Protection Act, etc. Furthermore, the guidelines state that projects and activities on National Forest System Lands within the river corridor (within ¼ mile) of an eligible or suitable river must be consistent with the following guidelines:

- The free-flowing character of the identified river is not modified
- Outstandingly remarkable values of the identified river area are protected
- Classification is maintained as inventoried unless a suitability study (a decision) is completed that recommends management at a less restrictive classification (such as from wild to scenic or scenic to recreational)

Regarding oil and gas development, Section 82.51 of USFS (2006a) states, “Leases, licenses, and permits under mineral leasing laws would be subject to conditions necessary to protect the values in the event it (a suitable Wild and Scenic River) is subsequently included in the National System.” In accordance with this direction and to protect the suitability of these streams, a ¼-mile buffer measured out from either streambank is applied to suitable streams in this EIS. The area encompassed by the buffer around suitable streams is specified in Table 3.3-2.

3.3.5 Pine Valley Ranger District

3.3.5.1 Inventoried Roadless Areas and Unroaded-Undeveloped Areas

There are 17 IRAs on the Pine Valley Ranger District covering a total of 253,342 acres. The IRAs are identified in Table 3.3-1 and are Atchison (17,663 acres), Bull Valley (10,907 acres), Cave Canyon (5,661 acres), Cedar Bench (8,917 acres), Cottonwood (6,752 acres), Cove Mountain (16,634 acres), Dixie (109), Gum Hill (3,181), Headwaters/Pine Park Bench/Pine Park (10,949 acres), Kane Mountain (8,016 acres), Lost Peak (4,144), Mogotsu (16,771 acres), Moody Wash (31,853 acres), North Hills (24,485 acres), Pine Valley Mountains (57,683 acres), Rock Canyon (16,463 acres), and Stoddard Mountain (13,155 acres).

There are 13 Unroaded-Undeveloped Areas in the Pine Valley Ranger District, covering 380,108 acres. Sixty-five percent of these areas fall within IRAs. None of these areas are less than 5,000 acres in size.

The Pine Valley Ranger District contains the largest amount of biological crusts and gypsiferous soils and these resources would be expected to occur on IRAs. Eight municipal watersheds covering 14,669 acres are at least partially located on the Pine Valley Mountains IRA. The watersheds are Central, Enterprise, Leeds, New Harmony, Pine Valley, Pintura, Sawyer Spring, and St. George. In addition, based on Dixie National Forest GIS data, IRAs include 18,040 acres of known or suitable habitat for threatened and endangered species including California condor (*Gymnogyps californianus*) and Mexican spotted owl (*Strix occidentalis*). The IRAs also include 24,557 acres of suitable habitat for sensitive species including bald eagle (*Haliaeetus leucocephalus*), flammulated owl (*Otus flammeolus*), peregrine falcon (*Falco peregrinus*), northern goshawk (*Accipiter gentilis*), pygmy rabbit (*Brachylagus idahoensis*), sensitive fishes, and sensitive bats.

3.3.5.2 Suitable Wild and Scenic Rivers

There are no streams on the Pine Valley Ranger District that are suitable for inclusion in the National Wild and Scenic River System.

3.3.6 Cedar City Ranger District

3.3.6.1 Inventoried Roadless Areas and Unroaded-Undeveloped Areas

There are five IRAs on the Cedar City Ranger District covering a total of 47,842 acres. The IRAs are identified in Table 3.3-1 and are Bear Valley Peak (7,419 acres), Bunker Creek (7,286 acres), Hancock (9,806 acres), Lava Beds (14,940 acres), and Mineral Canyon (8,392 acres). The Bunker Creek IRA includes 1,163 acres of the Parowan municipal watershed. Based on Dixie National Forest GIS data, IRAs on the Cedar City Ranger District include 2,689 acres of known or suitable habitat for threatened, endangered, or candidate species including California condor, Mexican spotted owl, Utah prairie dog (*Cynomys parvidens*), and greater sage-grouse (*Centrocercus urophasianus*). IRAs on the Ranger District also include 24,381 acres of suitable habitat for sensitive species including flammulated owl, peregrine falcon, northern goshawk, pygmy rabbit, sensitive fishes, and sensitive bats.

There are nine Unroaded-Undeveloped Areas on the Cedar City Ranger District, covering 100,125 acres and none of these areas are less than 5,000 acres in size. Forty-one percent of these areas fall within IRAs. Three Unroaded-Undeveloped Areas: Ashdown Gorge (12,148

acres), Little Creek Peak (19,345 acres), and Wagon Box (5,671 acres) are completely outside IRAs.

3.3.6.2 Suitable Wild and Scenic Rivers

NORTH FORK OF THE VIRGIN RIVER

Approximately 0.7 miles of the North Fork of the Virgin River is classified as Scenic, beginning at the headwaters and extending downstream to the Dixie National Forest boundary. The North Fork of the Virgin River begins at Cascade Falls, a perennial spring that is fed by Navajo Lake through underground lava tubes and a limestone solution channel. Cascade Falls is located in the Pink Cliffs on the south edge of the Markagunt Plateau. From here, the river flows as a boulder dominated, cascading to step-pool stream system through the Grey Cliffs before cutting down through the Kolob Terrace into Zion National Park (USFS 2007d).

There are no water developments on the North Fork of the Virgin River; however, the segment is classified as Scenic due to signs of human activity and a four-wheel-drive road that provides access to private property that is within a half mile of the river corridor. Outstandingly remarkable values for this reach are scenic, geological, and recreational. The river begins at Cascade Falls and flows through the pink cliffs of the Virgin River rim and other high elevation landscapes of Jurassic and Cretaceous sediment deposits, with extensive viewsheds and examples of stream erosion. The stream corridor also supports a diverse riparian plant community, and near Cascade Falls the watershed supports a population of bristlecone pine (*Pinus longaeva*) trees. The North Fork of the Virgin River provides a unique recreational opportunity for hiking, sightseeing, and studying the ecology of southern Utah. The Cascade Falls National Recreation Trail (#32055) is one of the most popular and heavily used trails on the Dixie National Forest; however, it has been closed for several years due to erosion damage. The trail terminates at a viewpoint looking directly into the limestone cavern from which water exits and forms Cascade Falls. The Virgin River Rim Trail (#32011) also provides visitors a view of the river segment (USFS 2007d).

3.3.7 Powell Ranger District

3.3.7.1 Inventoried Roadless Areas and Unroaded-Undeveloped Areas

There are six IRAs on the Powell Ranger District covering a total of 167,418 acres. The IRAs are identified in Table 3.3-1 and are Casto Bluff (87,416 acres), Deer Creek (39,784), Fishhook (12,921 acres), Horse Valley (13,603 acres), Red Canyon North (9,964 acres), and Red Canyon South (3,730 acres). The Deer Creek IRA overlaps 5,303 acres of the Antimony municipal watershed. Based on Dixie National Forest GIS data, IRAs on the ranger district include 43,745 acres of known or suitable habitat for threatened and endangered species including California condor, Mexican spotted owl, greater sage-grouse, and Utah prairie dog. IRAs also include 80,023 acres of suitable habitat for sensitive species including flammulated owl, peregrine falcon, northern goshawk, pygmy rabbit, boreal toad (*Anaxyrus boreas*), sensitive fishes, and sensitive bats.

There are nine Unroaded-Undeveloped Areas in the Powell Ranger District, totaling 203,106 acres and none of these areas are less than 5,000 acres in size. Seventy-nine percent of these areas fall within IRAs. Two Unroaded-Undeveloped Areas: Big Hollow (7,791 acres) and Blind Springs (9,917 acres) are completely outside IRAs.

3.3.7.2 Suitable Wild and Scenic Rivers

There are no streams on the Powell Ranger District that are suitable for inclusion in the National Wild and Scenic River System.

3.3.8 Escalante Ranger District

3.3.8.1 Inventoried Roadless Areas and Unroaded-Undeveloped Areas

There are 10 IRAs on the Escalante Ranger District covering a total of 101,958 acres. The IRAs are listed in Table 3.3-1 and are Boulder Mountain/Boulder Top/Deer Lake (14,888 acres), Box-Death Hollow (3,171 acres), Hog Ranch (17,114 acres), Jake Hollow (15,135 acres), Long Neck Mesa/Steep Creek/Oak Creek – Steep Creek/Oak Creek (11,139 acres), McGath Lake–Auger Hole (8,328 acres), New Home Bench (10,505 acres), Shakespeare Point (750 acres), South Rim (1,367 acres), and Table Cliffs – Henderson Canyon (19,561 acres). The Hog Ranch and McGath Lake – Auger Hole IRAs overlap with 1,006 acres of the Escalante municipal watershed and the New Home Bench IRA overlaps with 426 acres of the Boulder Town municipal watershed. The Side Hollow Ponderosa Pine Provenance Study Area covers 4.5 acres within the New Home Bench IRA. The Study Area contains ponderosa pine (*Pinus ponderosa*) from various origins that are being used for genetic studies (USFS 2006b). Based on Dixie National Forest GIS data, IRAs on the ranger district include 85,203 acres of known or suitable habitat for threatened and endangered species including California condor, Mexican spotted owl, and Utah prairie dog. IRAs also include 106,119 acres of suitable habitat for sensitive species including flammulated owl, peregrine falcon, northern goshawk, pygmy rabbit, sensitive fishes, and sensitive bats.

There are 15 Unroaded-Undeveloped Areas on the Escalante Ranger District, totaling 219,923 acres. Only Shakespeare Point is less than 5,000 acres in size. Thirty-eight percent of these areas are within IRAs. Six Unroaded-Undeveloped Areas: Antimony (20,604 acres), Birch Creek (6,105 acres), Canaan Mountain (7,683 acres), Dry Lake (9,268 acres), Heaps Canyon (6,622 acres), and Pacer Lake (16,328 acres) are completely outside IRAs.

3.3.8.2 Suitable Wild and Scenic Rivers

There are three stream segments on the Escalante Ranger District, Death Hollow Creek, Mamie Creek, and Pine Creek, which are suitable for inclusion in the Wild and Scenic River System. All three segments are classified as Wild. These segments are entirely within the Box-Death Hollow Wilderness Area. As a result, these streams would not be impacted by oil and gas leasing and will not be described in detail below.

3.4 Recreation Resources

3.4.1 Introduction

Recreation resources on the Dixie National Forest are extensive and a major attraction for at least half a million visitors each year (USFS 2004a, USFS 2006c, USFS 2010b). The Dixie National Forest contains over 1,300 miles of trails, which includes 143 miles within wilderness areas, the Great Western Trail, two National Recreation Trails, and 11 scenic byways and backways that are frequented by regional, national, and international visitors.

The Forest Service manages recreation settings in order to provide opportunities for recreational experiences. Those experiences are also influenced by many other factors

including the recreationists' own views, perceptions, and expectations. Experience has demonstrated that the public expects a wide range of recreation opportunities and settings on the Dixie National Forest from wilderness to fully developed campgrounds.

The objective in managing recreational settings on the Dixie National Forest is to provide opportunity for people to have recreational experiences. The key to providing most recreational experience opportunities is the setting and how it is managed. Land managers can facilitate or hamper many desired experiences by the way they manage such setting indicators as access, remoteness, social encounters, visitor management, facilities and site management, visitor impacts, and naturalness.

3.4.2 Visitation

The Dixie National Forest is primarily frequented by visitors from areas within one-hour driving time of the Forest, as well as those from major population centers in Utah, southern Nevada, and California (USFS 2010b). Three National Parks and two National Monuments are adjacent to the Dixie National Forest and the scenic beauty of these areas is characteristic of the region. These National Parks and Monuments draw millions of national and international visitors to the region and may provide a spillover effect on Forest visitation numbers and demographics. In 2009, approximately five percent of Forest visitors were from other countries (USFS 2010b).

A national forest site visit is the entry of one person upon a national forest site or area to participate in recreation activities for an unspecified period of time. A national forest visit is composed of one or more national forest site visits. For a multiple-day visit to count as one national forest visit, time spent on the forest must be continuous. For example, one national forest visit could include hiking on one day, spending the night in a Forest Service campground, and then going fishing on the second day. However, if the individual spent the night in a hotel in the local community, the two days of activity (hiking one day and fishing the next) would count as two national forest visits (USFS 2004b).

In fiscal year 2003, recreation use on the Dixie National Forest was approximately 773,789 national forest visits with an 80 percent confidence interval of +/- 13.3 percent (USFS 2004a). In addition, there was an average of 1.15 site visits per national forest visit (900,873 total site visits, including 13,952 Wilderness visits). Revised visitation numbers from 2006, report 646,000 forest visits and 728,000 site visits (80 percent confidence interval of 7.1 percent, USFS 2007f). Visitation numbers from 2009 report 924,300 forest visits and 1,077,700 site visits (90 percent confidence interval of 14 percent). This shows a general decrease in visitation on the Dixie National Forest in recent years followed by a sharp increase in 2009.

Typical visitors to the Dixie National Forest are white, male, and fall into the 40 to 49 year age class. A large percentage of visitors also fall into the under 16 age class suggesting that many young families visit and recreate on the Forest (USFS 2004a; USFS 2010b).

Visitors to the Dixie National Forest engage in a variety of recreational activities, which are listed in Table 3.4-1 along with the percentages that participate in these activities. Most visitors consider hiking/walking, relaxing, and viewing natural features and wildlife as primary reasons to choose the Dixie National Forest for recreation.

Table 3.4-1 Recreation Activities on the Dixie National Forest and Visitor Participation

Activity	Percent of Visitors Participating in Activity[1]
Relaxing	66.1
Viewing Natural Features	54.4
Hiking/Walking	40.6
Viewing Wildlife	35.7
Driving for Pleasure	32.2
Fishing	26.2
Downhill Skiing	18.0
Motorized Trail Activity	16.7
Picnicking	13.9
Nature Center Activities	11.3
Primitive Camping	10.2
Nature Study	8.1
Developed Camping	8.0
Hunting	7.2
Visiting Historic Sites	5.4
Off-Highway Vehicle (OHV) Use	4.7
Gathering Forest Products	4.4
Bicycling	3.8
Resort Use	1.3
Motorized Water Activities	1.3
Other Non-Motorized Activities	1.2
Non-Motorized Water Activities	1.1
Horseback Riding	1.0
Backpacking	0.5
Snowmobiling	0.2
Cross-Country Skiing	0.1
Other Motorized Activity	0.0

[1] Percentages exceed 100 percent due to visitor participation in more than one activity.
Source: USFS 2010b

3.4.3 Recreation Opportunity Spectrum

Recreation provides tangible benefits for individuals, families, communities, and society as a whole. National Forest System lands support a vast array of recreational activities, ranging from hiking in remote areas to skiing on groomed trails to camping in developed sites. In response, the Forest Service has developed the Recreation Opportunity Spectrum (ROS) classification system to characterize and help manage for recreation opportunities. The ROS provides a framework for stratifying, defining, and managing classes of outdoor recreation settings, activities, and experience opportunities. ROS is a continuum or spectrum that has been divided into six classes ranging from least developed to most developed settings (see 3.4.3.2 for a description of each class): Primitive, Semi-primitive Non-motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban.

3.4.3.1 ROS Setting Indicators

The setting indicators considered in defining the various ROS classes are introduced in Table 3.4-2 and discussed below.

Table 3.4-2 ROS Class Setting Indicators

Setting Factors	Physical	Social	Managerial
ROS Class Setting Indicators	Access	Social encounters	Facilities & Site development
	Remoteness	Visitor impacts	Visitor management
	Naturalness		

ACCESS

Access includes type and mode of travel. Highly developed access generally reduces the opportunities for solitude, risk, and challenge. However, it can enhance opportunities for socializing and feelings of safety and comfort. Accessibility for persons with disabilities can be organized along the ROS framework. Access in Rural or Urban settings should be easy per the Americans with Disabilities Act Guidelines (ADAAG) of 1990. Increasing difficulty should be designed into travelways as one moves toward the primitive end of the spectrum to elicit greater feelings of challenge and achievement (Table 3.4-3).

Table 3.4-3 Compatibility of Setting Access Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	Cross-country (off-trail) travel and travel on non-motorized trails	Non-motorized trails	Motorized trails & primitive roads	Controlled service level roads	Full access
Primitive					
Semi-Primitive Non Motorized					
Semi-Primitive Motorized					
Roaded Natural					
Rural					
Urban					

Table Key: **Fully Compatible** | **Normal** | **Inconsistent** | **Unacceptable**

Source: ROS Primer and Field Guide (USFS 1990a)

REMOTENESS

Remoteness refers to the extent to which individuals perceive themselves removed from the sights and sounds of human activity. Remoteness is important for some ROS settings such as primitive experience in Wilderness and conversely lack of remoteness is important in rural or urban setting experience (Table 3.4-4).

Table 3.4-4 Compatibility of Setting Remoteness Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	Out of sight and sound of human activity, more than 1-1/2 hour walk	Distant sight and/or sound of human activity, more than 1/2 hour walk from any motorized travel	Distant sight and/or sound of human activity, more than 1/2 hour walk from any better-than-primitive roads	Remoteness of little or no relevance	
Primitive	Normal	Inconsistent	Unacceptable	Unacceptable	Unacceptable
Semi-Primitive Non Motorized	Fully Compatible	Normal	Inconsistent	Unacceptable	Unacceptable
Semi-Primitive Motorized	Fully Compatible	Fully Compatible	Normal	Inconsistent	Unacceptable
Roaded Natural	Fully Compatible	Fully Compatible	Fully Compatible	Normal	Normal
Rural	Fully Compatible	Fully Compatible	Fully Compatible	Fully Compatible	Normal
Urban	Fully Compatible	Fully Compatible	Fully Compatible	Fully Compatible	Normal

Table Key: Fully Compatible | Normal | Inconsistent | Unacceptable

Source: ROS Primer and Field Guide (USFS 1990a)

NATURALNESS

Naturalness refers to the degree of human-caused change in the landscape setting. This affects psychological outcomes associated with enjoying nature. This indicator is assessed by using the compatible scenic integrity objective for each setting (Table 3.4-5).

SOCIAL ENCOUNTERS

This factor refers to the number and type of other recreationists or other Forest-users that are met along travelways, or camped or encountered within sight or sound of others (Table 3.4-6). This setting indicator measures the extent to which an area provides experiences such as solitude or the opportunity for social interaction. Increasing the number of visitors to an area or developing an area for oil and gas leasing changes the kind of recreation experience offered, attracting additional users, and causing others to leave.

Table 3.4-5 Compatibility of Setting Naturalness Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	Very high scenic integrity[1]	High scenic integrity[1]	Moderate scenic integrity[1]	Low scenic integrity[1]	Very low scenic integrity[1]
Primitive	Normal	Inconsistent	Unacceptable	Unacceptable	Unacceptable
Semi-Primitive Non Motorized	Fully Compatible	Normal	Inconsistent	Unacceptable	Unacceptable
Semi-Primitive Motorized	Fully Compatible	Fully Compatible	Normal	Inconsistent	Unacceptable
Roaded Natural	Fully Compatible	Normal	Normal	Normal	Inconsistent
Rural	Fully Compatible	Fully Compatible	Normal	Normal	Inconsistent
Urban	Fully Compatible	Fully Compatible	Fully Compatible	Fully Compatible	N/A

Table Key: Fully Compatible | Normal | Inconsistent | Unacceptable

[1] These descriptions are tied to the scenic integrity objectives in the USFS Scenery Management System (USFS 1995).

Source: ROS Primer and Field Guide (USFS 1990a)

Table 3.4-6 Compatibility of Setting Social Encounters Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	6 parties or less met per day, less than 3 parties seen at campsites	6-15 parties met per day, 6 or less parties seen at campsites	Moderate to high contact on roads. Moderate to low contact on trails and developed sites	Moderate to high contact at developed sites, roads, and trails	Large numbers of users on-site and nearby areas. High number of social encounters
Primitive					
Semi-Primitive Non Motorized					
Semi-Primitive Motorized					
Roaded Natural					
Rural					
Urban					

Table Key:	Fully Compatible	Normal	Inconsistent	Unacceptable

Source: ROS Primer and Field Guide (USFS 1990a)

VISITOR IMPACTS

This factor refers to visitor use of the environment and the impacts associated with different recreation uses (Table 3.4-7). Land managers are primarily concerned with determining how much environmental change should be allowed and which actions are appropriate for control. For example, impacts on wildlife habitat, soil, air, water, and sound quality also affect visitor experience. Visitor impacts can alter wildlife habitat or displace wildlife species. Maintaining resource quality standards, and by association, recreation settings in the face of future oil and gas developments is important across all ROS classes.

FACILITIES AND SITE DEVELOPMENT

This indicator refers to the level of site development (Table 3.4-8). A lack of facilities and site modifications can enhance feelings of self-reliance and independence and can provide experiences with a high degree of naturalness. Highly developed facilities can add feelings of comfort and convenience and increase opportunities for socializing.

It is unlikely that any oil and gas activities would affect the level and type of recreation site development, thus this setting indicator will not be used to measure potential effects.

Table 3.4-7 Compatibility of Visitor Impacts Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	Unnoticeable impacts. No site hardening	Subordinate impacts. No site hardening	Subordinate impacts. Limited site hardening	Subtle site hardening	Site hardening may be dominant but in harmony
Primitive					
Semi-Primitive Non Motorized					
Semi-Primitive					

Motorized					
Roaded Natural					
Rural					
Urban					

Table Key:	Fully Compatible	Normal	Inconsistent	Unacceptable

Source: ROS Primer and Field Guide (USFS 1990a)

Table 3.4-8 Compatibility of Setting Facilities and Development Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	No facilities for user comfort. Rustic & rudimentary facilities for site-protection only. Native materials only.	Rustic & rudimentary facilities primarily for site-protection only. No evidence of synthetic materials. Native materials only.	Rustic facilities providing some comfort for the user as well as site protection. Native materials but with more refinement in design. Synthetic materials should not be evident.	Some facilities designed primarily for user comfort & convenience. Some synthetic but harmonious materials are may be incorporated. Design may be more complex and refined.	Facilities mostly designed for user comfort & convenience. Synthetic materials are commonly used. Facility design may be highly complex and refined but in harmony or complimentary to the site.
Primitive					
Semi-Primitive Non Motorized					
Semi-Primitive Motorized					
Roaded Natural					
Rural					
Urban					

Table Key:	Fully Compatible	Normal	Inconsistent	Unacceptable

Source: ROS Primer and Field Guide (USFS 1990a)

VISITOR MANAGEMENT

This includes the degree to which visitors are regulated and controlled as well as the level of information and services provided for visitor enjoyment (Table 3.4-9). In some ROS settings, controls are expected and appropriate. For example, people sometimes seek developed campgrounds and other similar settings for security and safety. Elsewhere, on-site controls such as locked gates and fenced well pads may detract from desired recreation experiences.

The type and level of information and where it is provided to the visitor may facilitate or hinder desired recreation experience. On-site interpretive and directional signing may adversely affect the visitor where experiences such as self-discovery, challenge, and risk are important. In other situations, on-site information may be essential to achieve desired experiences and satisfaction.

Generally, on-site information is more appropriate at the developed end of the spectrum, rural and urban, while off-site sources are preferable at the primitive and semi-primitive end.

Table 3.4-9 Compatibility of Setting Visitor Management Compared to ROS Class

ROS Class	Description of Setting Relative to ROS Class Indicator				
	Low regimentation & no on-site controls or information facilities	Subtle on-site regimentation & controls, Very limited information facilities	On-site regimentation & controls are noticeable but harmonize with the natural environment, Simple informational facilities	Regimentation & controls are obvious & numerous but harmonize, More complex information facilities	Regimentation & controls are obvious & numerous, Sophisticated information exhibits
Primitive					
Semi-Primitive Non Motorized					
Semi-Primitive Motorized					
Roaded Natural					
Rural					
Urban					

Table Key: **Fully Compatible** | **Normal** | **Inconsistent** | **Unacceptable**

Source: ROS Primer and Field Guide (USFS 1990a)

3.4.3.2 Forest ROS Inventory

For this analysis, the ROS classifications of Rural and Urban are not discussed. There are no areas inventoried as Rural or Urban ROS Settings on the Dixie National Forest. This leaves four remaining ROS classes that occur across the Forest. Inventoried ROS acres are described below.

PRIMITIVE

Primitive areas are characterized by a natural, unmodified environment with similar characteristics as are found in designated Wilderness. Approximately 80 percent of Primitive ROS areas on the Dixie National Forest are within designated Wilderness. In Primitive areas, users will rarely encounter other people or evidence of human activity, and the areas offer a high degree of challenge and risk. There may be trails, but few structures. Of the lands classified under the ROS on the Dixie National Forest, 103,924 acres (six percent) are classified as Primitive (Table 3.4-10). Figure 3.4-1 shows the location of these areas across the Forest.

SEMI-PRIMITIVE NON-MOTORIZED

Semi-Primitive Non-Motorized areas are characterized by a natural or natural-appearing environment. Although concentration of use is low, some evidence of human activity can be observed. A high probability of experiencing isolation from other user groups exists, and opportunities for challenge and risk are available. The setting may have subtle modifications, but they remain unobtrusive to users moving through the area. Areas that are classified as Semi-Primitive Non-Motorized are dispersed throughout the Dixie National Forest and generally

occur where no roads exist. As a result, most IRAs are classified as Semi-Primitive Non-Motorized. However, there are areas on the Dixie National Forest that are outside of IRAs and are classified as Semi-Primitive Non-Motorized. Further, although IRAs are protected from road building by the 2001 Roadless Area Conservation Rule, areas classified as Semi-Primitive Non-Motorized are part of the ROS classification system used for land management and are not protected from development by federal law. Of the lands classified under the ROS on the Dixie National Forest, 700,990 acres (43 percent) are classified as Semi-Primitive Non-Motorized (Table 3.4-10). Figure 3.4-1 shows the location of these areas across the Forest.

SEMI-PRIMITIVE MOTORIZED

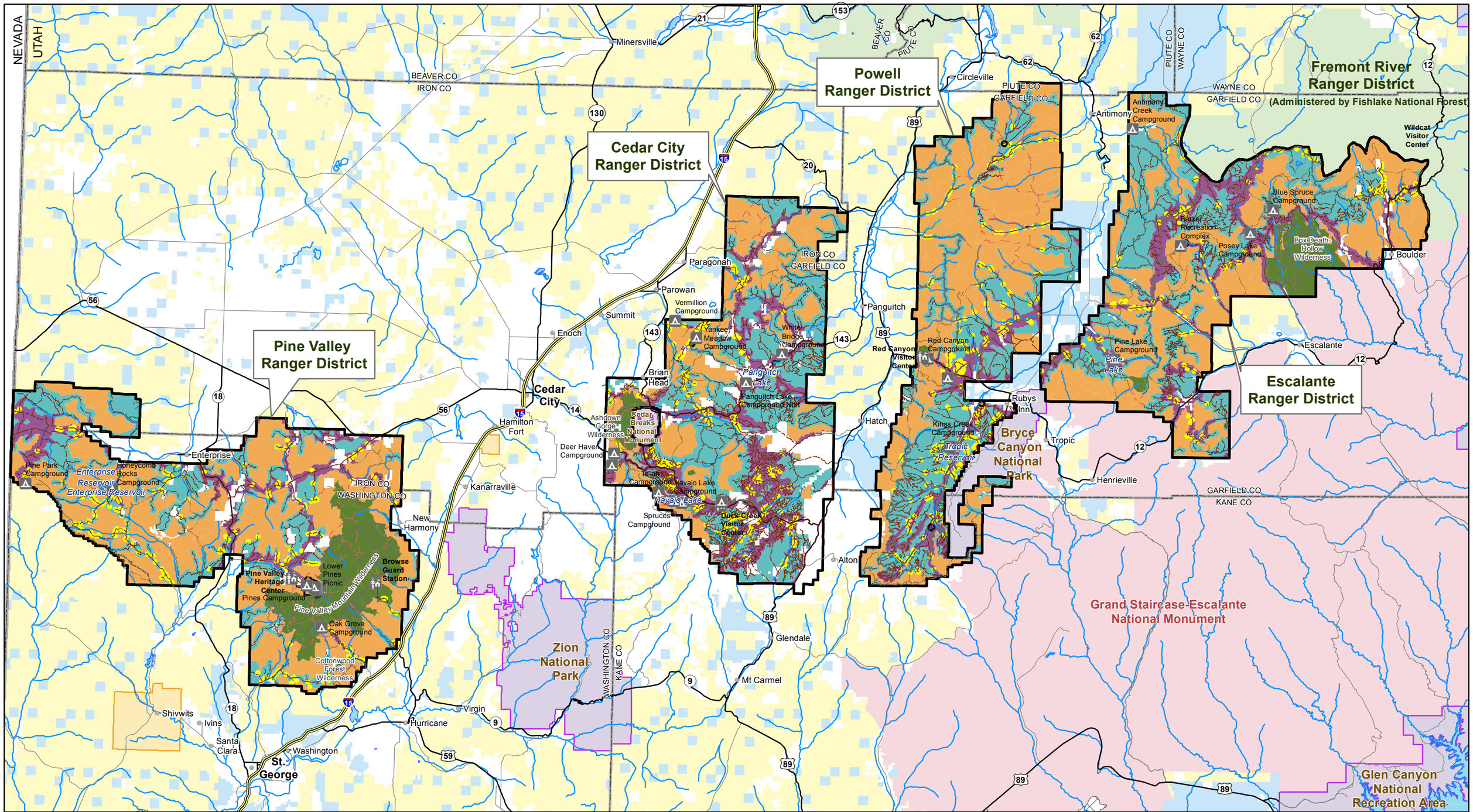
Semi-Primitive Motorized areas are characterized by a predominately natural or natural-appearing environment. Although concentration of use is low, evidence of human activity can be observed throughout the area. A moderate probability of experiencing isolation from other user groups exists, and opportunities for challenge and risk are available. The setting may have subtle modifications, but they remain visually unobtrusive to users traveling the trails and primitive roads in the area. Motorized travel is allowed. Semi-Primitive Motorized areas usually occur at a distance greater than 0.5 mile from highly modified, constructed roads. Of the lands classified under the ROS on the Dixie National Forest, approximately 560,052 acres (34 percent) are classified as Semi-Primitive Motorized (Table 3.4-10). Figure 3.4-1 shows the location of these areas across the Forest.

ROADED NATURAL

Roaded Natural areas are characterized by a predominately natural-appearing environment with moderate evidence of human activity. An equal probability of experiencing isolation from or affiliation with other user groups exists. There are opportunities for a high degree of interaction with the natural environment, but opportunities for challenge and risk are minimal. Resource modification and utilization are evident, but harmonize with the natural environment. From sensitive travel routes and use areas, these alterations should remain visually subordinate. Roads within these areas consist of paved and gravel through highways, local roads, and primitive Forest Service roads that form a large network throughout the Dixie National Forest. Most of the secondary paved highways take travelers through the Forest to other destinations while many of the gravel roads and primitive Forest Service roads lead to developed recreation sites or dispersed recreation areas and private residences. Of the lands classified under the ROS on Dixie National Forest, approximately 264,434 acres (16 percent) are classified as Roaded Natural (Table 3.4-10). Figure 3.4-1 shows the location of these areas across the Forest.

3.4.4 Developed Recreation

Developed recreation includes a variety of activities that are generally centered on developed facilities such as campgrounds and visitor centers (Figure 3.4-1). These facilities provide a safe, efficient, and comfortable experience for visitors of differing abilities. Much of the developed recreation on the Dixie National Forest is located near the five scenic byways and six scenic backways that cross the Forest. Mapped, developed recreation areas occur on all four ranger districts (Table 3.4-10) and include developed sites, administrative sites, and recreation residences. These areas are described below.



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.4-1
Developed Recreation Resources

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

Forest Trails
- Unspecified
- Motorized
- Non-Motorized
- Non-Mechanized

Forest Sites
- Campgrounds
- Visitor Centers

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

- Dispersed Campsites
- Recreation Residences (1/4-mi buffer)

Recreation Opportunity Spectrum
- Roaded Natural
- Semi-Primitive Motorized
- Semi-Primitive Non-Motorized
- Primitive

- Administrative Sites
- Recreation Sites

Miles: 0 3 6 9 12

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

Table 3.4-10 Acres of Mapped Developed Recreation on the Dixie National Forest

Type of Site	Pine Valley	Cedar City	Powell	Escalante	TOTAL
Developed sites (includes recreation sites)	2,169	1,393	610	752	4,924
Administrative sites	232	0	489	127	848
Recreation residences	241	579	0	0	819

3.4.4.1 Campsites and Other Developed Sites

There are approximately 65 developed recreation sites and administrative sites on the Dixie National Forest. There are 28 larger sites that cover approximately 4,924 acres. Of these, 16 are campgrounds (including two equestrian campgrounds) with three separate historic guard stations operated as rental cabins, and the Red Canyon and Duck Creek Visitor Centers. The majority of these areas average between 100 and 200 acres in size, with the exception of the Pine Valley Recreation Complex, which covers approximately 1,964 acres. Administrative sites alone cover 848 acres. The location of these areas is shown in Figure 3.4-1 and the acres by ranger district are presented in Table 3.4-10.

3.4.4.2 Recreation Residences

Recreation residences on the Dixie National Forest include 42 privately owned cabins authorized under special use permits. The recreation residences are concentrated in two areas on the Dixie National Forest. Thirty-three recreation residences are located on the western edge of Navajo Lake on the Cedar City Ranger District. Nine recreation residences are located on the Pine Valley Ranger District near the Pine Valley Recreation Area. Recreation residences with a ¼-mile buffer cover approximately 579 and 241 acres on the Cedar City and Pine Valley Ranger Districts, respectively (Table 3.4-10). Figure 3.4-1 shows the location of these areas.

3.4.5 Dispersed Recreation

Generally speaking, the Dixie National Forest's recreation opportunities are more unstructured or dispersed in nature. These dispersed recreation activities are a very important component of the Forest's recreation opportunity niche. Dispersed recreation requires few, if any, improvements and typically occurs in conjunction with roads or trails. Dispersed activities are often day-use oriented and involve many types of activities such as fishing, hunting, mountain biking, nature study, off-highway vehicle (OHV) use, hiking, cross country skiing, horseback riding, picnicking, and viewing natural features and wildlife, either on foot or from a vehicle. Many visitors that enjoy these day-use activities also choose to camp overnight within the Dixie National Forest.

3.4.5.1 Camping

Dispersed camping is popular on the Dixie National Forest. There are over 1,000 inventoried dispersed campsites on the Forest. Dispersed campsites generally have small improvements such as existing fire rings, but do not have other improvements, hardened surfaces, or modern facilities. The majority of these areas are located adjacent to existing roads as shown in Figure 3.4-1. Six areas with heavy impacts from dispersed camping (i.e., East Fork of the Sevier River, Yankee Meadows, Mammoth Springs, Mammoth Creek, Enterprise Reservoir, and Leeds Creek) are closed to open-access camping and limit visitors to designated dispersed camping sites. This management approach focuses and redistributes widespread impacts to only a few areas.

3.4.5.2 Hiking and Equestrian Use

Trail uses on the Dixie National Forest range from hiking alpine mountains and slot canyons to horseback riding along the Great Western Trail. There are over 187 non-motorized and non-mechanized trails that cross the Forest. Off-highway vehicles (OHVs) including snowmobiles are prohibited from non-motorized trails, however human-powered mechanized equipment (i.e., bicycles) are permitted to use these trails. All non-mechanized trails are located within designated wilderness areas and are off limits to both motorized and mechanized equipment.

The Dixie National Forest monitors 20-30 non-motorized trails and motorized trails for use each year. The monitoring occurs on all four ranger districts.

3.4.5.3 Mountain Biking

There are numerous opportunities for mountain biking on the Dixie National Forest, but only on roads and specified trails. Some popular routes include Dave's Hollow Trail, Casto Canyon Trail, East Fork of the Sevier Scenic Backway, and the Great Western Trail. In 2006, 2007, and 2008, trail monitoring studies (Section 3.4.5.2) indicated that most of the high use trails tended to be either scenic and/or mechanized (USFS 2006c, USFS 2008b, USFS 2009b).

3.4.5.4 OHV Use

Increased OHV use on the Dixie National Forest has been linked not only to the growing popularity of OHVs, but also to the population growth of southwestern Utah, Salt Lake City, Utah, and Las Vegas, Nevada over the past decade. Concurrent growth of subdivisions located within and adjacent to the Dixie National Forest has also occurred, accounting for hundreds of building permits issued annually for private use and residential and vacation homes. Increased OHV use and related impacts have been observed surrounding these growing communities. The Record of Decision for the Dixie National Forest Motorized Travel Plan established a designated system of approximately 2,700 miles of motorized roads and trails open to the public and eliminated cross-country travel.

In at least 2006 and 2007 there was an increase in the total use numbers for motorized trails (USFS 2006c and 2008b); use leveled off in 2008, which may reflect the economic downturn (USFS 2009b). In general, trail use is expected to increase with increases in population growth and recreating public (USFS 2009b).

3.4.5.5 Hunting and Fishing

Hunting is a major recreation activity for residents and nonresidents on the Dixie National Forest. Rifle hunting for mule deer (*Odocoileus hemionus*) is the most common; however, permits for elk (*Cervus elaphus*) and pronghorn (*Antilocapra americana*) are allowed. Limited Entry hunting permits are typically expensive and may be limited for each user over a lifetime. Harvest success rates for Limited Entry elk hunts are high for most hunt types (excluding archery; UDWR 2006a). Limited Entry permit areas for elk occur on the Cedar City, Powell, and Escalante Ranger Districts, and include the following Utah Division of Wildlife Resources (UDWR) hunt units: Panguitch Lake (Cedar City), Paunsaugunt (Powell), Mount Dutton (Powell), Plateau/Boulder (Escalante), and Kaiparowits (Escalante).

There are many reservoirs, lakes, and streams on the Dixie National Forest used by anglers. Several fisheries are stocked with rainbow trout (*Oncorhynchus mykiss*) in the summer months.

Other game fish include brook trout (*Salvelinus fontinalis*), cutthroat (including native Bonneville cutthroat (*Oncorhynchus clarki utah*) and Colorado River cutthroat (*Oncorhynchus clarki pleuriticus*)), and brown trout (*Salmo trutta*).

There are approximately 40 commercial outfitters and guides that operate in Dixie National Forest. The majority of these outfitters and guides provide equipment and tours for hunting, fishing, mountain biking, horseback riding, and OHVs.

3.4.5.6 Winter Activities

Winter sports, such as downhill skiing, cross country skiing, and snowmobiling are available in many of the areas on the Dixie National Forest, including Brian Head Ski Area. The Utah Department of Parks and Recreation maintains an extensive system of groomed snowmobile trails on Cedar Mountain (Cedar City Ranger District) under an MOU with the Forest Service (Intermountain Region). Approximately 1,000 acres on Cedar Mountain have been designated the Deer Valley Nonmotorized Winter Recreation Area. Trails for cross country skiing and snow shoeing are groomed by volunteers.

3.4.6 Pine Valley Ranger District

The Pine Valley Ranger District is known for its distinctive vegetation, ranging from Pinyon/Juniper to Engelmann Spruce forests. The Pine Valley Mountain Wilderness is located in this district and is the second largest wilderness area in the state. It is also known for its most prominent feature, the Pine Valley Laccolith. This unique geologic feature is the largest of its kind in the United States. Approximately 14 percent (67,286 acres) of the ranger district is classified as Primitive (most within Pine Valley Mountain and Cottonwood Forest Wilderness Areas), 48 percent (225,173 acres) of the ranger district is classified as Semi-Primitive Non-Motorized, 25 percent (115,425 acres) as Semi-Primitive Motorized, and 12 percent (54,764 acres) as Roaded Natural.

3.4.6.1 Developed Recreation

Developed recreational sites on the district include the Pine Valley Recreation Area, and the Honeycomb Rocks and Oak Grove campgrounds. Several additional campgrounds, a fishing area, and trailheads are located within the Pine Valley Recreation Complex. Administrative sites include the Pine Valley Administrative Site and Browse Guard Station. All of these developed and administrative sites cover approximately 2,400 acres. Enterprise Reservoir, located near the Honeycomb Rocks Campground, provides fishing and boating opportunities. Recreation residences on the ranger district are located near the Pine Valley Recreation Area.

3.4.6.2 Dispersed Recreation

Access for various dispersed activities on the ranger district is provided by over 200 miles of trails including Gardner Peak, Oak Grove, and Water Canyon. Areas most commonly used for dispersed recreation on the Pine Valley Ranger District largely occur in the Pine Valley Recreation Area and near the trailheads at Pinto Creek, Comanche Spring, and Bench Spring (USFS 1994a). There are also 241 acres occupied by recreation residences within and in the vicinity of the Pine Valley Recreation Area. Inventoried dispersed camping sites near these areas and across the ranger district cover approximately 24 acres. Upper and Lower Enterprise Reservoirs, Leeds and South Ash Creeks, and the Santa Clara River are all available for fishing. The reservoirs allow powerboats and contain rainbow trout and bass. The low elk population in this area offers difficult hunting within the Pine Valley General Any Bull Elk Unit (UDWR 2006a).

3.4.7 Cedar City Ranger District

The Cedar City Ranger District is known for its high alpine mountain meadows bordered by large aspen stands and its abundant wildlife. The geology of the ranger district is a unique blend of red rock cliffs, cinder cones, and large lava fields. The Ashdown Gorge Wilderness is adjacent to Cedar Breaks National Monument and is characterized by extremely steep-walled canyons cut through the west rim of the Markagunt Plateau. Approximately 2 percent (7,260 acres) of the ranger district is classified as Primitive (most within Ashdown Gorge Wilderness), 28 percent (96,937 acres) as Semi-Primitive Non-Motorized, 43 percent (153,143 acres) as Semi-Primitive Motorized, and 27 percent (95,148 acres) as Roaded Natural.

3.4.7.1 Developed Recreation

Developed recreation sites on the Cedar City Ranger District include the Cedar Canyon, Deer Haven, Duck Creek, Navajo Lake, Spruces, Te-ah, White Bridge, and Yankee Meadows campgrounds as well as the Panguitch Lake recreation area. These areas cover a combined total of 1,393 acres (Table 3.4-10). There are also 579 acres on the west end of Navajo Lake that are occupied by recreation residences. In addition, there are five points of interest, including the Brian Head Observation Point near Brian Head Ski Area, Zion Overlook and Navajo Lake viewing area along Scenic Highway 14, Cascade Falls National Recreation Trail with access from Forest Service Road No. 054, and Strawberry Point with access from Forest Service Road No. 058 (USFS 1994).

3.4.7.2 Dispersed Recreation

Aspen Mirror, Bristlecone Pine, Cascade Falls, and Navajo Lake are a few of the 51 trails (approximately 155 miles) that cross the Cedar City Ranger District and provide access for many dispersed recreation activities. There are approximately 112 miles of non-motorized trails that can be used by mountain bikes. The Markagunt Motorized Trail System on Cedar Mountain contains hundreds of miles of designated roads and trails with special signing. Commonly used dispersed recreation areas occur in the areas of Bear Valley, Bear Flat, Yankee Meadow Reservoir, the Pass (near Copper Knoll), Mammoth Springs, Deer Valley, and to the south of Scenic Byway 14 between Dry Valley and Strawberry Creek (USFS 1994). Inventoried dispersed camping sites across the ranger district cover approximately 45 acres.

The Cedar City Ranger District has seven lakes and reservoirs that serve as magnets for dispersed recreation activities on the Forest. Aspen-Mirror Lake, Navajo Lake, and Panguitch Lake are popular with anglers and are stocked with rainbow trout during the summer. More than eight creeks and other tributaries are available for fishing as well. The Panguitch Lake Limited Entry Elk Hunting Unit is also located on this district.

3.4.8 Powell Ranger District

The Powell Ranger District encompasses nearly 400,000 acres of high plateau country, with distinctive vegetation and geological features. The Red Canyon “Little Bryce” area of the ranger district offers many unique hiking experiences with spectacular views. Less than one percent (529 acres) of the ranger district is classified as Primitive, 52 percent (197,547 acres) as Semi-Primitive Non-Motorized, 36 percent (140,321 acres) as Semi-Primitive Motorized, and 12 percent (45,242 acres) as Roaded Natural.

3.4.8.1 Developed Recreation

Developed recreation sites on the Powell Ranger District include the King Creek and Red Canyon campgrounds as well as the Jones Corral and Podunk Guard Stations, which are operated as rental cabins. There is also an equestrian campground. These areas cover a total of 1,099 acres (Table 3.4-10). The Red Canyon Area includes a scenic byway, roadless area, campground, visitor center, and an extensive trail system to assist visitors in viewing the outstanding rock formations (USFS 1994).

3.4.8.2 Dispersed Recreation

Commonly used dispersed recreation areas in the Powell District are located near Jones Corral, and along the East Fork of the Sevier Backway, mainly at Tropic Reservoir, Blubber Creek, Kanab Creek, and near the Podunk Forest Service Guard Station (USFS 1994). Inventoried dispersed camping sites across the district cover approximately 34 acres. Popular hiking areas on the district include Arches, Bird's Eye, Losee Canyon, Cassidy, and Photo trails, among others. There are approximately 129 miles of non-motorized trails on the district that can be used for mountain biking. Motorized trails on the ranger district include the Paunsaugunt, Casto Canyon, and Fremont Trails.

The ranger district lies within two adjacent Limited Entry Elk Hunt Units: the Paunsaugunt (in the south) and Mt. Dutton (in the north). Tropic Reservoir, East Fork of the Sevier, and Podunk Creek are stable fisheries and yield rainbow, brook, and brown trout for anglers.

3.4.9 Escalante Ranger District

The Escalante Ranger District is known for its hundreds of high mountain lakes and large stands of aspen trees. The majority of the district is located on high timbered plateaus with rolling hills and open meadow. The Box-Death Hollow Wilderness is located in this district and is characterized by vertical gray-orange walls of Navajo sandstone above two canyon tributaries of the Escalante River in Pine Creek and Death Hollow. Approximately 7 percent (28,849 acres) of the ranger district is classified as Primitive (most within Box-Death Hollow Wilderness), 42 percent (181,332 acres) as Semi-Primitive Non-Motorized, 35 percent (151,162 acres) as Semi-Primitive Motorized, and 16 percent (69,280 acres) as Roaded Natural.

3.4.9.1 Developed Recreation

Developed recreation sites on the Escalante Ranger District include the Blue Spruce, Pine Lake, and Posy Lake campgrounds. The Barker Recreation Area is located on the district and includes individual and group campsites, a day use area, fishing lakes, and many trails. The Cowpuncher Guard Station (operated as a rental cabin) is located on the district and is well situated for stream fishing, hiking, mountain biking, and big game hunting. These areas cover a total of 879 acres (Table 3.4-10). The Escalante District has two major points of interest including the Powell Point and Roger Peak viewing areas (USFS 1994).

3.4.9.2 Dispersed Recreation

Commonly used dispersed recreation areas on the Escalante Ranger District occur in the vicinity of Barker Reservoir, Lower Barker Reservoir, Joe Lay Reservoir, around McGath Lake, along the East Fork of Boulder Creek, and around the location of Chriss Lake, Green Lake, and Deer Lake (USFS 1994). Inventoried dispersed camping sites across the district include approximately 20 acres. The Posy Lake Lookout Trail, Great Western Trail, and the Barker Complex Trail System also provide access for many dispersed activities. There are

approximately 108 miles of non-motorized trails that can be used by mountain bikes. Motorized trails on the ranger district include the Pine Lake and Poison Creek Trails. There are many lakes, reservoirs, and creeks available for fishing, including Barker's Reservoir, Pine Lake, and Posey Lake, to name a few.

3.5 Fish and Wildlife

3.5.1 Introduction

The diverse mosaic of vegetation on the Dixie National Forest provides habitat for approximately 350 wildlife species. The most abundant vegetation types – pinyon-juniper, aspen/conifer, ponderosa pine, and sage steppe – along with cliffs, canyons, streams, and lakes, provide year-round habitat for rabbits, rodents, carnivores, ungulates, amphibians, bats, reptiles, and birds that occur on the Dixie National Forest. A comprehensive list of wildlife species that occur or have the potential to occur on the Dixie National Forest can be found in USFS (1993).

Wildlife species on the Dixie National Forest include mammals, reptiles, birds, and aquatic species. In order to compare the alternatives outlined in Chapter 2, which are based on leasing options, only fish and wildlife with associated oil and gas leasing options (Table 2.5-1) are discussed specifically. These species include migratory birds (including raptors) and aquatic species. Other species are discussed in more general terms, with terrestrial species discussed in Section 3.5.2 and 3.5.3 and aquatic species discussed in Section 3.5.4.

Special status species (Threatened, Endangered, Candidate, or Forest Service-Sensitive) are covered in detail in Section 3.6. In addition, Section 3.6 discusses Management Indicator Species (MIS).

3.5.2 Wildlife

Terrestrial wildlife discussed in this section includes mammals, reptiles, and birds. General mammals and reptiles are only discussed briefly in this section as all mammals and reptiles assigned special leasing options or protected by specific laws are discussed in Section 3.6, Special Status Species. Most birds are protected by the Migratory Bird Treaty Act and are discussed in more detail in the next section (3.5.3).

Mammals are hairy, warm-blooded vertebrates that give birth to live young, and can be found in a variety of habitats on the Dixie. Mammals on the Dixie National Forest include small animals such as shrews, bats, lagomorphs (rabbits and hares), chipmunks, and mice; larger mammal predators such as coyote (*Canis latrans*), bobcat (*Lynx rufus*), weasel (*Mustela spp.*), badger (*Taxidea taxus*), and cougar (*Felis concolor*); big game (discussed in Section 3.6); and black bears (*Ursus americanus*). Reptiles are cold-blooded, egg-laying vertebrates that are generally small and located in warm habitats. Reptiles are present on the Dixie National Forest in relatively low abundance.

3.5.3 Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act, which prohibits "take" of migratory birds (including disturbance of nests) and emphasizes conservation of migratory bird populations and promoting the long-term sustainability of their habitats. To "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Direction from the USFWS regarding migratory birds on USFS lands states that activities occurring within

migratory bird habitats should “minimize direct take of individual migratory birds when feasible” (USFS 2007g). The Dixie National Forest is considered compliant with the Migratory Bird Treaty Act if this direction is followed and habitats as well as populations of migratory birds are sustained over the long term.

A wide variety of migratory birds are found on the Dixie National Forest either seasonally, as transients, or as permanent residents. High value waterfowl habitat is relatively scarce on the Dixie and exists at Enterprise Reservoir (Pine Valley Ranger District); Panguitch and Navajo Lakes (Cedar City Ranger District); and several small lakes near the boundary of the Escalante Ranger District. Of the 124 species of migratory birds that occur on the Dixie National Forest, about 60 percent breed in wetland, riparian, or other wet habitats (including playa lakes and coastal areas). The most abundant breeding habitats for migratory birds on the Dixie National Forest include ponderosa pine or woodland (including oak), followed by aspen (including mixed conifer), pinyon-juniper, subalpine conifer (i.e., spruce fir), cliffs or rocks, bogs or open woods, shrub steppe, high desert scrub, mountain shrub, grassland or meadow, agriculture, and alpine or tundra habitat. Most migratory birds on the Dixie National Forest are ground nesters (Table 3.5-1); several nest in trees or shrubs (information taken from Parrish et al. 2002).

Eighteen species of migratory birds that are known or suspected to occur on the Dixie National Forest (see USFS 2007h) are considered to be birds of conservation concern; these species are included on either the Birds of Conservation Concern (USFWS 2002b) or Partners in Flight priority species lists (Parrish et al. 2002). Species on these lists were identified by USFWS as meriting special attention to comply with the Migratory Bird Treaty Act (USFS 2007g) and are listed in Table 3.5-1.

Table 3.5-1 Selected Priority Migratory Birds that Occur on the Dixie National Forest

Species	Breeding habitat	Status on Dixie National Forest	Occurrence on Dixie National Forest
American avocet *Recurvirostra americana*	On the ground near desert wetlands or shallow ponds; nests north of Dixie National Forest	Summer	Common
American white pelican *Pelecanus erythrorhynchos*	On the ground; Great Salt Lake only	Summer	Uncommon; on water bodies
Black-rosy finch *Leucosticte atrata*	On the ground or on a cliff; alpine habitat	Winter	Uncommon
Black-throated gray warbler *Dendroica nigrenscens*	In trees; pinyon-juniper	Summer	Common
Brewer’s sparrow *Spizella breweri*	In a shrub; shrub steppe obligate	Summer	Common
Broad-tailed hummingbird *Selasphorus platycercus*	In a deciduous tree or conifer	Summer	Common
Burrowing owl *Athene cunicularia*	Underground burrows in open habitat	Summer	Uncommon; may occur in Pine Valley Ranger District
Flammulated owl[1] *Otus flammeolus*	In snag; mature ponderosa pine and Douglas-fir	Summer	Uncommon
Grace’s warbler *Dendroica graciae*	In trees; pine or other coniferous	Summer	Common

Species	Breeding habitat	Status on Dixie National Forest	Occurrence on Dixie National Forest
	forest habitat		
Gray vireo *Vireo vicinior*	In fork of juniper tree or shrub; pinyon-juniper habitat in southwestern Utah	Year-round	Common
Lewis's woodpecker *Melanerpes lewis*	In a cavity within deciduous tree or snag; breeds mainly in northern Utah	Year-round	Uncommon
Long-billed curlew *Numenius americana*	On the ground; rangeland and pastures; also grassy shorelines and arid grasslands	Summer	Uncommon; one breeding record in Cedar City Ranger District (Bosworth 2003)
Marbled godwit *Limosa fedoa*	Loose colonies; on the ground in dry areas of prairie wetlands	Transient	Common
Sage sparrow *Amphispiza belli*	In a shrub or on the ground; shrub steppe obligate	Summer	Common
Three-toed woodpecker[1] *Picoides tridactylus dorsalis*	In a snag	Year-round	Uncommon
Virginia's warbler *Vermivora vinginiae*	On the ground in chaparral and montane habitats	Summer	Common
Williamson's sapsucker *Sphyrapicus thyroideus*	In a cavity within deciduous tree or conifer	Summer	Uncommon; most likely in Cedar City and Powell Ranger Districts (high elevation plateaus)
Wilson's phalarope *Phalaropus tricolor*	On the ground within 100 meters of water; Great Salt Lake	Summer	Common

[1] TES species discussed in Section 3.6.

Raptors on the Dixie National Forest are also protected under the Migratory Bird Treaty Act. Active raptor nests have special leasing stipulations (Table 2.5-1), and are protected individually, unlike (non-raptor) migratory birds that are protected at the habitat level (see USFS 2007g). The Bald and Golden Eagle Protection Act of 1940, as amended, provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle (*Aquila chrysaetos*), by prohibiting, except under certain specified conditions, the taking, possession, and commerce of individual birds. Although the Bald and Golden Eagle Protection Act was modeled from the Migratory Bird Treaty Act, its civil and criminal penalties are more severe.

Suitable habitat for raptors includes appropriate areas for nesting, rearing, roosting, and foraging. Raptors generally nest in forested and riparian areas, in large trees, on cliffs, or in open areas on the ground or beneath shrubs. Roosting may occur in trees, cliffs, on power poles, fences, or other man-made structures. Foraging generally occurs in open areas such as agricultural fields, grasslands, or shrub habitats. There are 17 raptor species that can be found on the Dixie National Forest, including three TES species (California condor, goshawk, and peregrine falcon, see Section 3.6); species are listed in Table 3.5-2.

Table 3.5-2 Raptors on the Dixie National Forest

Species[1]	Suitable habitat	Nest type; location	Occurrence on Dixie National Forest
American kestrel *Falco sparverius*	Open habitats; prairies, deserts, wooded stream, farmlands	Cavity; in snag or on cliff	Common; year-round resident
Bald eagle[2,3] *Haliaeetus leucocephalus*	Forested stands near water (winter roosting)	Platform; on cliff or in large tree	Uncommon winter and summer resident; most likely to occur at Panguitch Lake, Pinto Creek, Enterprise Reservoir, or Duck Creek. Pairs have been observed nesting on the Forest.
California condor[3] *Gymnogyps californianus*	Chaparral-covered mountains; roosting in large snags, cliffs	Platform; in cave, pothole, sheltered rock outcrop	Rare; reported sightings in Cedar City Ranger District
Cooper's hawk *Accipiter cooperii*	Woodland areas and riparian zones	Platform; in conifer or deciduous tree	Common; year-round resident
Ferruginous hawk *Buteo regalis*	Open habitats; pinyon-juniper, shrub steppe, or grassland	Platform; in conifer or other tree, on cliff, ground outcrop, or utility structure	Uncommon summer resident; most likely to occur in Pine Valley Ranger District
Golden eagle[2] *Aquila chrysaetos*	Open habitats, especially mountainous regions	Platform; usually on cliff or rocky outcrop. Often on top of existing nests and materials from previous structures (Hawkwatch 2007).	Common; year-round resident; occurs on all four ranger districts.
Merlin *Falco columbarius*	Any open country, grassland or desert scrub	Platform; on cliff or in deciduous tree	Uncommon winter resident
Northern goshawk[3] *Accipiter gentilis*	Montane coniferous and deciduous woodland interspersed with small openings.	Platform; in conifer or deciduous tree	Uncommon year-round resident
Northern harrier *Circus cyaneus*	Open habitats; marshes, fields, and grasslands	Platform; on ground or in shrub; within thick vegetation	Common; year-round resident
Osprey *Pandion haliaetus*	In Utah, mountain lakes and along Green River	Platform; on cliff or in deciduous trees	Uncommon summer resident; at lease six nest sites on the Cedar City Ranger District.
Peregrine falcon[3] *Falco peregrinus*	Open habitats	Scrape; on cliff or in tree	Rare; eight nest sites are known in Cedar City and Powell Ranger Districts
Prairie falcon *Falco mexicanus*	Open habitats; plains and prairies	Scrape or crevice; on cliff	Common; year-round resident
Red-tailed hawk *Buteo jamaicensis*	Open habitats with scattered trees or	Platform; on cliff or in deciduous tree	Common; year-round resident

Species[1]	Suitable habitat	Nest type; location	Occurrence on Dixie National Forest
	other perches		
Rough-legged hawk *Buteo lagopus*	In winter, open habitats such as grasslands, marshes, or sagebrush	Usually in trees, on cliffs, or other man-made structures	Common; winter resident
Sharp-shinned hawk *Accipiter striatus*	Forest and woodland areas	Platform; in conifer or deciduous tree	Common; year-round resident
Swainson's hawk *Buteo swainsoni*	Open habitats; shrub and grassland	Platform; on cliff or in deciduous tree	Uncommon summer resident
Turkey vulture *Cathartes aura*	Most common in open habitats, also in forest	No nest; eggs laid on cliff crevices or snags	Uncommon summer resident

[1] All raptor species are protected under the Migratory Bird Treaty Act.
[2] Protected by Bald and Golden Eagle Protection Act in addition to the Migratory Bird Treaty Act.
[3] Discussed in Section 3.6

3.5.4 Aquatic Species and Habitat

3.5.4.1 Fisheries

Aquatic habitats on the Dixie National Forest include approximately 400 miles of streams and over 3,100 acres of lakes and reservoirs, which support a variety of native and non-native fish (USFS 1995b). Many lakes and reservoirs are also stocked with game fish (including MIS trout; see Section 3.6) by the UDWR. Blue Ribbon Fisheries on the Dixie National Forest include Panguitch Lake, McGath Lake, Paragonah (aka Red Creek) Reservoir, and Panguitch Creek. All Blue Ribbon Fisheries meet certain standards for water quality and quantity, public accessibility, and sustainability (i.e., natural reproduction capacity; UDWR 2006b). Although the larger lakes are developed for recreational fishing, there are also numerous small lakes supporting good fisheries. Native and non-native fish species that are likely to occur in the waters of the Dixie National Forest are listed in Table 3.5-3.

Table 3.5-3 Common Native Fishes and Non-native Game Fishes that occur on the Dixie National Forest

Common Name[1]	Origin	Occurrence on Dixie National Forest[2]			
		PV	CC	PL	ES
NATIVE FISHES					
Utah chub *Gila atraria*	Bonneville Basin		X	X	X
Speckled dace *Rhinichthys osculus yarrowi*	Bonneville Basin	X	X	X	X
Mottled Sculpin *Cottus bairdi*	Bonneville Basin		X	X	X
Redside shiner *Richardsonius balteatus*	Bonneville Basin		X	X	
Mountain sucker *Catostomus platyrhynchus*	Bonneville Basin		X	X	X
Desert sucker *Catostomus clarki*	Virgin River drainage	X			
NON-NATIVE (GAME) FISHES (not including MIS species)					
Tiger trout *Salmo trutta X S. fontinalis*	stocked (hybrid)		Panguitch Lake, Paragonah Reservoir		Several lakes across the district

Splake *Salmo namaycush X S. fontinalis*	stocked (hybrid)		Navajo Lake		
Smallmouth bass *Micropterus dolomieu*	stocked	Lower Enterprise Reservoir			
Arctic grayling					Several lakes across the Boulder Top

[1] Does not include Special Status Species or MIS
[2] Ranger Districts: PV = Pine Valley, CC = Cedar City, PL = Powell, ES = Escalate

Tiger trout and splake are both sterile, hybrid sport fish that do not reproduce and as such their population numbers are controllable (by UDWR).

The state has defined six stream classes and four quality ratings that may be applied to streams on the Dixie National Forest and denote their relative importance as fisheries. Class I waters are the highest class and most important fisheries in Utah. Most streams on the Dixie National Forest are Class III fisheries streams; no Class I streams or lakes have been designated (USFS 1995b). Class III waters are smaller lakes used primarily by nearby residents; Class I waters, by contrast, are large bodies of water that satisfy heavy fishing pressure and where fish productivity is high. The Dixie National Forest considers all stream sections, reservoirs, lakes, and ponds identified as Class III as "high value," which denotes "intensive use area" for one or more species of historic or existing high-interest wildlife (i.e., wildlife of economic, aesthetic, scientific, or educational significance; USFS 1995b: Appendix A).

Endangered, threatened, sensitive, and MIS fish species, their ecology, distribution, and habitat are discussed in Section 3.6. These species include Bonneville cutthroat trout (MIS and sensitive; *Oncorhynchus clarki utah*), Colorado cutthroat trout (MIS and sensitive; *Oncorhynchus clarki pleuriticus*), brown trout (MIS; *Salmo trutta*), brook trout (MIS; *Salvelinus fontinalis*), rainbow trout (MIS; *Oncorhynchus mykiss*), other cutthroat species (MIS), Virgin spinedace (MIS; *Lepidomeda mollispinus*), Southern leatherside (MIS and sensitive; *Lepidomeda alecia*), Virgin River chub (endangered; *Gila seminuda*), and woundfin (threatened; *Plagopterus argentissimus*). The quantity and quality of surface water, stream morphology, riparian vegetation, and wetland and floodplain function is discussed in Section 3.7.

3.5.4.2 Mollusks and Amphibians

Most mollusks on the Dixie National Forest are associated with springs or other wet habitats and are only known from a few locations. Out of 38 mollusks listed in CWCS (UDWR 2005a) for example, 17 are known only from springs and nine are known only from stream banks, lakes or ponds, marshes, or seeps. Eight species are known from only one location/population in Utah; eight species are known from only two or three populations. On the Dixie National Forest, the Brian Head mountainsnail (*Oreohelix parawanensis*) occurs on Brian Head Peak (Oliver and Bosworth 1999).

Herpetofauna is relatively limited on the Dixie National Forest. Amphibians are likely to occur in any relatively high quality aquatic or riparian habitat (Section 3.7). Most amphibians would be found in slow water near streams, lakes, and stream and lake margins, including riparian areas and floodplains. They would also be expected in and around wetlands. Eleven amphibians are known or suspected to occur within wetland or riparian habitats on the Dixie National Forest (USFS 1993).

3.5.4.3 Aquatic habitat

Aquatic habitats on the Dixie National Forest are critical ecosystem components because water sources in the region are relatively rare. The overall health of aquatic habitats is a direct result of the condition of the entire watershed (i.e., uplands, riparian corridor and the stream channel), particularly the upland plant community. The condition and health of vegetation throughout a watershed is the major factor determining the quantity and quality of the associated flow regime, which is naturally regulated by healthy and diverse bank vegetation. Vegetation in good condition provides greater ground cover, which reduces runoff and increases infiltration rates, and diverse plant communities contain microsites that extend the runoff period through variable snowmelt. Collectively, these factors produce more stable base flows that are essential for high quality fish and riparian habitats (WFGD 2004). The condition of riparian vegetation on the Dixie National Forest is discussed further in Section 3.7.

MACROINVERTEBRATES

Aquatic macroinvertebrates are invertebrates that live in water and that are large enough to be seen with the naked eye. They are useful indicators of aquatic habitat conditions due to their strict habitat requirements. Most macroinvertebrate species are adapted to fast-water stream environments, as evidenced by flattened bodies, streamlined shape, suckers, friction pads and hooks, secretions, and upstream migrations. Species include mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), and true flies (Diptera); as well as crustaceans, mollusks, and freshwater earthworms (Rodriguez 2004).

Aquatic macroinvertebrate communities are naturally dynamic, due to seasonal variations, life cycles, and natural stream disturbances. According to Macroinvertebrate analyses from 2002 (Vinson 2003), 2003 (Vinson 2005), 2004 (Vinson 2006), and 2007 (Wisseman 2008), a comparable number of streams on the Dixie National Forest had good or excellent biotic condition indexes as had poor or fair indexes. Biotic condition indexes use the indicator-taxa concept, based on species' differing tolerances to pollution, so that in theory, more intolerant species indicate a higher biotic condition. Since 2010, it was determined that the biotic condition index is easily affected by conditions not related to management and thus not an indicator of effects of management activity (i.e., macroinvertebrates are no longer a MIS; USFS 2010a).

Aquatic habitat conditions in some areas of the Dixie National Forest have been severely affected by flood or fire in the past several years. Aquatic habitat condition data from 2005 indicated that fire-affected streams on the Dixie National Forest (i.e., Antimony, Cottonwood, Deep, Deer, Mill, and Water Canyon creeks) were lacking invertebrate diversity by several metrics, including low total taxa richness, few Ephemeroptera/Plecoptera/Trichoptera taxa (mayflies/stoneflies/caddisflies), virtually no longer lived taxa, low predator richness and abundance, and high dominance of relatively few taxa. Most of these stream sites were found to be dominated by black flies and mayflies, two taxa that tend to colonize streams after disturbances (Wisseman 2006) and monopolize resources. Surveys of Deep, Deer, and Cottonwood creeks in 2005 found that none of the streams met the standards for fish and riparian habitat conditions in USFS (1986) (USFS 2005). Additional streams were surveyed in 2006 (i.e., Forest, Pine, Harmon, and Leap creeks) and similar conditions were found (Wisseman 2007), with the exception of Forest Creek and Pine Creek, which both had moderately higher diversity scores and showed relatively high biological integrity. As of 2007, several streams had recovered to a point where habitat conditions were supporting a limited population of fish. Bonneville cutthroat trout have been introduced to several fire-affected

streams, and as of the last data collection, most reintroduced populations have shown overwinter survival and evidence of reproduction (see Section 3.6).

3.5.5 Pine Valley Ranger District

Migratory birds are probably most abundant in the Pine Valley Ranger District. Extensive pinyon-juniper and mountain shrub communities, as well as scattered desert scrub and chaparral, provide habitat for migratory birds that build nests on the ground and in trees. Across the Dixie National Forest, these habitats are substantially more abundant on the Pine Valley Ranger District, which is at a lower elevation than the rest of the Forest. Ferruginous hawk and other raptors also occur in these habitats.

The Pine Valley Ranger District includes streams that drain north into the Bonneville Basin as well as those that drain south into the Virgin River and Colorado River basin. Water quality sampling indicates that phosphorous levels in the upper Santa Clara River are above state limits (USFS 2004c). Biotic indices from 2002 indicate that aquatic habitat in this river is poor (Vinson 2003). Overall there are few sample sites within the Pine Valley Ranger District used to collect macroinvertebrate data that could be used to indicate the health of the aquatic habitat.

Aquatic habitat in fire-affected streams in the Pine Valley Ranger District is poor. Three fire-affected streams within the Pine Valley Ranger District were analyzed for aquatic habitat condition and were found to be of poor quality; invertebrate diversities in Mill Creek and Leap Creek were “very low” and diversity in Harmon Creek was “low” (Wisseman 2006 and 2007).

3.5.6 Cedar City Ranger District

Forest communities (e.g., aspen and ponderosa pine) on high elevation plateaus and waterbodies within the Cedar City Ranger District provide good habitat for migratory birds, and cliffs across the ranger district provide raptor habitat. Similar migratory bird habitats can be found on the Powell and Escalante Ranger Districts.

According to UDWR (2006b), Blue Ribbon Fisheries on the Cedar City Ranger District include Panguitch Lake (1,234 surface acres), Paragonah (aka Red Creek) Reservoir (70 surface acres), and Panguitch Creek (11 miles total, from an irrigation diversion near Panguitch to the Butler Creek confluence; 9.5 miles on the Dixie National Forest). Asay Creek is a Blue Ribbon Fishery located just downstream from the Dixie National Forest, which joins the main stem of the Sevier River just west of the Forest boundary.

The majority of the Cedar City Ranger District is within the Sevier River basin and the extreme southern portion of the district drains into the Virgin River basin. The loss of riparian vegetation in Threemile Creek has led to a decrease in shade levels and a concomitant increase in stream temperatures above state limits; however, this creek currently supports self-sustaining fish populations. Biotic Condition Index data from 2003 indicates that Threemile Creek is in good condition (Vinson 2003). Data from 2002 indicate that Butler Creek, Castle Creek, and Lower Center Creek are in excellent condition; Upper Center Creek, Mammoth Creek, and Mammoth Spring were in poor condition in 2002 (Vinson 2003). Data from 2003 indicate Bowery Creek is in excellent condition (Vinson 2005), and 2004 data (Vinson 2006) indicate that Bunker Creek and parts of Deer Creek unaffected by fire are also in excellent condition. Duck Creek was in poor condition in 2004 (Vinson 2006). Fine sediment in Little Creek is greater than 25 percent, which decreases spawning and overwintering habitat of native fishes (USFS 2004c).

3.5.7 Powell Ranger District

Sagebrush habitat on the Powell Ranger District provides habitat for many migratory birds that build nests on the ground or in shrubs. Migratory bird habitat in the Powell Ranger District is similar to that found in the Cedar City and Escalante Ranger Districts. Raptors such as ferruginous hawks are likely to nest in these areas, and other raptors likely use sagebrush habitat for foraging as well as cliffs for nesting.

The East Fork Sevier River (11.5 miles from the Otter Creek Reservoir Diversion to the confluence with Deer Creek; UDWR 2006b) is a Blue Ribbon Fishery stream located east of the Powell Ranger District, but is downstream from several streams on the Forest.

The Powell Ranger District includes streams that drain primarily into the Sevier River and the East Fork Sevier River. In 2004, Kanab Creek was in excellent condition according to Biotic Condition Index data (Vinson 2006).

Regarding fire-affected streams, fish habitat inventories were conducted in 2004 on Cottonwood Creek, Deep Creek, and Deer Creek (USFS 2004c) and surveys showed that the streams and associated riparian areas were beginning to recover from the heavy impacts of the Sanford Fire. Bonneville cutthroat trout have been introduced to Deep Creek (Section 3.6). Recovering riparian vegetation has been impacted by trespass cattle (USFS 2004c). Pine Creek had “moderately high” invertebrate diversity (no streams on the Dixie National Forest were “high” or “very high”; Wisseman 2006 and 2007).

3.5.8 Escalante Ranger District

Waterbodies on the Escalante Ranger District provide important water sources for migratory birds. Several forested and shrub-dominated vegetation types as well as cliffs, similar to the Cedar City and Powell Ranger Districts, provide roosting, nesting, and foraging habitat for migratory bird species, including raptors.

McGath Lake (43 surface acres) is a Blue Ribbon Fishery located on the Escalante Ranger District (UDWR 2006b).

The majority of streams on the Escalante Ranger District drain into the Escalante River drainage. Other parts of the District drain into the East Fork Sevier River (Bonneville Basin), including Antimony Creek, Center Creek, and Ranch Creek. Many of the more western streams draining into the Escalante River drainage have higher sediment concentrations due to less vegetated watersheds overlying shale and siltstone (USFS 1995c). The loss of riparian vegetation in Bear Creek has led to a decrease in shade levels and a concomitant increase in stream temperatures above state limits; however, this creek currently supports self-sustaining fish populations. In 2002, two reaches sampled in Bear Creek were in poor biotic condition and one was in good condition (Vinson 2003). Ranch Creek was in excellent biotic condition in 2002 (Vinson 2003). West Fork Boulder Creek was in poor biotic condition in 2003 (Vinson 2005). Antimony Creek, in the northwestern end of the ranger district had “moderately high” invertebrate diversity (no streams analyzed by Wisseman on the Dixie National Forest were “high” or “very high”; Wisseman 2006 and 2007). Antimony Creek was in excellent condition in 2002 (Vinson 2003). In Twitchell Creek in Garfield County, one reach was poor, one was fair, and one was in excellent condition according to biotic condition indices (Vinson 2003).

3.6 Special Status Species

3.6.1 Introduction

Threatened, Endangered, Candidate (TEC), and Forest Service Sensitive species and MIS on the Dixie National Forest ("special status species") are described in this section. Species information includes descriptions of suitable habitats, life history information where relevant, and habitat or occurrence data relevant to the Dixie National Forest. Sources include Bosworth (2003), Parrish et al. (2002), Rodriguez (2008), Utah Native Plant Society Rare Plant Guide (UNPS 2007), and the draft leasing EIS for the Dixie National Forest prepared in 1993-1994 (USFS 1995a, 1995b, and 1995d). TEC species are discussed in Section 3.6.2; Sensitive species are discussed in Section 3.6.3; MIS are discussed in Section 3.6.4. Bonneville cutthroat trout, Colorado cutthroat trout, southern leatherside, and northern goshawk are Sensitive species and MIS.

3.6.2 Threatened, Endangered, and Candidate (TEC) Species

TEC species are identified by the US Fish and Wildlife Service (USFWS). Seven TEC species are known to occur or have suitable habitat present on the Dixie National Forest (Table 3.6-1). For most TEC species, the Dixie National Forest provides at least some suitable habitat and ongoing surveys are conducted by Dixie National Forest biologists.

Table 3.6-1 TEC Species Known or Suspected to Occur on the Dixie National Forest, by Ranger District

Species		Status	Pine Valley	Cedar City	Powell	Escalante
Virgin River chub *Gila seminude*	fish	Endangered	present off-Forest[1]	no habitat	no habitat	no habitat
Woundfin *Plagopterus argentissimus*	fish	Endangered	present off-Forest[1]	no habitat	no habitat	no habitat
California condor *Gymnogyps californianus*	bird	Endangered	may occur, fully protected by ESA	Exp pop area[2]	Exp pop area[2]	Exp pop area[2]
Utah prairie dog *Cynomys parvidens*	mammal	Threatened	no habitat	habitat	habitat	habitat
Mexican spotted owl *Strix occidentalis*	bird	Threatened	habitat	habitat	habitat	habitat
Greater sage-grouse *Centrocercus urophasianus*	bird	Candidate	habitat	present	present	present
Western yellow-billed cuckoo *Coccyzus americanus*	bird	Candidate	marginal habitat[3]	marginal habitat[3]	marginal habitat[3]	marginal habitat[3]

[1] Species does not occur on Forest Service-administered lands but has been documented downstream in the Virgin River.
[2] Exp pop area = Experimental/nonessential population area for a reintroduced species
[3] The exact locations of potentially suitable (marginal) habitat on the Dixie National Forest are not known.

3.6.2.1 Endangered species

According to the USFWS, endangered species are animals or plants in danger of extinction within the foreseeable future throughout all or a significant portion of their range (USFWS 2007a). Virgin River chub, woundfin, and California condors are endangered species that may occur or that may be affected by activities on the Dixie National Forest. Suitable habitats for endangered species on the Dixie National Forest are listed in Table 3.6-2.

Table 3.6-2 Acres of Mapped Habitat for Endangered Species on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
California condor rim habitat	65,884[2]	40,461	102,930	232,022	441,298

[1] May not add up exactly due to rounding
[2] Condors in the Pine Valley Ranger District are fully protected by ESA; condors outside of the Pine Valley Ranger District are part of the Experimental/Nonessential population.

VIRGIN RIVER CHUB AND WOUNDFIN

The Virgin River chub and woundfin are rare minnows that are now restricted to the Virgin River mainstem from Pah Tempe Springs (Utah) downstream to the Mesquite diversion (near the Arizona-Nevada border) and downstream to Lake Mead, respectively (USFWS 2000). The Virgin River chub is endemic to the Virgin River system of southeastern Utah, southern Nevada, and northwestern Arizona; the woundfin is endemic to the Colorado River system. Designated critical habitat for both species extends on the mainstem Virgin River from the confluence of La Verkin Creek to Halfway Wash, Nevada. The La Verkin Creek confluence is approximately 14 stream miles southeast of the Pine Valley Ranger District.

During a “normal” year with adequate flows, both Virgin River chub and woundfin inhabit the mainstem of Ash Creek from the confluence with La Verkin Creek up to the Toquerville and Ash Springs diversions (southeast of the Dixie National Forest). The diversions are large head cuts that cut down into the shallow alluvial aquifer to withdraw water, and as a result, provide some surface flow to the creek, but often go subsurface during periods of low flow. During periods of high flow, both Virgin River chub and woundfin may also move upstream of these diversions, with presence noted in the mainstem of Ash Creek as far north as Ash Creek Reservoir (A.H. Rohm, Wildlife Biologist, UDWR, Personal Communication). Thus, both species can be found in waters that flow directly from the Pine Valley Ranger District; however, no known populations of Virgin River chub or woundfin occur within the Forest boundary (Rodriguez 2008).

CALIFORNIA CONDOR

The California condor is one of the largest flying birds in the world, with a wingspan of nearly 10 feet and weighing approximately 22 pounds. Condors require large areas of remote country for nesting, foraging, and roosting. Nesting occurs primarily in chaparral-covered mountains in caves, potholes, and sheltered rock outcrops. Foraging occurs in grasslands. Condors feed on carrion, mainly of larger animals (i.e., bison, deer, pronghorn, or beached marine animals). Roosting occurs on large, old growth trees or snags, or on isolated rocky outcrops and cliffs (Mesta 1996). In 1987, when the last wild birds were captured, condors were limited to the coastal foothills and mountains of southern California. In 1997, condors were released in the wild in northern Arizona near the Grand Canyon (Vermillion Cliffs) as part of a captive breeding and reintroduction program. In Utah, the designated nonessential experimental population area for these reintroduced birds is bounded on the west by I-15, on the north by I-70, and on the east by Highway 191; thus, the area overlaps the Cedar City, Powell, and Escalante Ranger

Districts of the Dixie National Forest. Condors within the Pine Valley Ranger District would not be part of this experimental population and would be considered Endangered. Condors from the Vermillion Cliffs release point have subsequently been observed in various locations in southern Utah, including in and around Zion National Park adjacent to the Pine Valley Ranger District. These birds appear to eventually return to the Vermilion Cliffs in Arizona where they were released.

Suitable habitat for condors occurs on the Dixie National Forest as part of the experimental population area; however, California condors are not known to nest on the Dixie National Forest and would only be expected on a transient basis. Condors have been observed searching for nests along the I-15 corridor, between the Pine Valley and Cedar City Ranger Districts. Condors have also been observed in at least three locations on the Cedar City Ranger District north of Highway 14 (Long Valley, Aspen Mirror Lake, and Panguitch Lake) in the recent past. On the Dixie National Forest, over 450,000 acres of "rim" habitat that is suitable for California condor have been mapped (Table 3.6-2). Only condors in the Pine Valley Ranger District are protected by ESA.

3.6.2.2 Threatened species

According to the USFWS, threatened species are those that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range (USFWS 2007a). Threatened species either present or with suitable habitat on the Dixie National Forest include Utah prairie dogs and Mexican spotted owls. Suitable habitats for threatened species on the Dixie National Forest are listed in Table 3.6-3; locations of suitable habitat are shown in Figure 3.6-1.

Table 3.6-3 Acres of Mapped Habitat for Threatened Species on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Utah prairie dog colonies	0	6,412	30,883	12,333	49,628
Potential (unverified) Mexican spotted owl habitat	22,437	9,193	7,227	8,676	47,532
Designated Critical Mexican spotted owl habitat[2]	0	0	0	18,048	18,048
Mexican spotted owl PACs	0	0	0	732	732

[1] May not add up exactly due to rounding.
[2] Most areas of Designated Critical habitat are not included in "potential Mexican spotted owl habitat."

UTAH PRAIRIE DOG

Utah prairie dogs are highly sociable, herbivorous rodents that live in underground burrow colonies called "towns." Towns are organized into discrete family units. Utah prairie dogs require deep, well-drained soils in which to dig burrows, vegetation low or sparse enough to see over or through, and suitable forage. Utah prairie dogs prefer alfalfa and grasses as forage, but also eat insects, particularly cicadas. In general, drought or the lack of sufficient moist vegetation is thought to be one of the most important factors influencing the distribution of Utah prairie dogs (Rodriguez 2008). Utah prairie dogs presently occur in three areas in southwestern

and south central Utah: the Awapa Plateau (Escalante Ranger District), the Paunsaugunt region along the east fork of the Sevier River (Powell Ranger District), and the West Desert region east of Iron County (not on the Forest; USFWS 1991).

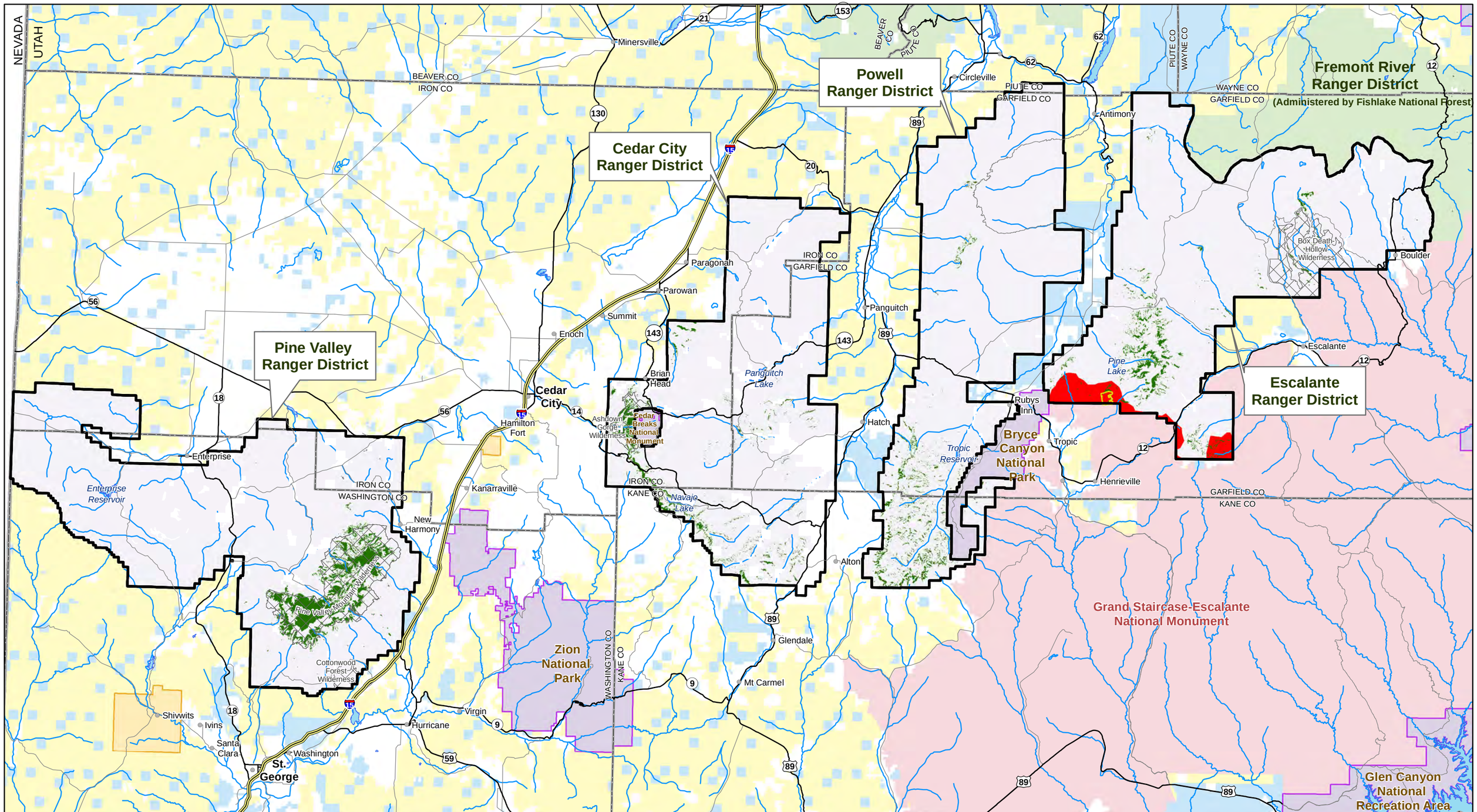
The Utah prairie dog was listed as an endangered species on June 4, 1973 (38 FR 14678). At the time of listing the species was threatened by habitat destruction and modification, over exploitation, disease, and predation (USFWS 2010). In 1972 the UDWR started a transplant program to move animals from private to public lands (USFWS 1991). From 1972 to 2000, over 19,561 Utah prairie dogs were removed from private lands and relocated to lands managed by the BLM, USFS, NPS, and State of Utah (Bonzo and Day 2003). Utah prairie dog populations increased significantly in portions of their range and on May 29, 1984 (49 FR 22330) the species was reclassified as threatened with a special rule to allow regulated take of the species (USFWS 2010). In 2002, a total of 382 prairie dogs were translocated from 21 different colonies in the West Desert Recovery Unit, to three different locations (two in the West Desert; one on the Paunsaugunt). Post-release counts at two West Desert sites accounted for 1) between 11 and 16 Utah prairie dogs (on different days; out of 186 released) at one site, and 2) between 9 and 34 Utah prairie dogs (on different days; out of 196 total) at the other. From these results it appears that survivorship of the translocated Utah prairie dogs for this particular effort was low. Since 2002, a more successful translocation effort has been observed at a relocation site on the Dixie National Forest (Berry Springs, within the Paunsaugunt Recovery Unit), where many provisions of a Recommended Translocation Procedures document (2006 – see USFWS 2009) have been implemented. Spring counts at this location increased from 8 adult Utah prairie dogs in 2007 to approximately 100 adult Utah prairie dogs in 2010 (UDWR 2011; USFWS 2009).

The Utah Division of Wildlife Resources (UDWR) initiated biannual census counts in 1975 and annual counts in 1978. According to the 2002 annual report, Utah prairie dogs in the Awapa Plateau and Paunsaugunt Recovery Units showed a recent declining trend (Bonzo and Day 2003: Appendix I; counts from 1998-2002 in Awapa Unit = 353, 201, 424, 244, 218; counts from 1998-2002 in Paunsaugunt Unit = 1,100, 1,173, 934, 735, 863). Recent monitoring (trends as of 2007) of Utah prairie dog colonies in the Awapa and Paunsaugunt Recovery Units shows that populations are at least stable, if not increasing (Rodriguez 2008). There are 50,000 acres of colony areas (with 0.5-mile buffer) that have been mapped on the Dixie National Forest (Table 3.6-3). Considering that only colonies on public lands count toward recovery of the species, colonies on the Powell Ranger District may contain the majority of Utah prairie dogs within the Paunsaugunt Recovery Unit (USFWS 1991).

MEXICAN SPOTTED OWL

The Mexican spotted owl is a large owl that typically roosts and nests in shady, mature forests, but in southern Utah prefers the cracks of deep slot canyons (USFWS 1995). In Utah, breeding spotted owls typically utilize deep, steep-walled canyons that contain mature coniferous or deciduous trees within the canyon bottom. Nest sites in Utah have only been documented on cliff ledges. During winter, owls tend to move out of the canyons and onto mesa-tops, benches, and warmer slopes (Rodriguez 2008).

“Potential habitat” for spotted owls occurs on all four ranger districts of the Dixie National Forest and covers about 47,000 acres (Table 3.6-3; Figure 3.6-1). Potential habitat was mapped using breeding and roosting habitat from the 1997 and 2000 Willey-Spotskey Mexican Spotted Owl Habitat Models, which is to be used for “initial evaluation of potential habitat within project areas” and must be verified by “field evaluations to determine the actual extent of owl habitat in the project area and the subsequent need for owl surveys (USFWS 2002a).” The presence of



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.6-1
Threatened & Endangered Species Habitat

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:590,000

1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Mexican Spotted Owl

- Protected Activity Centers
- Potential Habitat
- Critical Habitat

Miles: 0 4 8 12 16

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

suitable Mexican spotted owl breeding/roosting habitat within potential habitat is officially unverified until field surveys document the suitability of breeding/roosting habitat. Surveys may be warranted if habitat is determined to be suitable and if activities within 0.5 miles are proposed. Of the acres identified as potentially suitable breeding/roosting habitat (see Table 3.6-3), about 25,000 have been field-verified.

The Dixie National Forest is located within the northern edge of Critical Habitat unit CP-12 (Colorado Plateau-12) for Mexican spotted owls, one of five Critical Habitat units in Utah that cover more than two million total acres. About 18,000 acres of CP-12 overlap the southern edges of the Escalante Ranger District (Table 3.6-3; Figure 3.6-1). A 732-acre Protected Activity Center (PAC) for Mexican spotted owls occurs within this Critical Habitat area, near Pasture Canyon. Two spotted owls were detected on the Cedar City Ranger District during winter in non-canyon areas. Both locations were the results of a telemetry study monitoring dispersal, and in both cases the owls did not stay on the Dixie National Forest. Spotted owls have also been detected on the Escalante Ranger District in steep-walled canyon complexes and in the established PAC; however, no nests have been located (Rodriguez 2008). As of 2008, no nesting owls have been located anywhere on the Dixie National Forest.

3.6.2.3 Candidate species

Candidate species do not receive federal protection under the Endangered Species Act, but are treated as Listed for the purpose of this analysis. Candidate species have been studied and the USFWS has concluded that they should be proposed for addition to the federal endangered and threatened species list (USFWS 2007a). The only candidate species known or suspected to occur on the Dixie National Forest are the western yellow-billed cuckoo and greater sage-grouse.Suitable habitats for candidate species on the Dixie National Forest are listed in Table 3.6-4; locations of suitable habitat are shown in Figure 3.6-1.

Table 3.6-4 Acres of Mapped Habitat for Candidate Species on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Sage grouse brood rearing habitat	0	3,415	0[2]	9,562	12,977
Sage grouse leks	0	16,739	23,268	2,809	42,816

[1] May not add up exactly due to rounding.
[2]All brood-rearing habitat is contained within the buffered “leks” area on the Powell Ranger District.

GREATER SAGE-GROUSE

The USFWS found on 5 March 2010 that listing greater sage-grouse (range-wide) was warranted, but that listing was precluded by higher-priority listing actions. The greater sage-grouse was assigned a Candidate Listing Priority Number of 8, where 1 is the highest priority; FR 75(55):13910-14014, published March 23, 2010). Thus, greater sage-grouse is a candidate species for listing as of March 5, 2010.

Sage-grouse are large, chicken-like birds that are brownish grey with conspicuous black and white markings (Parrish et al. 2002). Sage-grouse are dependent on sagebrush habitats, specifically big sagebrush (*Artemisia tridentata*) for brood rearing, nesting cover, and year-round diet. Suitable sagebrush habitat is limited by elevation and topography (USFS 1995b:25). Sage-grouse habitat on the Dixie National Forest contains varied topography and vegetation communities are heterogeneous. Sage-grouse populations on the Dixie have not contracted in

size at the same scale as populations in Wyoming (WAFWA 2008). According to Connelly et al. (2004), forested and alpine habitats in mountainous areas were likely unoccupied historically by sage-grouse, including the Markagunt, Paunsaugunt, and Aquarius Plateaus. However, current populations in Utah appear to be more isolated than they were in pre-settlement times (Schroeder et al. 2004). Loss, fragmentation, and degradation of sage-grouse habitat occurred gradually across Utah, beginning with the establishment of settlements along sagebrush foothills and in valleys, followed by ploughing of arable areas and livestock grazing, and exacerbated by fire and invasions of exotic species (particularly cheatgrass; Beck et al. 2003).

Breeding in greater sage-grouse occurs on “leks” or openings surrounded by sagebrush in broad valleys, ridges, benches, and plateaus or mesas. Lek sites generally have good visibility (for predator detection), acoustical qualities (so mating sounds will carry), and an abundance of sagebrush within about 300 to 660 feet (for escape cover). Hens build nests at the base of a live sagebrush plant and remain in sagebrush vegetation with chicks until conditions are too dry, at which point hens with broods move towards wet meadow or riparian areas. Preferred nest habitats are those with live sagebrush along the periphery for escape cover.

Flocks of sage-grouse form in early fall, containing unsuccessful and successful hens and chicks from several broods. During fall and early winter, movements of sage-grouse flocks can be extensive. Sagebrush habitats are still important to sage-grouse in winter (20% canopy cover preferred; Parrish et al. 2002). In Utah, Homer et al. (1993) found that wintering grouse preferred shrub habitats with medium to tall (40-60 cm) shrubs and moderate shrub canopy cover (20-30 percent; Homer et al. 1993). Sage-grouse avoided winter habitats characterized by medium (40-49 cm) shrub height with sparse (<14 percent) sagebrush canopy cover. As described in Connelly et al. (2004), the spatial distribution of sage-grouse in winter often is related to snow depth. At the onset of winter, sage-grouse typically move to lower elevations with greater exposure of sagebrush above snow and taller sagebrush; in migratory populations, this movement may extend up to 160 km. Winter migration areas for sage-grouse populations on the Dixie are not known, but winter use by sage-grouse is expected.

Mapped brood-rearing habitat for sage-grouse occurs on the Cedar City and Escalante Ranger Districts. Brood-rearing areas occur primarily adjacent to the Dixie National Forest, overlapping the northeast corner of the Cedar City Ranger District and the north edge of the Escalante Ranger Districts (Table 3.6-4; Figure 3.6-1). Actual lek sites on the Dixie National Forest (mapped with a one- or two-mile buffer, depending on the alternative) total 42,816 acres (Table 3.6-4). The current status of these leks is not known (USFS 1995b:25). A large amount of suitable, unmapped brood-rearing habitat occurs within the lek buffer.

Based on GIS data of all roads on the Dixie National Forest, including unauthorized roads and trails, road/trail densities in the vicinity of leks on the Dixie National Forest are relatively high (greater than three miles per square mile within the subwatershed) in a few areas, including near leks northeast of Panguitch Lake and White Bridge Campground, and leks north of Highway 12 on the east side of the Powell Ranger District. Complete information on road density can be found in the Dixie National Forest Motorized Travel Plan EIS (USFS 2009c).

WESTERN YELLOW-BILLED CUCKOO

The western yellow-billed cuckoo is a distinctive neotropical migrant that nests in dense, deciduous, streamside forests. Most nesting in the West occurs within relatively large patches (25+ acres) of riparian forest containing cottonwoods or willows. Yellow-billed cuckoos require a humid, shady environment for nesting to protect eggs and fledglings from the otherwise

unsuitably dry and hot desert conditions. Nesting typically begins in mid-June and lasts less than three months, which is the shortest incubation and nestling period of any bird. Yellow-billed cuckoos eat a wide variety of insects, including caterpillars that are toxic to most other animals. Approximately 115 acres of potentially suitable habitat for western yellow-billed cuckoo has been identified on the Dixie National Forest and regular surveys are conducted; however, this area has not been mapped. Western yellow-billed cuckoos are unlikely to occur on the Dixie National Forest because cottonwood riparian areas with dense understories are at a much higher elevation on the Dixie National Forest than the species is known to prefer (Rodriguez 2008).

3.6.3 Sensitive Species

The Regional Forester identifies Sensitive species as those for which population viability ("persistence") is a concern, as evidenced by significant current and predicted downward trends in population numbers, density, and/or habitat capability that would reduce a species' existing distribution. Sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that could result in the need for federal listing (FSM 2672.1). Sensitive species that are known or suspected to occur on the Dixie National Forest are listed in Table 3.6-5. An "X" indicates confirmed presence; "habitat" indicates presence not confirmed but suitable habitat occurs.

Table 3.6-5 Sensitive Species That Occur on the Dixie National Forest, by Ranger District. "X" indicates presence

	Pine Valley	Cedar City	Powell	Escalante
FISHES and AMPHIBIANS				
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*				X
Bonneville cutthroat trout *Oncorhynchus clarki utah*	X	X	X	X
Southern leatherside (chub) *Lepidomeda aliciae*		X	X	X
Boreal toad *Anaxyrus boreas*		habitat[3]	X	habitat[2]
MAMMALS				
Pygmy rabbit *Brachylagus idahoensis*	habitat	habitat	X	habitat
Townsend's big-eared bat *Corynorhinus townsendii*	X	X	habitat	habitat
Spotted bat *Euderma maculatum*	habitat	X	habitat	habitat
Desert bighorn sheep *Ovis Canadensis nelsoni*	habitat	X	X	X
BIRDS				
Northern goshawk *Accipiter gentilis*	X	X	X	X
Peregrine falcon *Falco peregrinus*	habitat	X	X	X
Bald eagle *Haliaeetus leucocephalus*	winter/ migrant	winter/ migrant; nesting	winter/ migrant	winter/ migrant
Flammulated owl *Otus flammeolus*	X	X	X	X
Three-toed woodpecker	X	X	X	X

	Pine Valley	Cedar City	Powell	Escalante
Picoides tridactylus				
PLANTS				
Dana's milkvetch *Astragalus henrimontanensis*				X
Navajo Lake milkvetch *Astragalus limnocharis limnocharis*		X		
Table Cliff milkvetch *Astragalus limnocharis tabulaeus*				X
Guard milkvetch *Astragalus zionis vigulus*	X			
Peculiar moonwort *Botrychium paradoxum*				X
Aquarius paintbrush *Castilleja aquariensis*				X
Tushar paintbrush *Castilleja parvula parvula*		X[1]		
Reveal paintbrush *Castileja parvula revealii*		X	X	X
Yellow-white catseye *Cryptantha ochroleuca*			X	X
Cedar Breaks biscuitroot *Cymopterus minimus*		X	X	X
Creeping draba *Draba sobolifera*		X[1]		
Widtsoe wild buckwheat *Eriogonum aretioides*			X	X
Pine Valley goldenbush *Ericameria crispa*	X			
Jones golden-aster *Heterotheca jonesii*				X
Zion jamesia *Jamesia americana zionis*		X[1]		
Neese's pepperplant *Lepidium montanum neeseae*				X
Paria breadroot *Pediomelum pariense*			X[1]	
Red Canyon beardtongue *Penstemon bracteatus*			X	
Little (aquarius) penstemon *Penstemon parvus*				X
Pinyon penstemon *Penstemon pinorum*	X			
Arizona willow *Salix arizonica*		X	X	
Podunk goundsel *Packera malmstenii*		X	X	X
Peterson catchfly *Silene petersonii*		X	X	X
Rock tansy *Sphaeromeria capitata*			X	

[1]Presence not confirmed.
[2] Habitat not mapped.
[3] Amphibian habitat exists but no historical records of boreal toads.

Mapped habitat areas for Sensitive species, including bald eagle, pygmy rabbit, sensitive bats, peregrine falcon, flammulated owl, goshawk, and sage grouse are shown in Figure 3.6-2.

3.6.3.1 Fishes

Fisheries habitat on the Dixie National Forest for the purpose of this analysis includes habitat that is occupied, or habitat that is suitable (and unoccupied). Suitable, unoccupied habitats are all areas currently identified by Conservation Teams, UDWR, and/or the Forest as having the potential for reintroductions within the next ten years.

Sensitive aquatic species on the Forest include: 1) Colorado River cutthroat trout, 2) Bonneville cutthroat trout, 3) Southern leatherside chub, and 4) boreal toad. All species are cooperatively managed between the Forest Service and other Agencies under Conservation Agreement and Strategy (CAS) documents, shown in the following table. Virgin spinedace, an MIS, is also included.

Table 3.6-6 Conservation agreements in place for sensitive or MIS aquatic species on the Dixie National Forest

Species	Conservation Agreements	Signatories
Colorado River cutthroat trout	Range wide: CRCT Coordination Team 2006	Colorado Department of Natural Resources, Wyoming Game and Fish Committee, UDWR, USFWS, BLM, USFS, Ute Indian Tribe, NPS
Bonneville cutthroat trout	Range wide: UDWR 2000a	Idaho department of Fish and Game, Nevada Department of Wildlife, UDWR, Wyoming Department of Fish and Game, Confederate Tribes of the Goshute Reservation, USFWS, BLM, NPS, USFS, Utah Reclamation Mitigation and Conservation Commission
	Utah: UDWR 1997	UDWR, USFWS, BLM, USFS, Confederated Tribes of the Goshute Reservation, Bureau of Reclamation, Utah Reclamation Mitigation and Conservation Commission
Southern leatherside	Utah: UDWR 2010	UDWR, USFWS, BLM, Bureau of Reclamation, USFS, Utah Reclamation Mitigation and Conservation Commission, Utah Central Water Conservancy, Trout Unlimited
Virgin spinedace (MIS)	Utah: UDWR 2002	UDWR, USFWS, BLM, NPS, Nevada Department of Conservation and Natural Resources, Washington County Water Conservancy District, Arizona Fish and Game
	Utah: UDWR 2008b	UDWR, USFS, NPS, BLM (Arizona and Utah), Nevada Department of Wildlife, Arizona Fish and Game, Washington County Water Conservancy District
Boreal toad	Utah: UDWR 2005b	UDWR, USFS, USFWS, BLM, Bureau of Reclamation, and the Utah Reclamation

		Mitigation and Conservation Commission

Table 3.6-7 Acres of Fisheries and Boreal Toad Habitat on the Dixie National Forest.

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Fisheries habitat	4,896	4,105	7,892	6,572	23,465
Boreal toad habitat (mapped)	0	0	50,166	0	50,166

[1] May not add up exactly due to rounding

COLORADO RIVER CUTTHROAT TROUT (MIS AND SENSITIVE)

Colorado River cutthroat trout (CRCT) is one of three subspecies of cutthroat native to Utah. The species is restricted to the upper Colorado River drainage. CRCT occur in headwater streams and mountain lakes of the Uinta, La Sal, and Abajo Mountains, the Tavaputs Plateau, and the Escalante and Fremont River drainages (Bosworth 2003); pure strains occur predominantly in isolated headwater streams at high elevation (Behnke 1992, UNHP 2007). Two-thirds of all occupied habitats occur on National Forest lands (Hirsch et al. 2006).

CRCT were petitioned for listing under the Endangered Species Act in December 1999; the US Fish and Wildlife Service (USFWS) determined that listing was not warranted in April 2004 and in June of 2007. A status review was completed by the CRCT Conservation Team in 2005 (Hirsch et al. 2006). A Conservation Agreement and Strategy were signed in 2006. According to these documents, the current distribution of CRCT primarily in isolated headwater streams and lakes has been limited by the widespread introductions of non-native salmonids. The Conservation Assessment states that most conservation populations of CRCT are isolated but there are ongoing restoration efforts to create metapopulations.

CRCT were thought to have been extirpated from streams as far south as the Escalante River drainage until a remnant population was found in the East fork of Boulder Creek on the Escalante Ranger District in the 1980s. Subsequent surveys in the 1990s identified five populations of CRCT occupying approximately 8.2 miles of Escalante River tributary streams on the Dixie National Forest (Hepworth et al. 2001). Currently, CRCT occupy an estimated 27 miles of stream habitat and approximately 19 acres of lentic habitat (lakes/reservoirs) on the Escalante Ranger District (Hadley et al. 2008).

Within the 23,000 acres of suitable fisheries habitat on the Dixie National Forest, 4,849 acres on the Escalante Ranger District is mapped as occupied habitat for Colorado cutthroat trout and 183 acres on the Escalante Ranger District is mapped as potential (unoccupied) habitat.

BONNEVILLE CUTTHROAT TROUT (MIS AND SENSITIVE)

Bonneville cutthroat trout (BCT) is one of three subspecies of cutthroat trout native to Utah. It occurs in streams and lakes of the Bonneville Basin and a limited portion of the Virgin River Drainage (Hepworth et al. 1997; Bosworth 2003). BCT historically occupied most water bodies with suitable habitat within the Bonneville Basin, including portions of Utah, Nevada, Idaho, and Wyoming (USFWS 2001). In general, habitat is variable, ranging from high elevation streams with coniferous and deciduous riparian trees to low elevation streams in sage-steppe grasslands containing herbaceous riparian zones (Rodriguez 2008 and UNHP 2007). Regardless of habitat, BCT require a functional stream riparian zone that provides structure, cover, shade, and bank stability (UNHP 2007). This subspecies does relatively well in marginal habitats and has also been found in warmer, turbid water where non-native trout cannot survive (Behnke 1992).

Most populations are found in the headwater streams and high-elevation river reaches of drainages entering the Bonneville Basin at its east and southeast edge; small populations occur in perennial streams in the Deep Creek Mountains and in a few headwater streams of the Virgin River drainage in the Pine Valley Mountains (Hepworth et al. 1997; Bosworth 2003; Hepworth et al. 2003; Hadley et al. 2011). The USFS owns the vast majority (over 90 percent) of the land containing BCT in the Southern Geographic Unit (Sevier River Basin) on the Dixie and Fishlake National Forests (USFWS 2001).

BCT were petitioned for listing under the Endangered Species Act in February 1998. A range-wide Conservation Agreement and Strategy for BCT was published in 2000. A status review for BCT was completed in 2001 (USFWS 2001) and the petition for listing was found not warranted in October 2001.

On the Dixie National Forest, BCT remnant populations were found in Reservoir Canyon and Water Canyon within the Santa Clara River drainage in the 1970s. The Santa Clara drainage lies within the Virgin River Basin, which is outside what was thought to be the range of BCT; however, records from early pioneers indicate that cutthroat trout were common in the Santa Clara. That along with geological evidence supports the hypothesis that Grassy Creek may have been captured from the Bonneville Basin into the Virgin River Basin approximately 2,000 years ago making these two populations true remnants (Hepworth et al. 1997, Hadley et al. 2011). By 1995 two additional remnant populations had been found on the Dixie National Forest in Deep Creek and Ranch Creek, both of which drain into the East Fork Sevier River.

In addition to these four remnant populations, 14 tributaries on the Dixie National Forest have been renovated with pesticides or had BCT reintroduced to them. In the 2002 flooding, ash flows and debris flows following the Sanford fire extirpated the remnant population in Deep Creek, as well as another reintroduced population in Left Fork Sanford Creek. That same year, flooding, ash flows, and debris flows following the Sequoia Fire severely degraded BCT habitat in streams along the east side of the Pine Valley Mountains. Since then BCT have been reintroduced to Deep Creek, Mill Creek, Leap Creek, Harmon Creek, and South Ash Creek. The Deep Creek population has received several transfers from Ten Mile Creek on the Fishlake National Forest, where BCT salvaged from Deep Creek after the Sanford fire was reintroduced. Sampling in 2009 indicated that both the distribution and abundance of BCT is improving and that some reproduction and recruitment has occurred (Hadley et al. 2010).

Fire impacts have affected the current distribution of BCT on the Dixie National Forest. In addition, many of the streams containing BCT on the Forest have areas of marginal habitat, which cause fluctuations in the amount of occupied habitat between sampling efforts based on variations in climate conditions. Currently, conservation populations of BCT occupy 37.6 miles (60.9 km) of stream on the Forest, with their maximum distribution in these streams since the 1970s being 56.7 miles (90.2 km; Hadley et al. 2010, Hadley et al. 2011).

Within the 23,000 acres of suitable fisheries habitat on the Dixie National Forest, mapped suitable occupied habitat for Bonneville cutthroat trout includes 8,032 acres on all four ranger districts. Half the mapped, occupied Bonneville cutthroat trout habitat occurs on the Pine Valley Ranger District (4,110 acres). The 23,000 acres also includes potential (unoccupied) habitat for Bonneville cutthroat trout, which occurs on the Cedar City (1,987 acres) and Powell (6,205 acres) Ranger Districts.

SOUTHERN LEATHERSIDE (MIS AND SENSITIVE)

The southern leatherside is a small desert fish endemic to streams in the southern and eastern Bonneville Basin. Southern leatherside was formerly known as leatherside chub, which was split into two unique species, the northern and southern leatherside. Some information below pertains to leatherside chub and some is specific to the southern leatherside (the following taken from the Conservation Agreement for Southern Leatherside in Utah: UDWR 2010).

Southern leatherside require flowing water and do not persist in lakes or reservoirs. Occupied streams have a high variability of stream flow, annual precipitation, gradient, elevation, conductivity, and pH. Microhabitat variables associated with leatherside chub include low water velocities (2.5-45 cm/sec), intermediate water depths (25-65 cm), and low percent composition of sand-silt or gravel substrates. Adult and juveniles utilize the main channel of streams more often than off-channel habitats, although the presence of brown trout may shift habitat use. Southern leatherside occur in streams with a broad range of temperatures and have habitat requirements of healthy riparian vegetationand intact streambanks (UDWR 2010).

On the Dixie National Forest, Southern leatherside have been documented in two 4th-level HUCs (Hydrologic Unit Codes): the Upper Sevier and East Fork Sevier, since 1994. Within these HUCs, southern leatherside are known to occur in the mainstem of the Sevier River and the East Fork Sevier River downstream from Tropic Reservoir. Southern leatherside historically occupied almost the entire East Fork Sevier River; however their current distribution on the Powell Ranger District is limited to 5.0 miles of the East Fork Sevier River immediately downstream from Tropic Reservoir.

Tributaries known to contain southern leatherside on the Dixie Natinoal Forest include: Threemile Creek, Bear Creek, Panguitch Creek, Butler Creek, and Clay Creek (UDWR 2010). Recent survey efforts by UDWR and Dixie National Forest personnel indicate that southern leatherside is no longer present in Asay Creek, East Fork Sevier River upstream from Tropic Reservoir, or Mammoth Creek (Morvilius and Fridell 2004a, Bennion 2009a, Bennion 2009b, Golden and Mecham 2010a). Additionally, UDWR and Dixie National Forest surveys indicate that southern leatherside may have been extirpated from Clay Creek by a large flood event in 2008 (Morvilius and Fridell 2004b, UDWR 2009, Golden and Mecham 2010b). Prior to the extirpation of this population, the Dixie National Forest had 23.2 miles of stream occupied by southern leatherside; however, without this population occupied stream mileage is reduced to 20 miles. There are approximately 41.1 miles of potential historical habitat for southern leatherside on the Dixie National Forest.

Within the 23,000 acres of suitable fisheries habitat on the Dixie National Forest, suitable occupied habitat for southern leatherside includes 1,115 mapped acres on the Cedar City Ranger District (Bear Creek, Panguitch Creek, and Threemile Creek) and 433 mapped acres on the Escalante Ranger District (Clay Creek).

BOREAL TOAD

The boreal toad subspecies of the western toad (*Anaxyrus boreas*) is found from coastal Alaska south through British Columbia, western Alberta, Washington, Oregon, and northern California, and east through Idaho, western Montana, Wyoming, Nevada, the mountains of Utah and Colorado, and extreme northern New Mexico (USFWS 2005). The boreal toad within Utah and the Dixie National Forest is not part of the Southern Rocky Mountain Distinct Population Segment that was Candidate for Listing until 2005. There is some evidence, however, that the

Paunsaugunt Plateau population of boreal toad in southern Utah is genetically distinct (Goebel 2005; Hogrefe 2001; Keniath and McGee 2005; Goebel et al. 2009; Switzer et al. 2009).

A Conservation Plan for boreal toad in the State of Utah was published in November 2005 (UDWR 2005b). Cooperating agencies include UDWR, USFS, USFWS, BLM, Bureau of Reclamation, and the Utah Reclamation Mitigation and Conservation Commission.

Western toads are found in a variety of habitats such as desert springs and streams, meadows and woodlands, and in and around ponds, lakes, reservoirs, and slow-moving rivers and streams. Breeding areas are typically shallow water areas at the edges of ponds, or lakes, stream or river edges with slow-moving water, or other flooded or ponded areas (Keinath and McGee 2005). After breeding, western toads move to more terrestrial habitats and eventually to hibernacula that may be a substantial distance from the breeding site (up to 2.5 km, but usually much less; Keinath and McGee 2005). Western toads dig a burrow in loose soil or use burrows of small mammals (Groves et al. 1997) and remain in hibernation until the following spring.

Occupied wetlands in Utah are surrounded by a variety of upland vegetation communities, including sagebrush and grassland, pinyon-juniper, mountain shrubs, and coniferous forest. Extensive observations of upland and winter habitat use in Utah have not been completed. However, toads have been observed using small mammal burrows in drier upland areas. Breeding habitats in Utah include low velocity, low gradient streams, off channel marshes, beaver ponds, small lakes, reservoirs, stock ponds, wet meadows, seeps, and associated woodlands. Hibernacula in Utah have not been described. As of 2005, only one hibernaculum was discovered in the Paunsaugunt Plateau (UDWR 2005b).

UDWR inventories of boreal toads in southern Utah from 1994 to 1998 reported toads on the Dixie National Forest from seven beaver dam complexes built on the East Fork Sevier River, Left Fork Kanab Creek, and Tropic Reservoir (UDWR 2000b). In recent years, however, breeding activity in this area appears to be limited to only a few beaver ponds on the East Fork Sevier River upstream from the Mill Creek confluence and along the Left Fork of Upper Kanab Creek (Mike Golden, Fish Biologist, Dixie National Forest, Personal Commuication 22 March 2010). Boreal toads are also found in and around the Boulder Mountain area (UDWR 2000b), which is north of the Escalante Ranger District (see Goates et al. 2007).

Suitable mapped habitat for boreal toad includes three areas within two Level 6 (HUC 12) subwatersheds on the Powell Ranger District (50,000 total acres; Table 3.7-7). Suitable habitat also occurs on the Cedar City and Escalante Ranger Districts but is not mapped on either District and there are no historical records on the Cedar City Ranger District.

3.6.3.2 Mammals

Mapped acres of sensitive mammal habitat on the Dixie National Forest are summarized in Table 3.6-8.

Table 3.6-8 Acres of Mapped Sensitive Mammal Habitat on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Pygmy rabbit habitat	16,302	10,822	25,097	8,532	60,752
Sensitive bat habitat	635	290	684	852	2,461

[1] May not add up exactly due to rounding

PYGMY RABBIT

Pygmy rabbits are small, secretive rabbits that dig their own burrows. Pygmy rabbits are limited to habitat characterized by deep, friable soils and tall (often greater than six feet), dense sagebrush, which provides both food (95% of the diet) and cover. Burrows are usually located on slopes at the base of sagebrush plants. There is one known location of pygmy rabbit on the Dixie National Forest, located on the west edge of Mount Dutton on the Powell Ranger District. Over 60,000 acres of suitable habitat occurs across all four ranger districts (Table 3.6-8; Figure 3.6-2) and pygmy rabbits could be present in many other areas. Historic (pre-1983) records exist in several areas of the Dixie National Forest (Bosworth 2003).

TOWNSEND'S BIG-EARED BAT

Townsend's big-eared bat is one of the most common bat species in Utah, roosting in a variety of desert and forest communities at elevations between sea level and 10,000 feet elevation. Roosts occur in caves, rocky outcrops, old buildings, and mine shafts (Rodriguez 2008). In winter, both sexes hibernate in mines or caves, either alone or in small groups. In a survey of 820 potential roosting sites in northern Utah, abandoned mines and caves with small to midsize openings located at low to mid-elevations, in areas dominated by sagebrush, grassland, juniper woodlands, or mountain brush communities were most likely to be occupied by big-eared bats (Sherwin et al. 2000). Several individuals were located and monitored on the Dixie National Forest from 1997 to 2001. Mammoth Cave and Bower's Cave (Cedar City Ranger District) are known to be hibernacula sites for the species from October to February. Mammoth Cave and Bower's Cave are administratively closed to the public during winter and spring (October 1 – April 1) to protect hibernating bats (Section 3.8). Almost 2,500 acres of potential habitat for sensitive bats occur on all four ranger districts of the Dixie National Forest (Table 3.6-8; Figure 3.6-2). The largest concentrations of habitat occur in the Pine Valley Mountains (Pine Valley Ranger District), Cedar Breaks and Vermillion Castle areas (Cedar City Ranger District), Sunset Cliffs and Sevier Plateau (Powell Ranger District), and the Box Death Hollow Wilderness (Escalante Ranger District).

SPOTTED BAT

Spotted bats occur in a wide variety of habitats, including ponderosa pine (*Pinus ponderosa*) forests, pinyon/juniper woodlands, canyon bottoms, open pastures, and hayfields. Limited observations indicate that spotted bats roost in relatively remote and undisturbed areas, typically in rock crevices located high on steep rock faces in limestone or sandstone cliffs (Rodriguez 2008). Spotted bats forage primarily over dry, open coniferous forest (Groves et al. 1997). Migration patterns are poorly understood, but populations from lower elevation habitats apparently do not migrate. Surveys conducted on six sites on the Dixie National Forest in 1994 resulted in documented occurrence on the Cedar City Ranger District (Rodriguez 2008). Potential habitat for sensitive bats occurs on all four ranger districts of the Dixie National Forest (Table 3.6-8; Figure 3.6-2).

BIGHORN SHEEP

Desert bighorn sheep were added to the Region IV Sensitive Species List on July 29, 2009 (USFS 2011a). Desert bighorn sheep are native to southern Utah and mainly inhabit the southeastern part of the state (UNHP 2007). Significant populations occur across the Colorado Plateau and throughout the Colorado River (UDWR 2000c). Some native herds of desert bighorn sheep were nearly extirpated following pioneer settlement (UDWR 2008c), and desert bighorns were reintroduced to Utah in 1973 (in Zion National Park). The most recent population estimate (2008) for desert bighorns in Utah is 3,100 sheep (UDWR 2008c). Desert bighorn

sheep prefer open, rocky habitat types with adjacent steep areas for escape and safety, such as rugged canyons, gulches, talus cliffs, steep slopes, mountaintops, and river benches. Several unconfirmed sightings of desert bighorn sheep have been made on the Dixie National Forest in the past several years. These individuals have likely dispersed from populations in Canyonlands, Grand Staircase Escalante National Monument, BLM-administered lands in the Virgin River Gorge, or Zion National Park. Suitable habitat exists on the Dixie National Forest. However, the Forest has not mapped suitable habitat for bighorn sheep due to lack of data for this species.

3.6.3.3 Birds

Mapped acres of sensitive bird habitat on the Dixie National Forest are summarized in Table 3.6-9.

Table 3.6-9 Acres of Mapped Sensitive Bird Habitat on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Goshawk nest areas	1,470	26,303	17,728	17,831	63,331
Goshawk PFAs	2,195	35,637	24,975	21,530	84,337
Peregrine falcon nest areas	0	9,754	8,101	0[2]	17,855
Peregrine falcon rim habitat	65,884	40,461	102,930	232,022	441,298
Bald eagle winter concentration areas	3,612	4,173	1,744	1,736	11,265
Flammulated owl habitat	37,497	162,624	75,707	144,712	420,541

[1] May not add up exactly due to rounding
[2]One eyrie has recently been found on the Escalante Ranger District. Baseline acres reflect the original nest area as the impacts determination would not change with this addition.

NORTHERN GOSHAWK (MIS AND SENSITIVE)

Northern goshawks inhabit montane coniferous and deciduous woodland in the West, nesting in stands of intermediate to high canopy-closure with a thin understory, interspersed with small openings, fields, or wetlands. Important internal components of forests where goshawks nest in Utah include snags, multiple canopies, and down woody debris. In southern Utah, goshawks are most often associated with mature to old growth stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), followed by aspen (*Populus tremuloides*; Graham et al. 1999). Goshawks generally nest in large trees adjacent to open flight corridors; they appear to prefer north to east aspects as well as flat to moderately sloped land for nest sites because stands are typically denser (Shuster 1980 and Weber 2006). Nesting activity on the Dixie National Forest generally ranges from 20 to 30 nests annually (Rodriguez 2008). Buffered (radius = 0.5 mile) nest areas total over 63,000 acres on all four ranger districts, and Post Fledgling Areas (PFAs) total 84,337 acres (Table 3.6-9; PFAs shown in Figure 3.6-2). Active goshawk territories and goshawk production appear to be linked to precipitation data on the Dixie National Forest; the increase in goshawk activity in 2004, for example, coincides with the end of a prolonged five-year drought (USFS 2004d). In 2005, 39 territories were considered occupied and 36 were active (USFS 2005a). In 2006, 50 territories were occupied and 42 were active (USFS 2006c). In 2007 58 territories were occupied and 46 were active (USFS 2008b).

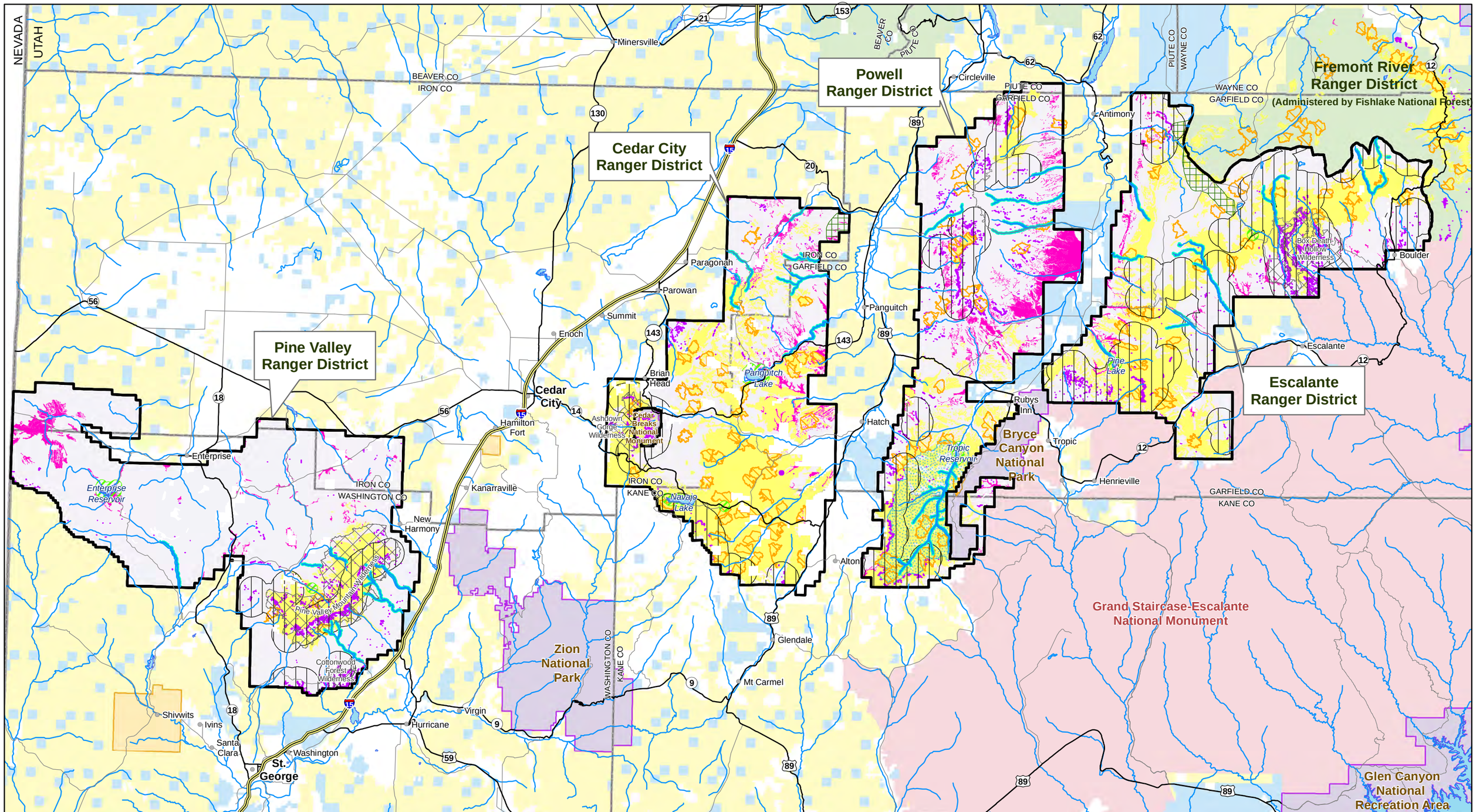
In 2008 41 territories were occupied and 28 were active (USFS 2009b). In 2009 47 territories were occupied and 26 were active (USFS 2010c). The most recent monitoring report lists 162 existing goshawk territories (USFS 2011b).

PEREGRINE FALCON

Peregrine falcons occupy a wide variety of open habitats. They forage wherever prey concentrate, usually along marshes, streams, and lakes within a 10-mile radius of the nest (Rodriguez 2008). Marshes, croplands, meadows, river bottoms, and lakes that support good populations of small- to medium-sized terrestrial birds, shorebirds, and waterfowl are important hunting sites. Cliffs are preferred nesting sites, although nests also occur on river banks, tundra mounds, stick nests of other species, tree cavities, and man-made structures (USFS 2003a:E-76). No Forest-wide surveys have been conducted on the Dixie National Forest. However, 14 nest sites are known on the Forest, and numerous sightings have occurred within the Forest boundary. Peregrine nest areas (with 0.5-mile buffer) total aboutt 18,000 acres on the Cedar City and Powell Ranger Districts (Table 3.6-9). In addition, one eyrie has recently been located on the Escalante Ranger District (Table 6.4-5; see footnote). Over 440,000 acres of mapped "rim" habitat for both peregrine falcon and California condor (Endangered; see Section 3.6.2.1) occurs across all four ranger districts (Table 3.6-9; Figure 3.6-2).

BALD EAGLE

Bald eagles occur in Utah generally on a migratory or wintering basis. Bald eagles are opportunistic predators, especially in winter, when they will feed on any available fish, waterfowl, small mammal, or carrion. Bald eagles tend to concentrate wherever food is available, roosting in large groups in forested stands that provide protection from harsh weather. They may also winter in upland habitats, feeding on small mammals and deer carrion. Marginal roosting habitat is available on the Dixie National Forest wherever large trees occur along bodies of water. Bald eagles typically occur on the Dixie National Forest during late winter (winter residents) or during fall and spring months (thought to be northern migrants). There is one known bald eagle nesting territory on the Dixie National Forest, located on the Cedar City Ranger District near Panguitch Lake. It is expected that more bald eagles will nest on the Dixie National Forest in the future. A nesting bald eagle has also been recorded near the town of Teasdale (off the Forest), on private land (Rodriguez 2008). Generally, when water bodies freeze in late fall or early winter, eagles on the Dixie National Forest move down in elevation to forage off the Dixie National Forest (Rodriguez 2008). Potential bald eagle wintering sites on the Dixie National Forest include Enterprise Reservoir and Pine Valley Reservoir (Pine Valley Ranger District); Duck Lake, Navajo Lake, and Panguitch Lake (Cedar City Ranger District; Panguitch Lake is also a nesting site); Tropic Reservoir (Powell Ranger District); and Pine Lake and Posey Lake (Escalante Ranger District). A total of 11,265 acres of winter concentration areas are mapped across the Dixie National Forest (Table 3.6-9; Figure 3.6-2). Intensive monitoring of four geographic areas within the Dixie National Forest has occurred since 1996, including Panguitch Lake, Pinto Creek, Enterprise Reservoir, and Duck Creek. The greatest number of bald eagle sightings generally occurs at Panguitch Lake; trends on the Dixie National Forest are stable (Rodriguez 2008).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.6-2
Sensitive Wildlife Species Habitat

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Special Status Wildlife Habitat

- Bald Eagle Winter Concentration Areas
- Condor/Peregrine Falcon Rim Habitat
- Flammulated Owl Habitat
- Greater Sage Grouse Brood-Rearing Habitat
- Pygmy Rabbit Habitat
- Sensitive Bats, Potentially Suitable Habitat
- Boreal Toad Habitat

Fisheries Habitat***

- 500-foot buffer

Northern Goshawk

- Protected Fledgling Area

Miles: 0 4 8 12 16

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.
***Streams and lakes occupied and suitable for Bonneville Cutthroat Trout, Colorado River Cutthroat Trout, Leatherside Chub, and Virgin River Spinedace.

FLAMMULATED OWL

Flammulated owls inhabit montane forest, specifically mature and old growth ponderosa pine and Douglas-fir habitats with open stand structure. This species typically nests in large cavities made by woodpeckers and feeds on nocturnal arthropods (USFS 2003a:F-73). Flammulated owls have a low reproductive rate, with a large variation in adult survival. Timber harvesting can have negative impacts on flammulated owls if large old trees, open stand structure, and somedense vegetation for roosting are not retained (McCallum 1994). Flammulated owl surveys have been conducted on the Dixie National Forest, which detected flammulated owls within all four ranger districts. The areas where detections were most concentrated occurred within the Paunsaugunt Plateau (Powell Ranger District) and the Aquarius Plateau (Escalante Ranger District). Suitable nesting habitat exists throughout the high-elevation forested areas of the Dixie National Forest (USFS 1995b) and covers 420,541 acres (Table 3.6-9; Figure 3.6-2).

THREE-TOED WOODPECKER

Northern three-toed woodpeckers are primarily associated with dense subalpine fir and Engelmann spruce forests at high elevations. Mature to old-growth stands are preferred due to an abundance of insect prey in large snags and downed woody debris. Three-toed woodpeckers excavate their own nest cavities in snags or occasionally in live trees. Nests are found in cavities located 5 to 12 feet above the ground in dead spruce, tamarack pine (*Larix* spp.), cedar (*Thuja* spp.), and aspen trees (Rodriguez 2008). Up to 75 percent of their diet consists of wood-boring beetles and caterpillars that attack dead or dying conifers (USFS 2003a:F-80). Populations have been shown to increase in some areas three to five years after forest fires, presumably in response to spruce beetle outbreaks (Koplin 1969). Formal surveys for three-toed woodpecker have been conducted on the Dixie National Forest and woodpecker habitat is present in all ranger districts. Three-toed woodpecker surveys have not yet been conducted on suitable habitat in the Pine Valley Ranger District; however, woodpeckers are expected to occur there. A total of 131 detections on Cedar City, Powell, and Escalante have been documented since 1996 and the numbers of individuals are increasing presumably due to the increase of spruce bark beetle infestations. In the Cedar City Ranger District, seven three-toed woodpeckers were detected at six calling points in both 1999 and 2000 near Brian Head Ski Area in association with a field ecology course (Rhett Boswell, UDWR, Personal Communication; via Nate Yorgason, Wildlife Biologist, Dixie National Forest). Three-toed woodpeckers have also been detected consistently on the Breeding Bird Survey Route #85020 (Navajo Lake). An average of five woodpeckers was detected each year along this route from 2000 to 2004. Since then, detections have dropped off considerably due to the spruce beetle epidemic having run its course. In the Escalante Ranger District, two nests were found along Barney Top northwest of the Table Cliff Plateau and individuals have been detected east of Antimony Creek.

3.6.3.4 Plants

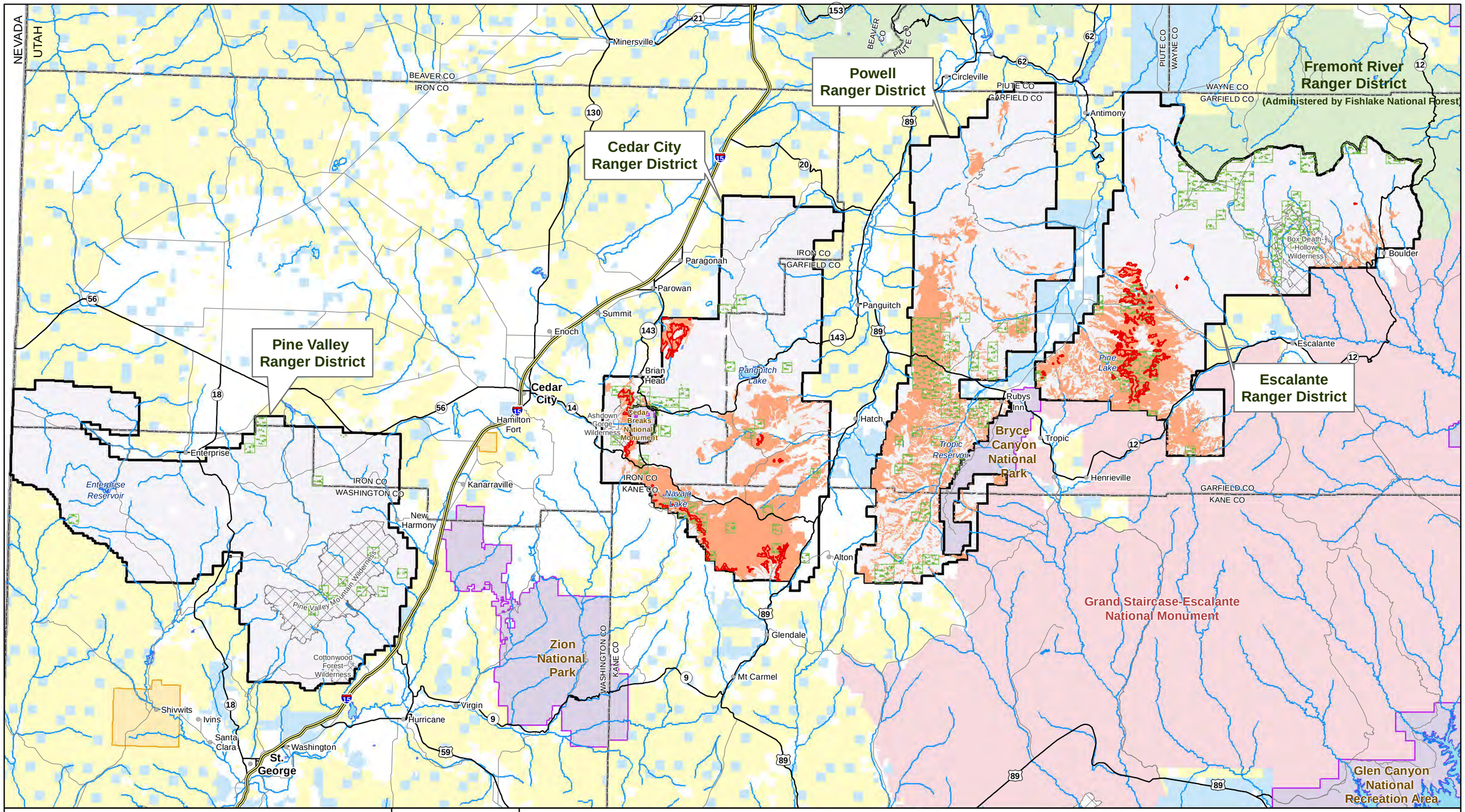
There are over 125,000 acres of sensitive plant habitat (including occurrences) mapped on the Dixie National Forest, spread across all four ranger districts (Table 3.6-10). This GIS coverage includes habitat for Threatened and Endangered species also, although no listed plants occur on lands administered by the Dixie National Forest.

Table 3.6-10 Acres of Mapped Sensitive Plant Habitat on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Sensitive (and TES) plant habitat	9,908	19,718	43,718	51,664	125,009

[1] May not add up exactly due to rounding

There are 24 sensitive plants that are known or suspected to occur on the Dixie National Forest (Table 3.6-11). Half of these species occur on Claron (Wasatch) Limestone or within rock garden and bristlecone pine communities (Figure 3.6-3), which are underlain by the Claron Limestone Formation. Claron Limestone is widespread on the southern Cedar City, central Powell, and southern Escalante Ranger Districts (Figure 3.6-3) and is associated with the following sensitive plants: Navajo Lake milkvetch, Table Cliff milkvetch, Reveal paintbrush, yellow-white catseye, Cedar Breaks biscuitroot, Widtsoe wild buckwheat, Neese's pepperplant, Paria breadroot, Red Canyon beardtongue, Podunk goundsel, Peterson catchfly, and rock tansy (Table 3.6-11).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.6-3
Threatened, Endangered & Sensitive Plant Species Habitat

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
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- State of Utah
- Tribal

Threatened, Endangered & Sensitive Plant Species Habitat

- Bristlecone Pine & Rock Gardens
- Claron Sandstone Formation
- Threatened, Endangered & Sensitive Plants

Miles: 0 4 8 12 16

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

Table 3.6-11 Sensitive Plant Species on the Dixie National Forest

Species[1]	Description[1]	Habitat[1]	Dixie National Forest Occurrence[1]
Dana's milkvetch	perennial herb; yellow-white flowers with purple tips open April-May	washouts, gravelly loam soil; 7,000-9,200 feet	Escalante Ranger District: Henry Mountains and Aquarius Plateau
Navajo Lake milkvetch	perennial herb; yellow-white or pinkish purple flowers open June-Aug	steep slopes with clay soils, loose rock; assoc with bristlecone pine on pink Wasatch Limestone and along terrace below high water mark at Navajo Lake; 8,800-10,500 feet	Cedar City Ranger District
Table Cliff milkvetch	perennial herb; pink-purple flowers open June-Aug	steep, unstable limestone slopes on pink Wasatch Limestone; 9,200-10,170 feet	Escalante Ranger District: Table Cliff Plateau
Guard milkvetch	perennial herb; pink-purple or pale flowers open April-July	assoc with pinyon-juniper, mountain mahogany, and oak-Garrya; 5,000-8,200 feet	Pine Valley Ranger District: Pine Valley Mountains
Peculiar moonwort	succulent; spike-like; cluster of sporangia have frosted, glaucous coloration	wet meadow, along intermittent draws, grassy fields on south-facing slopes; at about 10,800 feet	Escalante Ranger District: near Cyclone Lake on the Aquarius Plateau and near Jacobs Valley
Aquarius paintbrush	perennial herb; yellow inflorescence; "flowers" open June-Aug	silver sage meadows or cobbled rocky areas; 9,150-10,500 feet	Escalante Ranger District: top of Boulder Mountain and Aquarius Plateau
Tushar paintbrush	perennial herb; purple-fringed, green bracts; rarely purple; "flowers" open June to Aug	alpine meadows and talus slopes above timberline; tertiary igneous rockbeds sandy gravel; 10,000-12,000 feet	Cedar City Ranger District (suspected)
Reveal paintbrush	perennial herb; magenta to rose bracts; "flowers" open mid-June to mid-July	assoc with bristlecone and ponderosa pine; heavy clay soils from pink Wasatch Limestone; west to southwest-facing slopes; 7,800-8,500 feet	Cedar City and Powell Ranger Districts
Yellow-white catseye	perennial herb; pale yellow flowers open May-late June	dry, open sites on southern, warm slopes; pink Wasatch Limestone; 6,500-9,000 feet	Powell and Escalante Ranger Districts
Cedar Breaks	perennial; flowers pink	assoc with bristlecone,	Cedar City Ranger

Species[1]	Description[1]	Habitat[1]	Dixie National Forest Occurrence[1]
biscuitroot	or pale purple with white margins open July-Aug	ponderosa pine, and spruce fir; Wasatch Limestone; 8,000-10,400 feet	District
Creeping draba	perennial mustard; yellow flowers open July-Aug	igneous gravels and talus in alpine tundra or spruce-fir; 10,000-12,000 feet	Cedar City Ranger District (suspected)
Widtsoe wild buckwheat	perennial herb; yellow flowers open late May - June	dry, open ridgetops; pink Wasatch Limestone; 7,500-9,000 feet	Powell and Escalante Ranger Districts
Pine Valley goldenbush	woody shrub; yellow disk flowers open Aug	moderately open areas assoc with ponderosa pine, manzanita, fir, and aspen; 5,970-9,200 feet	Pine Valley Ranger District
Jones golden-aster	perennial herb; yellow ray flowers open May-Sep	on sandstone or in sand on south and west-facing slopes; 4,000-9,400 feet	Escalante Ranger District: Hell's Backbone Road and within Death Hollow Wilderness Area
Zion jamesia	woody shrub; white flowers open June-early Aug	assoc with pinyon-juniper, oak, and ponderosa pine; cliffsides, hanging gardens; 4,200-6,000 feet	Cedar City Ranger District: Kolob Terrace
Neese's pepperplant	perennial herb; white flowers open May-early June	dry, sandy sites, mostly open with little cover; pink and white Wasatch Limestone and Navajo Sandstone; 7,300-9,000 feet	Escalante Ranger District
Paria breadroot	perennial herb; cream to yellow-white flowers with purple open June-July	ponderosa pine or pinyon-juniper; calcerous or sandy soils on Wasatch Limestone, Navajo Sandstone, and Quaternary alluvium; 5,500-8,000 feet	Powell Ranger District (suspected)
Red Canyon beardtongue	perennial herb; blue to violet flowers open May-early June	pine needle duff on clay loam soils of calcerous, gravelly slopes and rock slides along pink Wasatch Limestone; 6,900-8,300 feet	Powell Ranger District: Bryce Canyon and Red Canyon
Little (aquarius) penstemon	perennial herb; blue flowers open June-Aug	assoc with sagebrush-grass, pinyon-juniper, and spruce; tertiary volcanic gravels in sandy, gravelly loam; 8,200-11,500 feet	Escalante Ranger District: Aquarius Plateau between Cyclone and Big Lake
Pinyon penstemon	perennial herb; blue-violet flowers open May-	pinyon-juniper; gravelly soils and volcanic	Pine Valley Ranger District: Pine Valley

Species[1]	Description[1]	Habitat[1]	Dixie National Forest Occurrence[1]
	early June	rubble of foothills; 5,620-6,700 feet	Mountains
Arizona willow	small perennial shrub; young stems are bright red; catkins have brown to black pubescent scales	wet meadows, streamsides, and cienegas on volcanic soils; above 8,500 feet	Cedar City and Powell Ranger Districts: Sidney Valley, Rainbow Meadows, and East Fork Sevier River
Podunk goundsel	perennial herb; yellow discoid flowers open June-Aug	assoc with bristlecone pine, spruce, fir, other conifers; talus slopes of Claron Limestone; 8,000-10,000 feet	Cedar City, Powell, and Escalante Ranger Districts: Markagunt and Paunsaugunt Plateaus and Canaan Mountain
Peterson catchfly	perennial herb; bright pink flowers open late July-Aug	assoc with ponderosa pine, aspen, and spruce-fir; open calcerous limestone and igneous gravels; 7,000-11,200 feet	Cedar City, Powell, and Escalante Ranger Districts
Rock tansy	perennial herb; yellow flowers open in July	occurs with bristlecone pine on exposed slopes of Cedar Breaks Limestone; 5,000-7,800 feet	Powell Ranger District Garfield County only

[1] Information taken from Rodriguez 2008, UNPS 2007, Welsh et al. 1987, and USFS 1995d

3.6.4 Management Indicator Species

Management Indicator Species (MIS) are species associated with certain vegetation types that are used in the planning process to monitor certain habitats on the Dixie National Forest. MIS are selected based on five criteria: 1) the species must have a strong, but not exclusive affinity for one vegetation type; 2) the vegetation type is key habitat to the life cycle of the species; 3) the species must be sensitive to habitat alteration; 4) the species must be highly visible and in adequate numbers as to make monitoring easy; and, 5) the species must be somewhat representative of all species that utilize the vegetation type. Some MIS species are designated due the high level of interest given them by the public, including Bonneville cutthroat trout, other trout, and big game.

MIS on the Dixie National Forest include trout and other fish species (Bonneville and Colorado River cutthroat, other cutthroat, rainbow, brook, and brown trout, southern leatherside, and Virgin spinedace), mule deer, Rocky Mountain elk, northern goshawk, wild turkey, and northern flicker. MIS species are presented with associated habitats in Table 3.6-12 and described in more detail below.

Table 3.6-12 MIS Species and Associated Habitats on the Dixie National Forest

MIS	Associated habitat
Bonneville cutthroat trout	Headwater streams
Colorado River cutthroat trout	
Cutthroat trout (other spp.) *Onychorhynchus clarki*	Streams, rivers, lakes, and reservoirs
Rainbow trout Oncorhynchus mykiss	

Brook trout *Salvelinus fontinalis*	
Brown trout *Salmo trutta*	
Virgin spinedace	Streams
Southern leatherside	
Rocky Mountain Elk *Cervus canadensis*	Grass-forb, sapling to mature aspen, sapling to old growth conifer
Mule deer *Odocoileus hemionus*	Grass-forb, sagebrush, mountain brush, pinyon-juniper, sapling to mature aspen, sapling to mature conifer
Northern goshawk	Riparian trees, mature aspen, mature to old growth conifer
Northern flicker *Colaptes auratus*	Mature aspen, mature conifer
Wild turkey *Meleagris gallopavo*	Mountain brush, pole to mature aspen, mature to old growth conifer

Sources: USFS 1986; USFS 2010a

3.6.4.1 Aquatic MIS

In June 2010 the Dixie National Forest amended their LRMP to eliminate aquatic macroinvertebrate biotic condition index (BCI) as a designated MIS, eliminate the use of the BCI as a designated monitoring method, include additional fish species as aquatic MIS, and eliminate obsolete references to directives. Changes to the LRMP are listed in the Environmental Assessment (USFS 2010a).

Six out of eight aquatic MIS species are trout. In general, the key components of trout habitat include cool, clear water; deep pools and cover, typically associated with well-vegetated stream banks and large woody debris; floodplain habitat for rearing and velocity refugia; and the availability of suitable spawning gravels, which should include a minimal amount (<25%) of fine substrate less than 6.35 mm in diameter (Sigler and Sigler 1996, Harig and Fausch 2002, Chapman 1988, and Magee et al. 1996). Spawning is influenced primarily by water temperature and flow, which are influenced by latitude and elevation. Generally, the distance trout migrate to spawn is short and the post-spawning mortality rate is high (Sigler and Sigler 1996).

Lack of recent fish population data on most streams in the Dixie National Forest makes population and MIS habitat assessments difficult, as baseline data on the Dixie National Forest is still being accumulated. The UDWR was collecting the bulk of fisheries data until 2003 with little input from the Dixie National Forest. From 2003 to present, Dixie National Forest personnel have collected fish population data at various sites across the Dixie National Forest in cooperation with UDWR. Monitoring is expected to continue at 10 to 20 streams/stations per year, allowing the Dixie National Forest to revisit all major stream fisheries every four to seven years and determine population trends.

The Sanford Fire affected Cottonwood, Deep, and Deer Creeks on the Powell Ranger District and the Sequoia Fire affected several tributaries of Ash Creek on the Pine Valley Ranger District, where Bonneville cutthroat trout were located (see Section 3.6.3). Aquatic habitat condition data from 2005 indicated that surveyed streams on the Dixie National Forest where the fire occurred (i.e., Antimony, Cottonwood, Deep, Deer, Mill, and Water Canyon Creeks) were lacking invertebrate diversity by several metrics, including low total taxa richness, few

Ephemeroptera/Plecoptera/Trichoptera taxa (mayflies/stoneflies/caddisflies), virtually no longer lived taxa, low predator richness and abundance, and high dominance of relatively few taxa. Most stream sites were found to be dominated by black flies and mayflies, two taxa that tend to colonize streams after disturbances (Wisseman 2006) and monopolize resources. Surveys of Deep, Deer, and Cottonwood Creeks in 2005 found that none of the streams met Land and Resource Management Plan standards for fish and riparian habitat conditions (USFS 2005). Additional streams were surveyed in 2006 (i.e., Harmon and Leap Creeks) and similar conditions were found in the analysis (Wisseman 2007). Trout reintroductions thus far appear successful in at least Deep Creek, Mill Creek, Harmon Creek, and South Ash Creek (Section 3.6.3). Other native fish and aquatic species in these areas are recovering naturally.

BONNEVILLE CUTTHROAT TROUT

Bonneville cutthroat trout are discussed in Section 3.6.3 (Sensitive Species).

COLORADO RIVER CUTTHROAT TROUT

Colorado River cutthroat trout are discussed in Section 3.6.3 (Sensitive Species).

CUTTHROAT TROUT

Cutthroat trout have the greatest North American distribution of all western trout species (Behnke 1992) and are economically important to the fishing industry and for consumption over virtually all of their range (Rodriguez 2008). There are four subspecies of cutthroat trout in Utah, three of which are native (Sigler and Sigler 1996; UNHP 2007). Inland cutthroat occur in high mountain lakes and streams. Most cutthroat trout evolved apart from rainbow and redband trout, and lack isolating mechanisms that would allow them to live with other trout (including nonnative species) without hybridizing. Non-native trout, including rainbow, brown, and brook trout, impact native cutthroat trout primarily through hybridization (rainbow trout) and competition (brown and brook trout). As a result, cutthroat trout are often limited to small headwater streams; however, prior to the introduction of non-native fishes, cutthroat trout were found throughout streams and large river systems (Quist and Hubert 2004). In general, cutthroat trout function better than non-native species in relatively cold, high-altitude headwaters (Behnke 1992). Cutthroat trout occur on all four ranger districts of the Dixie National Forest.

RAINBOW TROUT

The native range of rainbow trout includes drainages of the Pacific coast from Alaska to Mexico. The species is not native to Utah and has been introduced to cold waters throughout the state (Sigler and Sigler 1996). Rainbow trout feed primarily on invertebrates and other fishes. Stream-resident rainbow trout are primarily drift feeders, but will also feed on the surface. Lake-resident rainbow trout are more often piscivorous (fish-eating) than stream-resident trout (Sigler and Sigler 1996). Rainbow trout spawn in the spring, similar to cutthroat trout, and as a result readily hybridize with native cutthroat trout. Because the species is popular with anglers and most Utah rainbow trout do not reproduce in the wild, the UDWR stocks millions of rainbow trout in Utah waters each year (UNHP 2007). To reproduce, rainbow trout require a high amount of dissolved oxygen in the water and temperatures between 7 and 17 ºC. Where rainbow and cutthroat trout co-exist, similarities in spawning time and location often lead to the production of rainbow-cutthroat hybrids (UNHP 2007). Rainbow trout occur on all four ranger districts of the Dixie National Forest.

BROOK TROUT

Brook trout are a coldwater char native to the eastern United States and Canada. Brook trout are more suited to high, cold lakes, and small, cold streams than either rainbow or brown trout (Sigler and Sigler 1996). As a result, they have been stocked in high mountain lakes and streams across Utah and have become established (UNHP 2007). High mountain lakes on the Boulder Mountain area of the Escalante Ranger District support popular recreation fisheries for brook trout. Brook trout are voracious feeders and are omnivorous, feeding on drifting invertebrates in streams and on zooplankton in lakes. Brook trout spawn in late fall and early winter and can successfully reproduce in a small lake with no inlet or outlet (Sigler and Sigler 1996). While brook trout will prey on native cutthroat trout, they are not usually piscivorous. Brook trout more often displace cutthroat trout populations via interference competition (Quist and Hubert 2004). Brook trout are present on all four ranger districts of the Dixie National Forest.

BROWN TROUT

Brown trout are a largely piscivorous fish native to Europe and western Asia. They were introduced to Utah prior to 1900 (Sigler and Sigler 1996). Brown trout are a highly adaptable species present in most streams and reservoirs at the foot of many mountain ranges (Rodriquez 2004). In Utah, the species has been established in many cold-water areas and is a popular sport fish (UNHP 2007). Brown trout prefer cold water with temperatures up to 26ºC, and habitat areas with boulders, cobble, logs, rootwads, and overhead cover. Although they prefer cool lakes and streams, brown trout do not normally inhabit these areas, but are present in many of the lower elevation waters that can be relatively warm and are sometimes polluted. Brown trout are more tolerant of warm water and degraded habitat than other native or non-native salmonids, and are often the only trout present in these areas. Brown trout do not hybridize with native cutthroat trout. However, brown trout exert considerable predation pressure on native cutthroat trout (Quist and Hubert 2004). Brown trout are present on all four ranger districts of the Dixie National Forest.

SOUTHERN LEATHERSIDE

Southern leatherside are discussed in Section 3.6.3 (Sensitive Species).

VIRGIN SPINEDACE

The current distribution of Virgin spinedace is within the mainstem Virgin River and eleven of its tributaries including Moody Wash and Ash Creek, which is downstream of the Dixie National Forest. The largest populations occur in the upper mainstem Virgin River above Quail Creek diversion and in drainages of the Santa Clara River and Beaver Dam Wash (UDWR 2002).

Virgin spinedace are typically found in clear, cool, swift streams that have interspersed pools, runs, and riffles. They seem to prefer pools with some kind of protection such as undercut banks, boulders or debris. In Beaver Dam Wash, for example, Virgin spinedace utilize narrow, shallow runs with large amounts of emergent vegetation, and in the North Fork of the Virgin River, they most often occupy quiet pools (UDWR 2002).

Regular UDWR population monitoring has occurred at eleven different sites for approximately 14 years. Spinedace density estimates have been highly variable over the period of record. Tributary populations such as Ash Creek are relatively susceptible to major fluctuations in population size based on flow and habitat changes. Prior to the drying of Ash Creek in summers 2007 and 2008, Virgin spinedace were found in relatively high numbers from Krom

Diversion to the Virgin River confluence (UDWR 2008b). The only confirmed presence of Virgin spinedace on the Dixie National Forest is in Moody Wash.

Within the 23,000 acres of suitable fisheries habitat on the Dixie National Forest, suitable occupied habitat for Virgin spinedace includes 786 acres on the Pine Valley Ranger District (Moody Wash).

3.6.4.2 Big game

Big game (Rocky Mountain elk and mule deer) are the most visible wildlife on the Dixie National Forest and valuable to recreation resources (Section 3.4); as such they are the focus of several leasing options and conservation measures on the Dixie National Forest, including Dixie National Forest Standards and Guidelines (USFS 1986). The area occupied by big game throughout the year and over an entire life cycle is large because many animals migrate between ranges and move long distances in search of resources or suitable habitat. The area covered by big game often includes many different habitat areas that serve as seasonal ranges, including crucial and substantial summer range, crucial and substantial winter range, and calving (elk) or fawning (mule deer) areas (Table 3.6-13). Calving and fawning areas are relatively abundant on the Dixie National Forest and thus have no associated leasing options; these areas are discussed briefly.

Table 3.6-13 Acres of Mapped Big Game Habitats on the Dixie National Forest

	Pine Valley	Cedar City	Powell	Escalante	TOTAL[1]
Big game winter range	17,967	33,156	49,587	69,759	170,468
Big game summer range	140,142	95,573	148,289	19,214	403,218
Elk calving range	0	288,695	225,521	19,214	533,429
Mule deer fawning range	394,126	364,004	326,397	316,902	1,401,429

[1] May not add up exactly due to rounding

Road density is particularly relevant to big game due to their wide-ranging movements. Road density is discussed below, followed by life history and habitat information for Rocky Mountain elk and mule deer.

ROAD DENSITY

On average, there are about 1.5 miles of road per square mile on the Dixie National Forest (USFS 2004d). However, in several subwatershed areas (6th-level Hydrologic Unit Code) of the Forest, Open Motorized Road Density (OMRD) is above the USFS (1986)-recommended threshold of two miles per square mile of habitat. Above this threshold, habitat effectiveness for big game is thought to decrease. The subwatersheds with the greatest OMRD per square mile of habitat are located in the southern and central Cedar City Ranger District (10 out of about 40 subwatersheds with greater than three miles of road per square mile of habitat) and in the southern Powell Ranger District (four out of about 35 subwatersheds with greater than three miles of road per square mile of habitat). One subwatershed on the Escalante Ranger District (Clay Creek 160300020401) is also above the threshold. These relatively densely roaded areas overlap areas of mule deer (Cedar City, Powell Ranger Districts) and elk (Escalante Ranger District) winter range as well as mule deer summer range (Cedar City, Powell Ranger Districts).

SUMMER AND WINTER RANGES

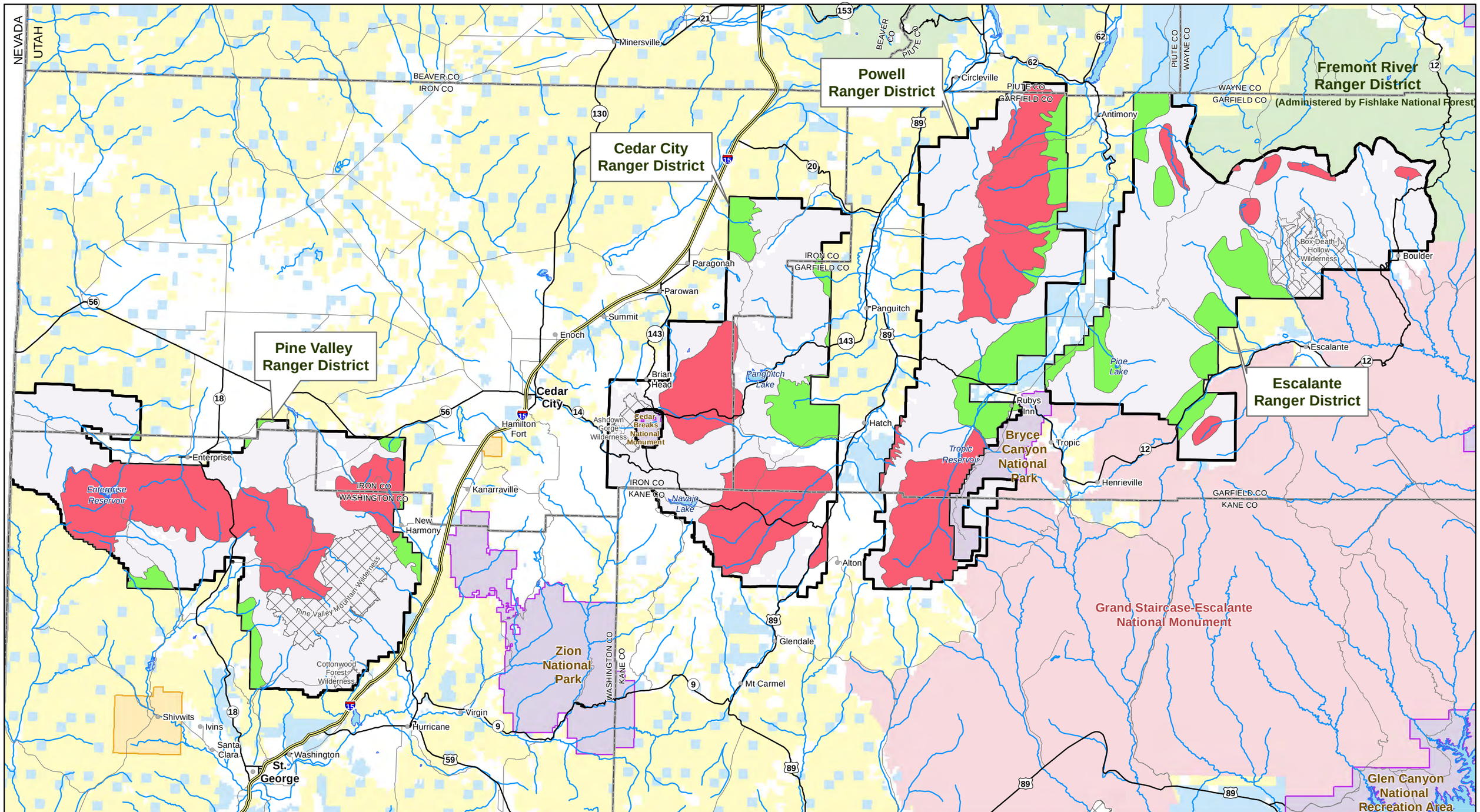
Winter range for deer and elk on the Dixie National Forest covers approximately 170,000 acres, mainly on the Escalante and Powell Ranger Districts (Table 3.6-13; Figure 3.6-4). Summer range for deer and elk covers over 400,000 acres and occurs on the Pine Valley (35%), Cedar City (25%), Powell (35%), and Escalante Ranger Districts (5%) (Table 3.6-13; Figure 3.6-4).

ROCKY MOUNTAIN ELK

Elk are migratory ungulates that formerly ranged over much of North America. In general, elk require mature, semi-open stands of deciduous and conifer forest, and dense brush understory for feeding, escape, and thermal cover. Elk habitat also includes foothills, plains, valleys, mountain meadows in summer, and travel corridors, although some elk herds do not migrate. In general, elk prefer to live within one-half mile of a water source (UDWR 2005c). Elk are herbivorous, grazing and browsing in herbaceous and brush stages of forests as well as open areas such as meadows, open parklands, and riparian areas. Major predators of elk include humans, mountain lions, and coyotes. Competition for food may occur with domestic livestock, wild horses, and mule deer (Rodriguez 2008).

Seasonal movements and calving areas: Elk usually migrate from high mountain meadows to lower elevations when snow cover increases and food becomes less available, seeking out areas within river bottoms and canyons, and lower mountain meadows. Migration between seasonal ranges generally occurs along well-established routes (USFS 1995b:23). Calving occurs in areas with available water and brushy vegetation that provides dense cover near openings and seclusion from human disturbance. Elk calving areas occur on 533,429 acres, mainly within the Cedar City (54%) and Powell (42%) Ranger Districts (Table 3.6-13). Elk calving occurs from April to June, often in aspen groves, during which time elk are sensitive to human activities. Elk have specific habitat needs for calving, and calving areas are slightly more sensitive than deer fawning areas (USFS 1995b).

UDWR population objectives: Elk herds have increased dramatically in Utah over the past 30 years, although in the past 10 years elk herds have been relatively stable (UDWR 2005c), and in recent years have declined in response to UDWR management strategies aimed at reducing the number of elk in some management units (Rodriguez 2008). Elk habitat occurs across the entire Dixie National Forest and elk are well distributed. The six herd units on the Dixie National Forest are healthy and close to objectives (UDWR 2006c). Elk herds are monitored on hunt units within all four ranger districts by UDWR. Populations that are above objectives are managed by hunting (USFS 2004d).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.6-4
Big Game Habitat

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Mule Deer & Rocky Mountain Elk

- Crucial Summer Range
- Crucial/Substantial Winter Range

Miles: 0 4 8 12 16

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

MULE DEER

Mule deer are adaptable ungulates that occur in wide variety of habitats. Mule deer occur in early- to intermediate-staged coniferous forests, desert shrublands, chaparral, and grasslands, preferring habitats with a mosaic of vegetation stages that provide cover, open areas, and water (Rodriguez 2008). Mule deer habitat is nearly always characterized by areas of thick brush or trees interspersed with small openings (UDWR 2003). Mule deer are herbivorous, grazing and browsing on new growth of shrubs, forbs, some grasses, and salt or mineral licks. Major predators of mule deer include humans, mountain lions, and coyotes. Competition for food may occur with domestic livestock, wild horses, wild pigs, and black bears (Rodriguez 2008).

Seasonal movements and fawning areas: Mule deer often migrate from lower to higher elevations in spring and summer where water and forage are more available. In winter, mule deer concentrate at lower elevations. Migration between seasonal ranges generally occurs along well-established routes (USFS 1995b:23). Fawning occurs in moderately dense shrublands and forests, dense herbaceous stands, and high-elevation riparian and mountain shrub habitats with available water and forage. Fawn production is closely tied to the abundance of succulent, green forage during spring and summer months (UDWR 2003). Deer fawning areas occur on all ranger districts of the Dixie National Forest and cover 82 percent (1,401,429 acres) of its area (Table 3.6-13). Mule deer fawning on the Dixie National Forest occurs during spring and summer, between 16 May and 1 July, during which time mule deer are sensitive to human activities and disturbance.

UDWR population objectives: Mule deer are the most important game animal in Utah (see Section 3.4, Recreation Resources). Mule deer populations have been declining for the past 30 years, due mainly to loss and degradation of habitat (UDWR 2003), although numbers in the past four years have increased (Rodriguez 2008). Mule deer habitat occurs across the entire Dixie National Forest and mule deer are well distributed. Populations have increased in all six management units on the Dixie National Forest as of 2006 (UDWR 2006c). As for elk, mule deer herds are monitored (populations estimated) on all four ranger districts by the Division of Wildlife Resources and managed by hunting (USFS 2004d).

3.6.4.3 Birds

NORTHERN GOSHAWK

Northern goshawks occur throughout the Dixie National Forest and are discussed in Section 3.6.3.

WILD TURKEY

Wild turkeys are large game birds that use distinct habitats during different periods of the year. Preferred winter habitat contains at least 50 percent mature forest, either ponderosa pine or cottonwood, depending on the subspecies of wild turkey (Merriam's and Rio Grande, both found in southern Utah). Summer and fall habitats consist of mowed hay fields, grazed pastures, glades, or open woods. Nesting habitat is varied, but hens usually nest near the edges of old fields, along trails, in hay fields, or in patches of briar or similar vegetation, and close to a source of permanent water. Nests are frequently abandoned if disturbed (Rodriguez 2008).

Large areas of high value habitat for Merriam's turkey exist in the Pine Valley Mountain Wilderness Area, in the southwest corner of the Powell Ranger District, and in the southwest portion of the Cedar City Ranger District. Critical habitat covers most of the central portion of

the Escalante Ranger District. The southwest corner of the Cedar City Ranger District also is included in a larger critical nesting area. Critical habitat for the Rio Grande subspecies is located off the Dixie National Forest between the Escalante and Powell Ranger Districts and all across the Pine Valley Ranger District (USFS 1995b:25). Wild turkeys occur on all four ranger districts of the Dixie National Forest. Numbers of both subspecies are either stable or have increased over the past 10 years. The UDWR manages wild turkey populations on the Dixie National Forest (USFS 2004d).

NORTHERN FLICKER

Northern flicker is a migratory woodpecker that excavates its nest in dead tree trunks, dead parts of live trees, or in telephone poles. Northern flickers have been found in a variety of habitats, including wooded areas with stands of dead trees, open areas, forest edges, clear-cuts, burns, agricultural lands, and residential areas. Flickers feed mainly on ants, but will consume a variety of other insects. This species migrates to the southern part of its range in the US and to northern Mexico for winter, and has also been found on Grand Cayman, Cuba, and the Nicaraguan highlands (Rodriguez 2008). Northern flickers occur on all four ranger districts of the Dixie National Forest. Approximately 112 line transects were surveyed in 2003, locating 287 northern flickers. In 2004, 110 line transects were surveyed, locating 329 flickers. The end of a five-year drought may have contributed to the flicker population increase in 2004 (USFS 2004d). In 2005, 213 flickers were detected (USFS 2005), in 2006 430 were detected (USFS 2006c), in 2007 559 were detected (USFS 2008b), in 2008 558 were detected (USFS 2009b), and in 2009 194 were detected (USFS 2010c).

3.6.5 Pine Valley Ranger District

Downstream impacts to endangered fish (woundfin and Virgin River chub) that occur in the Virgin River are possible only as a result of activities within this Ranger District, specifically within streams that drain the Pine Valley Mountains into the Virgin River (via Ash Creek). Suitable habitat for California condors and Mexican spotted owls also occurs within the Pine Valley Mountains.

Rainbow trout, brook trout, and brown trout have been introduced onto the Pine Valley Ranger District as sport fisheries. Bonneville cutthroat trout were discovered in 1973 in two tributaries to the Santa Clara River: Water Canyon and Reservoir Canyon creeks (Hepworth et al. 1997, USFWS 2001), and since their discovery, fish from these two creeks have been used to establish populations in eight other Pine Valley Mountain streams (Table 3.6-12). Area populations are stream residents with good recruitment and considered “conservation populations,” meaning no risk of hybridization with other salmonids and limited disease risk. While most populations are isolated, there is connectivity between Leeds Creek, Horse Creek, Pig Creek, and Spirit Creek; as well as between South Ash Creek, Harmon Creek, and Mill Creek (USFWS 2001). Leap Creek, Mill Creek, Harmon Creek, and South Ash Creek are recovering from the 2002 Sequoia Fire and occupied mileage is known to be less than indicated in Table 3.6-14 (thus, for these streams, occupied length represents available habitat).

Table 3.6-14 Streams on the Pine Valley Ranger District with Bonneville Cutthroat Trout

Stream	Occupied Stream Length (mi)[1]	Fish/mi
Leeds Creek	7.1	43
Horse Creek	0.9	19
Pig Creek	0.9	26
Spirit Creek	0.9	24
South Ash Creek	0	0

Harmon Creek	0	0
Mill Creek	2.2	26
Leap Creek	0	0
Reservoir Canyon	2.0	118
Water Canyon	0.7	8

[1]Data obtained from Hadley et al. (2010)

Virgin spinedace occurs downstream from the Pine Valley Ranger District but not within the Forest boundary. Sensitive wildlife found on the Pine Valley Ranger District include: Townsend's big-eared bat, bald eagle (wintering), flammulated owl, and northern goshawk. Three-toed woodpeckers are expected to occur in the Pine Valley Wilderness Area although surveys have not yet been conducted. This ranger district contains large areas of sensitive plant species occurrences and habitat primarily in the eastern region of the ranger district, the Pine Valley Mountains, and the Pine Valley Mountain Wilderness Area. Additional smaller areas of sensitive plant species habitat occur north, west, and south of the Pine Valley Mountains (Figure 3.6-3).

3.6.6 Cedar City Ranger District

Utah prairie dog colonies occur in the Cedar City Ranger District. Suitable habitat for California condors and Mexican spotted owls occurs along the western and southern edges of this ranger district and condors have been observed here.

Rainbow trout and brown trout form the base of a popular recreational fishery in several streams and reservoirs on the Cedar City Ranger District, including Duck Creek, Panguitch Lake, and Navajo Lake. Conservation populations of Bonneville cutthroat trout exist within the Threemile Creek drainage on the east side of the ranger district near Panguitch; occupied streams include Threemile Creek (5.0 occupied stream miles), Delong Creek (2.1 occupied stream miles), and Indian Hollow (0.9 occupied stream miles; Hadley et al. 2010). Additional habitat is available in some of these streams. BCT have also been reintroduced to Sandy Creek; however their present status in this previously fishless stream is unknown. Southern leatherside are present in Bear Creek (1.6 miles), Butler Creek (0.9 miles), and Panguitch Creek (11.4 miles), with historic records in Asay, Duck, and Mammoth Creeks.

Sensitive wildlife found on the Cedar City Ranger District include Townsend's big-eared bat, spotted bat, bald eagle (winter and summer, including nesting, on Panguitch Lake), peregrine falcon, northern goshawk, greater sage-grouse, three-toed woodpecker, and flammulated owl. This ranger district contains large areas of sensitive plant species occurrences and habitat: a narrow border exists along the edge of the Markagunt Plateau along the southern edge of the ranger district and includes a small region of the Ashdown Gorge Wilderness Area, and in the northern region of the ranger district, another area of potential habitat exists around Twin Peaks (Figure 3.6-3).

3.6.7 Powell Ranger District

Utah prairie dog colonies are most abundant in the Powell Ranger District. Suitable habitat for California condors occurs throughout the high plateaus of this ranger district. Suitable habitat for Mexican spotted owls occurs mainly in the southern half of the ranger district.

Non-native fish on the Powell Ranger District include rainbow trout, brook trout, cutthroat trout, and brown trout. Tropic reservoir on the East Fork Sevier River supports a popular recreational

fishery for rainbow trout. Prior to the Sanford Fire, two known conservation populations for Bonneville cutthroat trout existed on the ranger district: one in Left Fork Sanford Creek and one in Deep Creek (six miles of occupied habitat in Deep Creek prior to the Sanford Fire; USFWS 2001). The fire extirpated populations in both creeks. In 2005, 2006, and 2008, UDWR moved 40 to 50 Bonneville cutthroat trout from the rescued population in Tenmile Creek into Deep Creek upstream of the Dixie National Forest boundary. The Powell Ranger District also contains suitable boreal toad habitat, within two East Fork Sevier River subwatersheds upstream of Tropic Reservoir. As of 2010 the occupied distribution of BCT in Deep Creek is thought to be approximately 3.0 miles (Hadley et al. 2010). Southern leatherside occur in the East Fork Sevier River immediately downstream of Tropic Reservoir.

Sensitive wildlife on the Powell Ranger District include bald eagle (wintering), peregrine falcon, northern goshawk, greater sage-grouse, three-toed woodpecker, and flammulated owl. Sensitive plant species occurrences and habitat are throughout the southern half of this ranger district along the Paunsaugunt Plateau (Figure 3.6-3).

3.6.8 Escalante Ranger District

Mexican spotted owls are most likely to occur in this ranger district, which contains the only designated critical habitat and PAC for the species on the Dixie National Forest. California condors are also most likely to occur in this ranger district, as it contains the largest amount of suitable “rim” habitat. Some Utah prairie dog colonies also occur in this ranger district.

Non-native fish, including rainbow trout, brown trout, brook trout, and tiger trout have been introduced and presently constitute popular recreational fisheries in the Escalante Ranger District. High mountain lakes on Boulder Mountain are a popular recreation fishery for brook trout. Three known populations of Bonneville cutthroat trout exist: in Center Creek (4.8 occupied stream miles), Ranch Creek (2.9 occupied stream miles), and Rob’s Reservoir (2 acres).

There are eight populations of Colorado River cutthroat trout in streams located entirely on the Escalante Ranger District (Table 3.6-15) as recognized by Hirsch et al. (2006). All populations are in streams that drain into the Escalante River System. Four other conservation populations occur in lakes or reservoirs on the Escalante Ranger District, including Dougherty Lake (2.75 acres), Tall Four Reservoir (0.7 acres), Long Willow Bottom Reservoir (2.9 acres), and Round Willow Bottom Reservoir (7.1 acres). The latter two Reservoirs are also stocked with hybrid sport fish (see Section 3.5).

Sensitive wildlife that can be found on the Escalante Ranger District include: bald eagle (wintering), northern goshawk, greater sage-grouse, three-toed woodpecker, peregrine falcon, and flammulated owl. Suitable habitat for boreal toad is also present in the Boulder Creek drainage. This habitat has not been mapped.

This ranger district contains relatively large areas of sensitive plant species occurrences and habitat. In the southwestern region of the Escalante Mountains, habitat occurs primarily along the western side, while in the northwestern region, habitat occurs along the Aquarius Plateau. Habitat also occurs in most of the eastern region of this ranger district, which contains the Boulder Mountains and the Box Death Hollow Wilderness Area (Figure 3.6-3).

Table 3.6-15 Streams and Reservoirs on the Escalante Ranger District with Colorado River Cutthroat Trout

Stream/Reservoir	Occupied Habitat mi (acres)[1]	Habitat[2]	Fish/mi
Water Canyon	3.0	Poor	44
White Creek	1.7	Good	93
Twitchell Creek	2.2	Good	90
Pine Creek	6.8	Excellent	41
West Branch Pine Creek	2.5	Excellent	56
East Fork Boulder Creek	3.8	Good	49
West Fork Boulder Creek	6.9	Excellent	49

[1] Data obtained from Hadley et al. 2008

3.7 Water and Watershed Resources

3.7.1 Introduction

Water and watershed resources on the Dixie National Forest occur within one of two geographic regions: the Colorado Plateau (primarily in the Virgin River and Escalante River watersheds) or the Great Basin (primarily in the Sevier River watershed). The majority of the Powell and Cedar City Ranger Districts are located in the Great Basin, with only very small portions located in the Colorado Plateau. The Pine Valley and Escalante Ranger Districts are more evenly distributed between the Great Basin and the Colorado Plateau. Watershed boundaries for the main drainages (Hydrologic Unit Code 10) on the Dixie National Forest are given in Figures 3.7-1 through 3.7-4. According to Dixie National Forest GIS data, there are approximately 6,243 miles of streams on National Forest System land within the boundaries of the Dixie National Forest. The GIS metadata defines streams as “linear water features” derived from 1:24,000 Forest Service Cartographic Features Files and validated by Forest hydrologists. This category includes perennial and intermittent streams. In addition, there are 1,971 mapped springs and over 1,079 lakes and reservoirs. The lakes and reservoirs cover approximately 3,909 acres (Table 3.7-1).

There has not been a Forest-wide delineation of wetlands on the Dixie National Forest and the majority of floodplains and riparian areas have not been mapped. As a result, GIS data does not exist for these resources. Commonly, the Dixie National Forest will identify riparian and wetland areas of concern on an activity or project-specific basis. Riparian and wetland areas of concern are identified using a standard set of guidelines contained in Forest Service Handbook 2509.16. The guidelines specify that site-specific stream morphology or riparian conditions may be used to identify areas of concern, or a standard buffer may be applied based on the type of waterbody. The standard buffers specified are: a 300-foot buffer measured out from each side of the stream channel centerline (600 feet total width) for perennial fish bearing streams and a 150-foot buffer measured from each side of the stream channel centerline (300 feet total width) for perennial non-fish bearing streams, wetlands, ponds, lakes, reservoirs, springs, or intermittent streams. To simplify the analysis and ensure that water and watershed resources receive adequate protection, a 300-foot buffer was applied to all waterbodies in the Dixie National Forest’s GIS database, including perennial and intermittent streams, lakes, reservoirs, and springs. For streams, the buffer is measured out from the stream’s centerline as described above and from the water’s edge on lakes and reservoirs. The GIS data only depicts springs as one-dimensional points and, as a result, the buffer around springs is a circular buffer around the mapped point with a radius of 300 feet (600 feet in diameter). As most streams on the Dixie National Forest are steep mountain streams, the 300-foot buffer should adequately encompass

all riparian areas and the majority of floodplains (Chris Butler, Hydrologist, Dixie National Forest, Personal Communication).

A 300-foot buffer is also applied to wetlands (measured out from the edge of the wetland). However, as all wetlands have not been mapped, their distribution, or the acreage that would be encompassed by the 300-foot buffer, is not represented in the maps, tables, or figures presented in this EIS. Due to the steep topography and arid nature of the area, it is likely that wetlands would be located near waterbodies. As a result, many of the wetlands would be contained within the buffer applied to the other types of waterbodies for which GIS data is available. As explained in Chapter 2 (Section 2.3.1), the 300-foot buffer and associated stipulations would be applied to any wetlands outside the mapped 300-foot buffer that are located during future site-specific analysis. Similar to unmapped wetlands, if future site-specific analyses locate riparian areas or floodplains that extend beyond 300-feet from a mapped waterbody, a larger buffer would be applied.

With a 300-foot buffer applied to all waterbodies in the Dixie National Forest's GIS database, there are approximately 410,818 acres designated for the protection of water and watershed resources (Table 3.7-1). In this EIS, the acreage contained within the 300-foot buffer serves as a proxy to spatially represent the actual watershed resource components. This is done because, as mentioned above, the distribution of wetlands, floodplains, and riparian areas on the Dixie National Forest has not been mapped.

Table 3.7-1 Streams, Lakes, Reservoirs, and Springs on the Dixie National Forest and Total Acres within the 300-foot Buffer

Ranger District	Streams (miles)	Lakes and Reservoirs Number (acres)	Springs (number)	Area covered by 300-foot buffer (acres)
Pine Valley	2,080.7	196 (612.4)	786	138,781
Cedar City	1,454.1	372 (1,925.2)	583	83,185
Powell	1,389.8	200 (224.9)	383	96,077
Escalante	1,318.9	311 (1,147.1)	219	92,775
TOTAL	6,243.5	1,079 (3,909.6)	1,971	410,752

3.7.2 Watershed Resources

Wetlands, floodplains, and riparian areas are expected to overlap in many areas and perform similar ecosystems functions; however, some functions are specific to each. To highlight the differences and similarities, each resource will be described separately in further detail. In addition, stream channel morphology is discussed in conjunction with the discussion on floodplains.

3.7.2.1 Wetlands

Properly functioning wetlands regulate the quality and quantity of water delivered to aquatic ecosystems, provide areas of high biological productivity, and provide wildlife habitat (EPA 2001). Wetlands are usually associated with slow moving or stagnant water, which helps improve water quality by providing depositional areas for sediments, organic matter and other pollutants, and prevents these materials from entering lakes and streams. The slow depositional environment associated with wetlands also buffers adjacent waterbodies from periods of high flow by capturing the water and slowly releasing it during dry periods. The storage and release of water during dry periods provides higher base flows in adjacent streams, which improves habitat conditions for aquatic organisms. Further, due to the combination of

shallow water and large amounts of deposited organic matter and nutrients, wetlands are one of the most biologically productive ecosystems on earth (EPA 2001). The high productivity includes a large variety of plant life, which provides the structure and complexity needed by aquatic organisms, terrestrial wildlife, and birds. Wetland vegetation also absorbs and removes excess nutrients that would otherwise be released to lakes and streams.

Wetlands on the Dixie National Forest can be grouped into three general classes: riverine, lacustrine, and palustrine (Brinson et al. 1995, Cowardin et al.1979). Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. As a result, the distribution of riverine wetlands on the Dixie National Forest would often overlap with riparian and floodplain habitats. Lacustrine wetlands occur in the low-lying areas directly adjacent to lakes and reservoirs, and palustrine wetlands consist of all other wetlands not adjacent to streams or lakes. On the Dixie National Forest, palustrine wetlands are usually associated with small depressions and characterized by shallow surface water depths and emergent vegetation. Examples of palustrine wetlands include wet meadows, sedge-dominated fens, seeps, and small ponds (USFS 1995a). Due to a relatively dry climate and steep topography, most wetlands on the Dixie National Forest are typically small and are primarily riverine and lacustrine systems restricted to narrow bands bordering streams, small lakes, ponds, and reservoirs. As a result, it is assumed that the majority of wetlands would be within the 300-foot buffer applied to streams, lakes, reservoirs, and springs. However, wetlands outside of the buffer mapped in this analysis would also have a 300-foot buffer applied during administration of any future lease as described in Section 3.7-1.

3.7.2.2 Floodplains

Stream channels generally consist of an active channel and associated floodplains. The morphology of an active stream channel may change beyond its normal range of conditions due to natural or human-caused perturbations to the stream or watershed conditions. For example, artificially high flows or flow velocities can lead to channel incision, bank erosion, channel widening, and armoring of the streambed. Decreases in stream flow and/or increases in sediment supply can lead to channel aggradation and sedimentation of the streambed that can have negative impacts on aquatic habitat features such as pools, interstitial spaces, and spawning gravels. Floodplains are flat-lying areas immediately adjacent to the active channel that are formed by water that overflows the active channel during periods of high flow (Dunne and Leopold 1978). The connection between stream channels and floodplains is extremely important and has a profound influence on both the geomorphology and ecology of streams. By providing overflow areas during high flow, floodplains reduce stream velocities in the active channel and reduce erosion. Inundated floodplains also provide essential rearing habitat for larval and juvenile fish, and provide much of the biological productivity of some river systems (Thorp and Delong 1994). Further, sediment deposited on the floodplain perpetuates floodplain development and provides nutrients for riparian vegetation.

Large, lowland rivers that are unconstrained by geology have extensive floodplains; however, smaller mountain streams are often constrained by geology and have narrow floodplains (Gregory et al. 1991). The majority of streams on the Dixie National Forest are small and many of the floodplains may be contained entirely within the riparian area and within the 300-foot buffer applied to streams. A possible exception would be the East Fork of the Sevier River near the Dixie National Forest Boundary, which has large, better-developed floodplains (Chris Butler, Hydrologist, Dixie National Forest, Personal Communication). Any floodplains extending beyond the 300-foot buffer applied to streams would have an additional buffer applied, extending 300 feet from its outer edge. Also, as mentioned previously, many floodplains would

likely overlap with riverine wetlands and may be considered jurisdictional wetlands under Section 404 of the Clean Water Act.

3.7.2.3 Riparian Areas

Functionally, riparian areas can be defined as the area between the active stream channel and the outward limits of flooding (Gregory et al. 1991, USFS 1986). As a result, these areas would functionally overlap with floodplains; however, riparian vegetation serves different functions than floodplains. As riparian areas are subject to frequent change, the vegetation is generally diverse and consists of plants that can tolerate a broad range of conditions. Riparian vegetation is extremely important to stream ecosystem function in that it provides shade, woody debris, and leaf litter inputs. Shade levels affect stream temperatures and habitat suitability for aquatic organisms. Further, woody debris provides habitat for aquatic organisms, particularly fish, and in small mountain streams leaf litter input from riparian vegetation is the primary source of organic material. Due to its diversity and complexity, riparian vegetation provides invaluable habitat for a large variety of terrestrial wildlife. It is estimated that less than one percent of the landscape in the western US is covered by riparian vegetation, yet riparian habitats support more species of birds than surrounding uplands (Knopf et al. 1988). As with floodplains, many riparian areas would overlap with riverine wetlands and may be considered jurisdictional wetlands under Section 404 of the Clean Water Act.

On the Dixie National Forest, riparian areas are generally demarcated by willow (*Salix* spp.) stands at the upper elevations of the area. At the lower elevations, riparian areas are characterized by cottonwood (*Populus angustifolia*), bluegrass (*Poa* spp.), redosier dogwood (*Cornus stolonifera*), river birch (*Betula fontinalis*) and scattered Rocky Mountain juniper (*Juniperus scopulorum*; USFS 1995a). Many riparian areas are currently considered to be below their potential in terms of vegetative structure, density, and species diversity. A sample of 50 riparian areas across the Dixie National Forest in 2005 indicated that 64 percent were in a mid- to upper-successional stage. This is below the 70 percent guideline established by the 1986 Land and Resource Management Plan (USFS 2005a). This condition is likely due to overuse and overgrazing by permitted livestock in connection with drought conditions (USFS 1995a, 2005a).

3.7.3 Surface Water

Within the Colorado Plateau, several tributaries head in the Dixie National Forest: Beaver Dam Wash, Santa Clara River, Quail Creek, Ash Creek, North Fork Virgin River, and East Fork Virgin River, which all flow to the Virgin River prior to entering the Colorado; Kanab Creek and its tributary Johnson Wash; the Paria River; and the Escalante River. About 16 percent of the Virgin River watershed area is within Dixie National Forest boundaries and the USFS was one of the stakeholders in the recently completed Virgin River Watershed Management Plan (Washington County Water Conservancy District 2006).

Within the Great Basin, Dixie National Forest lands produce flows that are tributary to the Sevier River or that flow to internal playa-type basins within the Sevier River watershed. Shoal Creek, Pinto Creek, Coal Creek, and Parowan Creek all head in the Dixie National Forest and flow to internal basins located outside of the Forest. Bear Creek, Panguitch Creek, Mammoth Creek, and East Fork Sevier River are tributary to the Sevier River. The Sevier River is noted as being the state's largest river basin, and one of the Nation's most highly utilized, with only a small percentage of initial flow reaching the terminal basin (Utah Department of Water Resources 1999). Much of the water that is ultimately consumed is generated on the Dixie National Forest.

Throughout the Dixie National Forest, a wide range of elevation, topography, geology, and soil types results in diverse hydrologic regimes and water quality. Precipitation also varies widely across the Dixie National Forest, ranging from 10 inches annually in the lower elevations up to more than 40 inches on some of the higher peaks (USFS 1986). At the higher elevations, most precipitation falls as snow, providing the primary source of recharge to groundwater resources and supporting intermittent and perennial stream flows. Intense thunderstorms are common from July through September and produce heavy rains, which can cause flow and flash flooding in ephemeral streams.

3.7.4 Groundwater

The Forest Serivce and BLM have a joint responsibility to address groundwater as it pertains to oil and gas operations. However, BLM is solely responsible for the protection of groundwater associated with downhole operations (i.e., inside a well). The following section describes groundwater resources under Dixie National Forest surface, for which BLM is ultimately responsible.

Groundwater contained in shallow or perched aquifers within the Dixie National Forest is associated with springs, which typically represent discharge of small, locally recharged areas. More extensive regional aquifers are found at depths from several hundred to a thousand feet below ground surface (USFS 1995b). Typical of high elevation lands, much of the Dixie National Forest serves as recharge areas for shallow and regional aquifers, eventually supplying groundwater to the lower elevation, off-Forest lands. Groundwater recharge and flow patterns in the region are determined by geology. As described in more detail in a previous Dixie National Forest report (USFS 1995b), aquifers are associated with the Straight Cliffs, Wahweap, Kaiparowits, and Navajo Sandstone Formations, which are Mesozoic sedimentary formations found at depths underlying the High Plateau area of the Dixie National Forest. Of these, the Navajo is the most important regional aquifer. The overlying Tertiary sediments and igneous intrusives are noted (USFS 1995b) as formations with low primary, but high secondary permeability. These geologic units transmit infiltrated precipitation through fractures and solution channels to the underlying Mesozoic sandstones. Figure 3.7-2 shows Dixie National Forest-generated areas described as “lava fields over sensitive aquifers.” These areas are defined in the GIS metadata as sensitive aquifers defined originally in 1993 in support of oil and gas analysis, but modified dramatically in 2007. These lava fields are primarily associated with the Tertiary volcanics, which have high macro pore space and thus readily transmit infiltrating precipitation (including any surface contaminants). Where they overly a larger aquifer they can serve as a major source of the aquifer’s recharge.

Trans-basin groundwater outflow from the Sevier River Basin to the Colorado River Basin occurs within the Dixie National Forest from the Markagunt and Paunsaugunt Plateaus, with an estimated total annual of about 21,400 acre-feet (Utah Division of Water Resources 1999).

Currently, there are no EPA-designated Sole Source Aquifers in the Dixie National Forest (EPA 2007b). The State of Utah does not classify groundwater or specific aquifers as sole source. None of the areas in the Dixie National Forest have been classified to date. However, as described in more detail below, there have been petitions to classify two aquifers in the Pine Valley Ranger District as Class I aquifers, under Utah’s Groundwater Protection Program, as described in more detail below.

3.7.5 Water Quality

USFS (1986) recognizes that sediment represents a general surface water quality concern throughout the Dixie National Forest. Many Forest streams have naturally high sediment concentrations due to erodible soils and exposed sedimentary bedrock. Management activities, including road construction, timber harvest, and grazing in riparian areas, are noted in USFS (1986) as contributing to water quality degradation. In contrast, the chemical quality of most of the Dixie National Forest streams is good.

The Utah Division of Water Quality designates beneficial use classifications for surface waters within Utah, and protects those waters so as to maintain their designated uses (State of Utah 2007). Classes relevant to streams on the Dixie National Forest include: IC - protected for domestic purposes with prior treatment; 2B - protected for secondary contact recreation such as boating, wading, or similar uses; 3A - protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; 3C - protected for non-game fish and other aquatic life, including the necessary aquatic organisms in their food chain; 3D - protected for waterfowl, shore birds, and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain; and 4 - protected for agricultural uses including irrigation of crops and stock watering. Numeric surface water quality criteria are applied to each of these beneficial use classes by regulation at Utah Annotated Code R317-2-14.

Streams and lakes that the state considers impaired, and thus not able to meet their designated beneficial uses, are reported on the state's 303(d) list, which is updated every other year. Listed water bodies are then scheduled for Total Maximum Daily Load development. Specific Dixie National Forest streams and reservoirs listed on the currently approved 2006 state's 303(d) list are noted below in the individual ranger district sections. Generally, however, most assessed water bodies in the Dixie National Forest are not considered impaired; the ones that are, are primarily listed due to phosphorous.

Groundwater quality varies depending upon the aquifer's geologic properties and the water's proximity to the recharge area. An assessment of available water quality data found that total dissolved solids (TDS) values within portions of their study area, including parts of the Upper Ash Creek and Navajo/Kayenta aquifers, some of which are on Dixie National Forest lands, ranged from 200 to 300 mg/l (Hansen, Allen & Luce, Inc. 2005). The state has also generally considered the Navajo Sandstone aquifer as being of excellent quality in this area (Utah Division of Water Resources 1993).

3.7.6 Water Uses

Surface waters and groundwater produced within the Dixie National Forest are used for various consumptive and non-consumptive purposes, many of which occur outside of the Forest boundaries. In fact, water produced on the high elevation land associated with the Dixie National Forest makes up a large portion of the overall water yield in this part of Utah (USFS 1986). Many local communities obtain culinary and agricultural water from sources located on the Dixie National Forest. Extensive water developments such as reservoirs, diversions, and ditches have been constructed on the Forest to support these and other uses. The primary consumptive uses of surface water include off-Forest irrigation and culinary water supply. On-Forest uses include domestic water supplies for campgrounds and livestock/wildlife watering, and non-consumptive in-stream flows for aquatic habitat maintenance and recreation.

Within the Utah Department of Environmental Quality the Division of Drinking Water (DDW) acts as the administrative arm of the Utah Drinking Water Board and implements the rules which they adopt. The DDW implements a source protection program involving drinking water source watersheds, reviews and approves plans and specifications for construction of facilities for public water systems, and implements the EPA rules relating to drinking water quality, monitoring and treatment.

Public Water Systems (PWSs) are responsible for protecting their sources of drinking water from contamination. R309-600 sets forth minimum requirements to establish a uniform, statewide program for implementation by PWSs to protect their ground-water sources of drinking water, while R309-605 regulates protection of surface water sources. The 1996 amendments to the Safe Drinking Water Act required that all states develop source water assessment programs to assess the risk of accidental contamination of all drinking water sources.

The Utah DDW expressed a desire for cooperation with BLM to formalize a process to protect Drinking Water Source Protection Zones (DWSPZs) in Utah that may potentially be impacted from oil and gas exploration or development. The cooperative effort between DDW and BLM resulted in the BLM issuing Instruction Memorandum (IM) UT 2010-055 in July of 2010.

3.7.6.1 Utah Safe Drinking Water Act Terms

Public Water System (PWS): a system, either publicly or privately owned, providing water through constructed conveyances for human consumption and other domestic uses, which has at least 15 service connections or serves an average of at least 25 individuals daily at least 60 days out of the year and includes collection, treatment, storage, or distribution facilities under the control of the operator and used primarily in connection with the system, or collection, pretreatment or storage facilities used primarily in connection with the system but not under the operator's control.

Community Water System (CWS): a PWS which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-Transient Non-Community Water System (NTNCWS): a PWS that regularly serves at least 25 of the same nonresident persons per day for more than six months per year. Examples of such systems are those serving the same individuals (industrial workers, school children, church members) by means of a separate system.

Transient Non-Community Water System (TNCWS): a non-community PWS that does not serve 25 of the same nonresident persons per day for more than six months per year. Examples of such systems are RV parks, diners or convenience stores where permanent nonresident staff number less than 25, but the number of people served exceeds 25.

<u>Drinking Water Protection Zones</u>

Ground Water Source Zone 1: is the area within a 100-foot radius from the wellhead or margin of the collection area.

Ground Water Source Zone 2: is the area within a 250-day ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

Ground Water Source Zone 3: is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

Ground Water Source Zone 4: is the area within a 15-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

Surface Water Zone 1: (A) Streams, rivers and canals: Zone 1 encompasses the area on both sides of the source, 1/2 mile on each side measured laterally from the high water mark of the source (bank full), and from 100 feet downstream of the point of departure to 15 miles upstream, or to the limits of the watershed or to the State line, whichever comes first. If a natural stream or river is diverted into an uncovered canal or aqueduct for the purpose of delivering water to a system or a water treatment facility, that entire canal will be considered to be part of Zone 1, and the 15 mile measurement upstream will apply to the stream or river contributing water to the system from the diversion. (B) Reservoirs or lakes: Zone 1 is considered to be the area 1/2 mile from the high water mark of the source.

Surface Water Zone 2: the area from the end of Zone 1, and an additional 50 miles upstream (or to the limits of the watershed or to the State line, whichever comes first), and 1000 feet on each side measured from the high water mark of the source.

Surface Water Zone 3: the area from the end of Zone 2 to the limits of the watershed or to the State line, whichever comes first, and 500 feet on each side measured from the high water mark of the source.

Surface Water Zone 4: the remainder of the area of the watershed (up to the State line, if applicable) contributing to the source that does not fall within the boundaries of Zones 1 through 3.

For most public water systems, the Utah Department of Environmental Quality's Division of Drinking Water requires that protection zones be designated through an assessment program for drinking water sources. Transient, non-community systems (such as campgrounds) existing before 1993 that have a groundwater source do not have to establish protection zones. The Dixie National Forest relies upon these source protection plans to provide management direction and guidelines for municipal supply watersheds within Forest boundaries. The Dixie National Forest has identified numerous municipal watersheds within its boundaries covering a total of 53,405 acres. They are shown on Figures 3.7-1 through 3.7-4. The GIS metadata indicates that these watersheds were delineated for use in oil and gas analysis in 1993, and the database has subsequently been updated.

3.7.7 Pine Valley Ranger District

3.7.7.1 Watershed Resources

There are 2,080.7 miles of streams and 786 springs mapped on the Pine Valley Ranger District. In addition, there are 196 lakes and reservoirs covering 612.4 acres. The 300-foot buffer

applied to all waterbodies covers 138,781 acres, or 29 percent of the Pine Valley Ranger District. Figure 3.7-1 shows the 300-foot buffer applied to streams, springs, lakes, and reservoirs on the Pine Valley Ranger District.

3.7.7.2 Surface Water

Most of the northern half of the Pine Valley Ranger District is located within the Sevier River Basin, which is part of the Great Basin geographic region. This area (Figure 3.7-1) includes the headwaters of Shoal Creek and its tributaries, and the headwaters of Pinto Creek and its tributaries. Shoal and Pinto creeks each flow into the Escalante Desert, where they infiltrate and/or evaporate. The southern half and most of the eastern end of this ranger district are located primarily within the Santa Clara, Quail, and Ash Creek watersheds. These watersheds are tributary to the Virgin River, which is in the lower Colorado River Basin.

Several of these streams have been gaged within the Dixie National Forest by the United States Geological Survey (USGS), including South Ash Creek, Leap Creek, and Leeds Creek, which are all tributary to Ash Creek and the Santa Clara River. The USGS (2007) provides this flow data, which is briefly summarized below.

South Ash Creek (draining about 11 square miles) was gaged from 1966 to 1998. Average annual flows ranged from 1.3 to 16 cubic feet per second, with the highest monthly average typically occurring in May. Leap Creek drains about 9 square miles at the gaged location near the Forest boundary. During the seven years of record (1994 to 2001), average annual flows ranged from 0.6 to 5.1 cubic feet per second. This stream seems to peak earlier in the year (generally in March) than other gaged streams in the ranger district. Leeds Creek has been gaged since 1964 at a location near the Forest boundary; drainage area is about 15.5 square miles at the gage site. Peak flows typically occur in June, and average annual flows have ranged from 2.1 cubic feet per second in 2002 up to 26.5 in 2005. The Santa Clara River has been gaged for many years, beginning in 1959. At the gaging station located in Pine Valley, which drains 18.7 square miles, average annual flows have ranged from a low of 1.2 cubic feet per second in 2002 to a high of 40.9 in 2005. USFS (1986) notes that the Santa Clara River is one of several Dixie National Forest streams where snowmelt runoff can cause extensive and/or prolonged flooding, particularly in downstream, off-Forest areas. Its peak typically occurs in May.

Though not gaged, estimates of average flow in the Shoal and Pinto Creek watersheds are 17,000 and 16,000 acre-feet per year, respectively (Utah Division of Water Resources 1995).

There are two main reservoirs in this ranger district, both capturing water from Little Pine Creek, which is tributary to Shoal Creek watershed. Lower Enterprise Reservoir has a capacity of about 2,670 acre-feet and Upper Enterprise Reservoir has a capacity of 9,950 acre-feet (Utah Division of Water Resources 1995).

3.7.7.3 Groundwater

The Pine Valley and Bull Valley Mountains within the Pine Valley Ranger District serve to recharge regional aquifers. It has been estimated that most of the 48,100 acre-feet of annual recharge to the Beryl-Enterprise groundwater basin comes from Shoal and Pinto Creeks, whose watersheds are almost entirely within the Pine Valley Ranger District (Utah Division of Water Resources 1995). A number of small springs are located in the higher elevation areas, discharging groundwater from numerous small, perched aquifers. USFS (1986) also notes that there are geothermal waters found at depth within portions of the Pine Valley Ranger District.

In 2005, the Washington County Water Conservancy District petitioned the Utah Board of Water Quality for aquifer classification on a portion of the Ash Creek Basin and a portion of the Quail and Santa Clara basins (Hansen, Allen, and Luce, Inc. 2005). With aquifer classification, Washington County Water Conservancy District hoped to provide a means of reasonable protection of these groundwaters. While the requested class designation (Class IA - Pristine Groundwater where the TDS is below 500 mg/l (ppm) (for the portions of the aquifers within Dixie National Forest boundaries)) would not result in mandatory development prohibitions or use restrictions; it would provide an additional management tool in these areas. The aquifer has not yet been classified.

According to the petition, the Upper Ash Creek aquifer includes land in the Pine Valley Ranger District. Within the ranger district, that aquifer is described as the Tertiary Pine Valley monzonite aquifer, comprised of fractured monzonite, volcanic ashflow, tuff, andesite, volcanic breccia, sandstone, conglomerate, and limestone with an estimated thickness of more than 2,000 feet.

The Extended Aquifer Zone that is associated with the Navajo/Kayenta aquifer addressed in the petition also includes land along the southern boundary of the ranger district (the Navajo/Kayeta aquifer itself is outside of the Dixie National Forest). This zone is defined as "…the developable area (slope less than 30 percent) north of the exposed Navajo formation where the buried Navajo/Kayenta aquifer is estimated to remain unconfined… these formations are shallow enough in the Extended Aquifer Zone that infiltration of surface water may reach the Navajo Aquifer" (Hansen, Allen, and Luce, Inc. 2005).

3.7.7.4 Water Quality

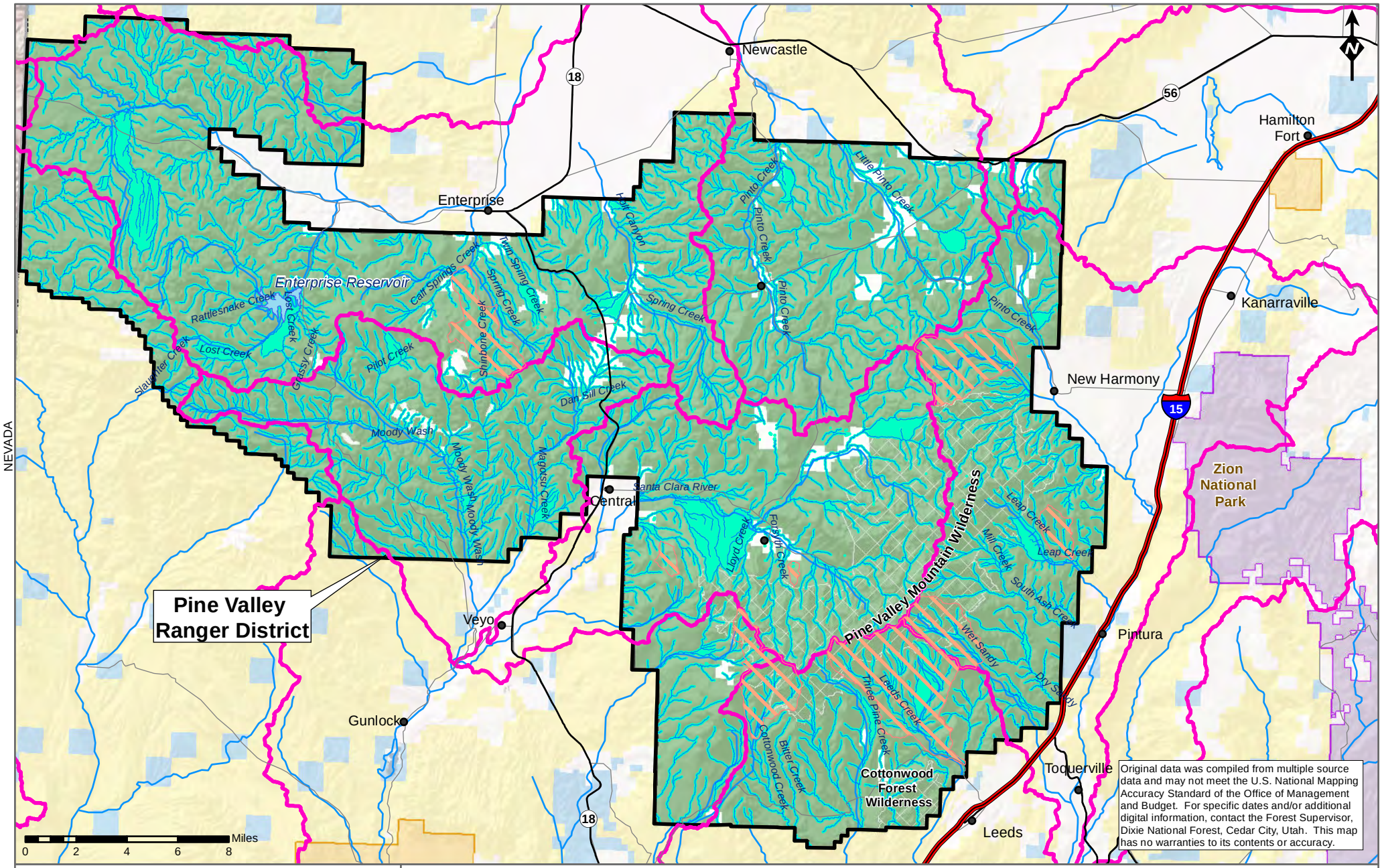
There are no streams or lakes on the Pine Valley Ranger District currently listed as 303d impaired (Utah Division of Water Quality 2006). Newcastle Reservoir, just downstream of the Dixie National Forest boundary, which impounds water from Pinto Creek and Little Pinto Creek, within the Pine Valley Ranger District, is listed as impaired for total phosphorous and dissolved oxygen.

Although not currently listed as impaired, the Santa Clara River has had problems with phosphorus exceedances (USFS 2004e).

Based on Dixie National Forest GIS data showing areas deemed unstable or subject to high erosion, portions of the watersheds in this ranger district may be susceptible to sediment-related water quality problems. These areas are primarily along the eastern and southeastern parts of the ranger district (in the Ash and Quail watersheds), and the parts of the southern ranger district, within tributaries to the Santa Clara River and Beaver Dam Wash.

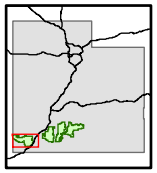
3.7.7.5 Water Uses

The majority of the stream reaches in the Pine Valley Ranger District have beneficial use designations of 2B, 3A, and 4 (State of Utah 2007). In addition to those three classes, the headwaters of Quail Creek are also designated as drinking waters under Class 1C. Both Upper and Lower Enterprise Reservoirs are designated as Class 2B, 3A, and 4 waters. In addition, Lower Enterprise is used for flood control and Upper Enterprise uses also include municipal and industrial (Utah Division of Water Resources 1995).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.7-1
Water & Watershed Resources of the Pine Valley Ranger District



Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:320,000	1 in = 5 miles

Legend

- Cities
- Minor Roads (1)
- Highways
- Freeways
- Streams
- Major Streams & Rivers
- Water Bodies

National Forest System Lands
- Dixie National Forest
- Wilderness Areas

Other Land Administration
- Bureau of Land Management
- National Park Service
- Private
- State of Utah
- Tribal

- 300-foot Riparian Buffer
- Watersheds (HUC 10)
- Municipal Watersheds

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.

Groundwater (with very limited exceptions) and surface water in the Virgin River watershed is considered completely appropriated (Utah Division of Water Resources 2006).

Numerous municipal watersheds have been designated on the Pine Valley Ranger District, as shown on Figure 3.7-1. They are Central, Enterprise, Leeds, New Harmony, Pine Valley, Pintura, Sawyer Springs, and St. George. On the Dixie National Forest, they cover a combined total of approximately 27,799 acres. The Utah Division of Water Resources' most recent Municipal and Industrial Report for the Kanab Creek/Virgin River Basin (Utah Division of Water Resources 2006) describes community and non-community water systems in the basin, at least some of which have their source on the Pine Valley Ranger District. Among these, Pine Valley Irrigation Company (which supplies culinary water to 100 residential connections) is listed as having a total diversion of 79 acre-feet in 2002, predominantly from spring sources, but supplemented by wells, all apparently on-Forest. Their water rights are for substantially more than this volume. Others who likely receive at least a portion of their water from the Pine Valley Ranger District are New Harmony (82 acre-feet diverted in 2004; Utah Division of Water Resources 2006), St. George, and Enterprise. The Municipal and Industrial Report for 1997 (Utah Division of Water Resources 1998) apparently pre-dates the Pine Valley Irrigation Company system, and the New Harmony system used 108 acre-feet that year.

3.7.8 Cedar City Ranger District

3.7.8.1 Watershed Resources

There are 1,454.1 miles of streams and 583 springs mapped on the Cedar City Ranger District. In addition, there are 372 lakes and reservoirs covering 1,925.2 acres. The 300-foot buffer applied to all waterbodies covers approximately 83,118 acres, or 21 percent of the Cedar City Ranger District. The ranger district is characterized by mountain valleys and high plateaus. Stream surveys conducted in 2004 (USFS 2004e) indicate that changes to stream morphology have occurred on Castle Creek, Little Creek, and Bear Creek. Beetle kill of mature spruce forest may have increased flows on Castle Creek, which has led to widening of the stream channel. In contrast, decreased flows under drought conditions may have led to increased sedimentation and aggradation of the channel on Little Creek. The loss of riparian vegetation on Bear Creek due to grazing has also led to channel widening there. Further, grazing and roads have impacted riparian vegetation on Threemile Creek, which has led to increases in stream temperature (USFS 2004e). Figure 3.7-2 shows the 300-foot buffer applied to streams, springs, lakes, and reservoirs on the Cedar City Ranger District.

3.7.8.2 Surface Water

The majority of the Cedar City Ranger District is within the Sevier River Basin, contributing flows to the main stem of the Sevier River (Figure 3.7-2). The upper Sevier River and its tributaries (including Asay, Mammoth, Panguitch, and Bear Creeks) flow generally northeast off the Markagunt Plateau to the main stem. The Hurricane Cliffs form the northwestern edge of the ranger district and include several streams that drain towards Parowan Valley and Little Salt Lake, which is a closed subbasin of the Sevier River Basin. The headwaters of Coal Creek are also located in the Cedar City Ranger District; Coal Creek terminates in Cedar Valley. The extreme southwestern portion of the ranger district includes the headwaters of some first order drainages within the North Fork Virgin River, and the extreme southwest portion includes the headwaters of the East Fork Virgin River. As noted above, the Virgin River is part of the Colorado River Basin.

Stream flows on the Cedar City Ranger District are typically snowmelt derived with high spring flows during spring snowmelt and low base flows in the summer and fall. While flows in Center Creek and Ashdown Creek increase during spring snowmelt, monsoonal rains can often cause peak flows to occur in summer months. USFS (1986) notes that snowmelt runoff can cause more extensive and/or prolonged flooding in Panguitch and Mammoth Creeks than occurs in some of the other streams in this ranger district.

Several of these streams have been gaged within the Dixie National Forest by the USGS and the flow conditions are briefly described below. Mammoth Creek has been gaged for many years, beginning in 1964. The data shows widely ranging seasonal variation, from an average low monthly flow of 11 cubic feet per second in February, to a high monthly average of 181 in May; the yearly average for this 105 square mile drainage ranged from 8 cubic feet per second in 2002 to 159 cubic feet per second in 2005. Panguitch Creek typically peaks in June, and during twenty years of record, annual average flow ranged from 14 cubic feet per second to 45 cubic feet per second. Stream gaging on Asay Creek, during four years in the 1950s, recorded average annual flows ranging from 20 to 61 cubic feet per second.

The two largest lakes on the Dixie National Forest are found in this ranger district: Panguitch Lake and Navajo Lake. Panguitch Lake is the largest lake on the Dixie National Forest and constitutes 20 percent of the total water yield for the entire Forest. Navajo Lake is a natural lake formed by a lava flow that cut off the natural surface drainage, and its eastern end has been diked. Red Creek Reservoir is another small impoundment located in the northwestern part of the ranger district.

3.7.8.3 Groundwater

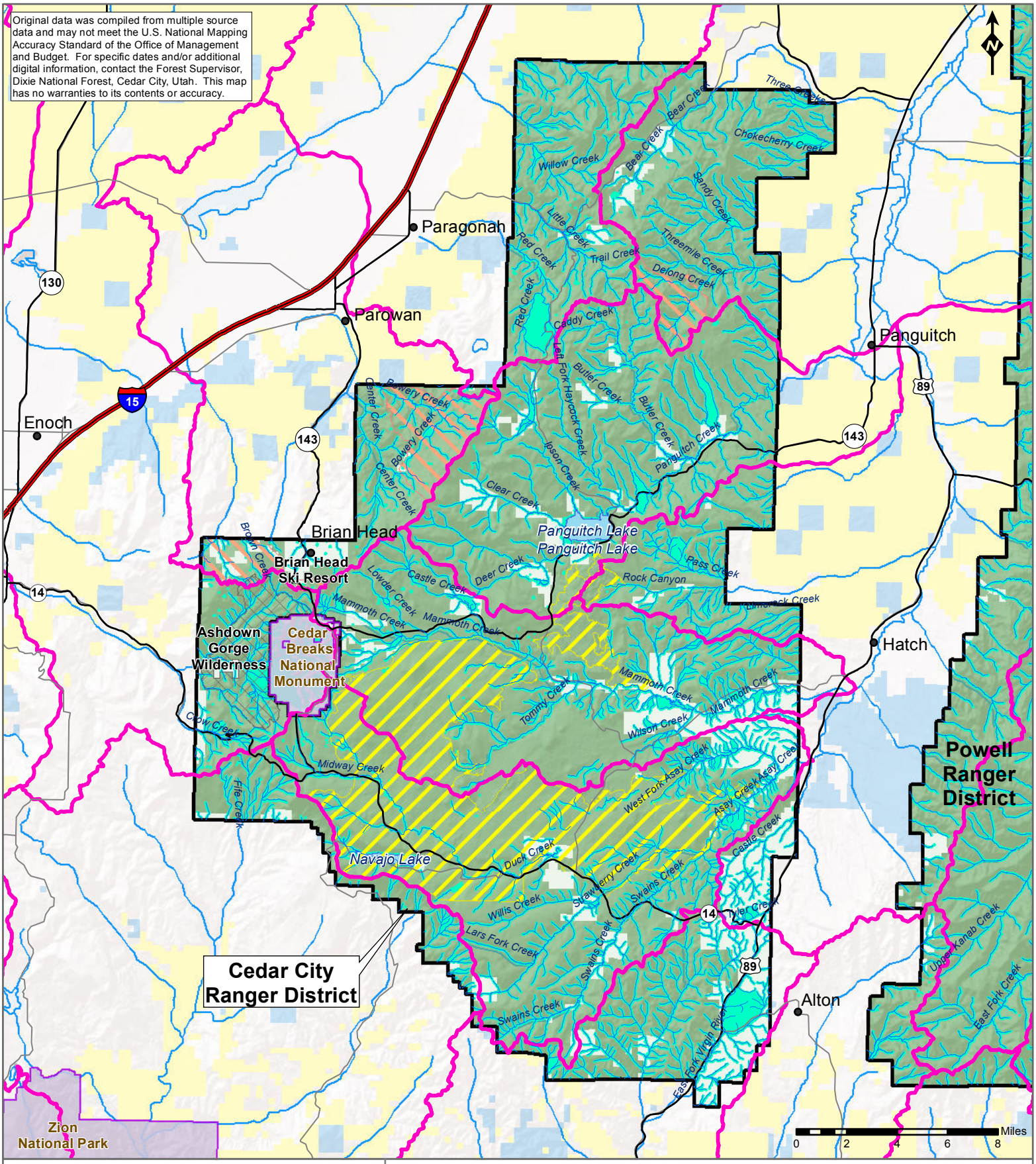
The Markagunt Plateau in the vicinity of Navajo Lakes supports groundwater not only within the Sevier Basin, in which watershed it is located, but also to the Virgin River Basin to the south, via transbasin outflow (Utah Division of Water Resources 1993). According to a previous Dixie National Forest report (USFS 1995c), bedrock solution channels in the Navajo Lakes areas provide a conduit for infiltrated precipitation to be conveyed to either the Sevier or Virgin River watersheds and emerge as springs. Duck Creek, Lower Asay, and Cascade Springs are the three largest of these.

Approximately 58,585 acres in this ranger district are on these lava fields where they are overlying a sensitive aquifer, as shown on Figure 3.7-2). As noted above, these are described as areas of high groundwater recharge associated with the Tertiary volcanics that have high macro pore space and thus readily receive precipitation and have been designated as No Lease (NL) under Alternatives A, B, and C.

The upper Markagunt Plateau also contains springs that are closely tied to the precipitation regime as a function of their recharge area with a moderate storage capacity (USFS 1995c). The Dixie National Forest report also notes that alluvial deposits associated with the larger creeks draining the Markagunt (including Asay, Mammoth, and Bear Valley Creeks) are of sufficient thickness and extent to contain alluvial groundwater. Further, the Land Resource Management Plan (USFS 1986) notes that there are geothermal waters within portions of the Cedar City Ranger District, particularly in the Navajo Lake area.

3.7.8.4 Water Quality

Dixie National Forest water quality monitoring indicates that Bowery Creek, Bear Creek, and Threemile Creek are above the state water quality standard for phosphorous (USFS 2004e). Water quality is also declining in Panguitch Lake and Navajo Lake (USFS 1995c). High



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.7-2
Water & Watershed Resources of the Cedar City Ranger District

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:320,000

1 inch = 5 miles

Legend

- Cities
- Minor Roads (1)
- Highways
- Interstates
- Streams
- Major Streams & Rivers
- Water Bodies

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration

- Bureau of Land Management
- National Park Service
- Private
- State of Utah
- Tribal

- 300-foot Riparian Buffer
- Municipal Watersheds
- Sensitive Aquifers
- Watersheds (HUC 10)

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.

phosphorous in Bear Creek may be due to its igneous geology; however, high phosphorous in Bowery Creek and especially Threemile Creek appears associated with sediment influxes accompanying high flow events. Panguitch Lake is one of the few water resources on the Dixie National Forest where human-caused water quality degradation has become a chronic problem. Nutrient levels have often exceeded state water quality standards and accelerated eutrophication has been documented; however, these conditions have improved in recent years. The state's Total Maximum Daily Load study for Panguitch Lake was approved by the EPA in 2004; that document set goals and strategies for total phosphorus reductions.

Streams that may be susceptible to sediment related water quality problems include Coal Creek, Stout Canyon (a small tributary to East Fork Virgin River), and Parowan Creek, as well as numerous other small headwater areas, based on GIS mapping of unstable and high erosion areas.

Noted sediment influxes in Threemile Creek are likely a result of the reduction of riparian vegetation as a result of grazing and dispersed recreational use as mentioned in Section 3.7.8.1 (USFS 2004e). In addition, the loss of riparian vegetation in Threemile Creek and in Bear Creek has led to a decrease in shade levels and an associated increase in stream temperatures above state limits.

Several watersheds in the Cedar City Ranger District have very low baseline amounts of fine sediment due to well-vegetated watersheds overlying extrusive igneous rock, sandstone, and limestone. These watersheds include: Mammoth Creek, Panguitch Creek, and Ash Creek (USFS 1995b). Streams from less vegetated watersheds overlying shale and siltstone, such as tributaries to the North and East Forks of the Virgin River, and streams near the Hurricane Cliffs (Summit Creek and Coal Creek) have higher sediment concentrations (USFS 1995b). In Little Creek, percent fine sediment in the stream channel is greater than 25 percent; which may be a result of drought, which has decreased flows and the sediment transport capacity of the stream (USFS 2004e).

According to the 2006 303(d) list, there are no streams in this ranger district currently listed as impaired (Utah Division of Water Quality 2006). Navajo Lake is currently listed as impaired for dissolved oxygen. Red Creek and Yankee Meadow Reservoirs, which drain toward Parowan Valley, are also listed: Red Creek for dissolved oxygen and Yankee Meadow for dissolved oxygen and pH. Panguitch Lake has been removed from the list due to development and approval of the Total Maximum Daily Load.

3.7.8.5 Water Uses

All of the stream reaches on the Cedar City Ranger District have beneficial use designations of 2B, 3A, and 4 (State of Utah 2007). In addition to those three classes, Duck Creek and stream reaches that are tributary to the North Fork Virgin River are also designated as drinking waters under Class 1C. Both Panguitch and Navajo Lakes are also designated for 2B, 3A, and 4 uses.

Groundwater (with very limited exceptions) and surface water in the Virgin River watershed is considered completely appropriated (Utah Division of Water Resources 2006)

Four municipal watersheds, shown on Figure 3.7-2, with a total acreage of about 12,869 acres have been designated on the Cedar City Ranger District to protect spring sources that supply municipal culinary water to Brian Head, Panguitch, Summit, and Parowan.

3.7.9 Powell Ranger District

3.7.9.1 Watershed Resources

There are 1,389.8 miles of streams and 383 springs on the Powell Ranger District. In addition, there are 200 lakes and reservoirs covering 224.9 acres. The 300-foot buffer applied to all waterbodies covers approximately 96,077 acres, or 25 percent of the Powell Ranger District. The East Fork of the Sevier River near the Dixie National Forest boundary is larger and less constrained by geology than other streams. As a result, there may be some floodplains that extend beyond the 300-foot buffer. In 2002, the Sanford Fire burned portions of the Cottonwood, Deep, Deer, and Sanford creek watersheds. The fire destroyed riparian vegetation, which led to high streambank instability, erosion, and the influx of large amounts of sediment (USFS 2005a). Although streambank instability has begun to improve and sediment levels have decreased, full recovery of the riparian vegetation has been hampered by livestock grazing (USFS 2004e). In some burned areas, riparian areas that were overgrazed are now dominated by rabbitbrush (*Chrysothamnus spp*.), which is a concern for future fires, as it will burn faster and hotter than riparian grasses/forbs/shrubs. Figure 3.7-3 shows the 300-foot buffer applied to streams, springs, lakes, and reservoirs on the Powell Ranger District.

3.7.9.2 Surface Water

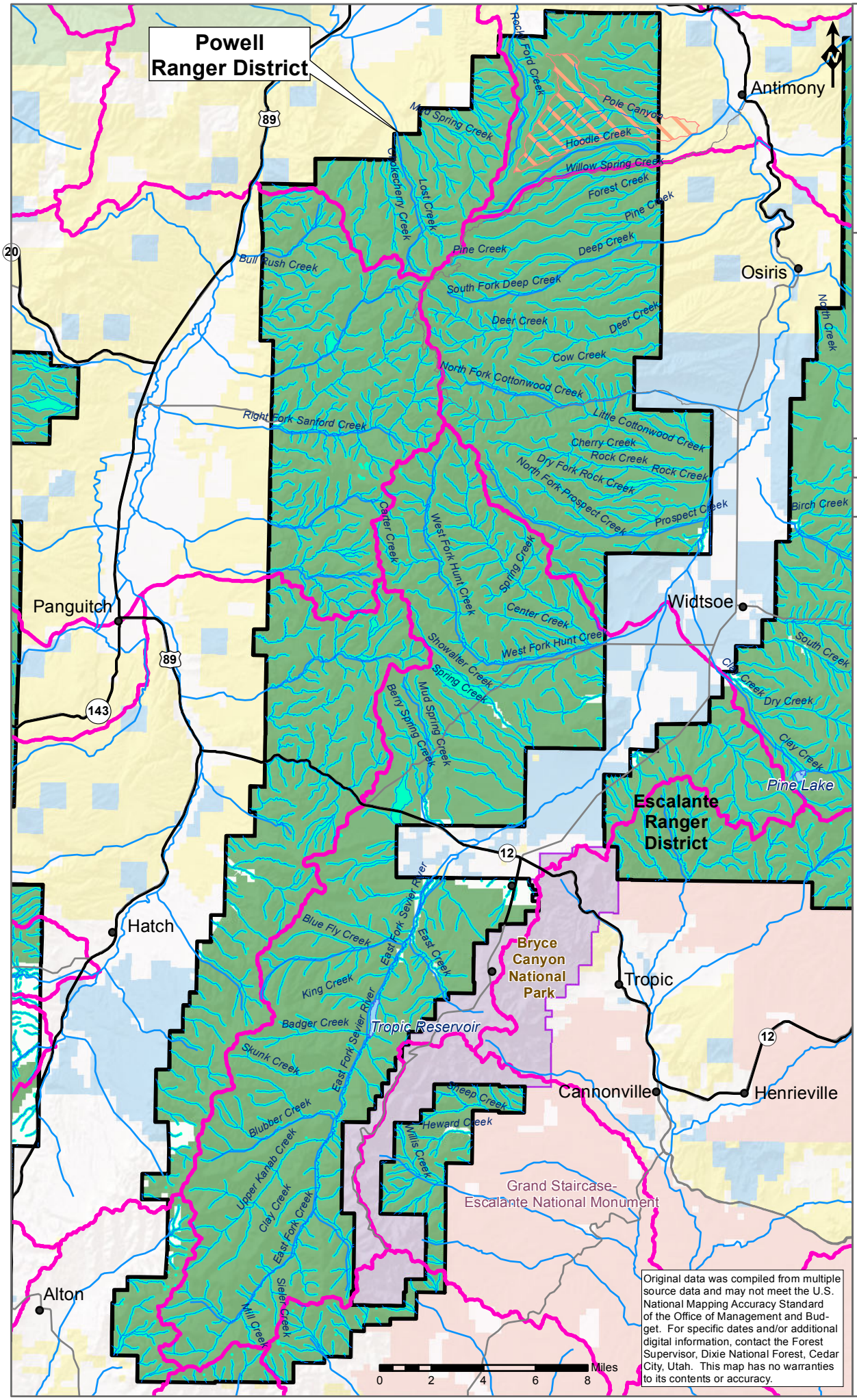
The Powell Ranger District is almost entirely within the Sevier River Basin. The western portion is comprised of many small tributaries to the main stem of the Sevier, many of which are intermittent or ephemeral (Figure 3.7-3). These include Smith Canyon, Sanford Creek, Sand Wash, Limekiln Creek, Red Canyon, and Hildale Canyon. The eastern portion is located in the East Sevier watershed and includes its headwaters as well as numerous smaller tributary streams such as Cottonwood Creek, East and West Forks Hunt Creek, and Blubber Creek. A very small part of the this ranger district drains south into the Upper Colorado River Basin via tributaries to Paria River, Johnson Wash, and Kanab Creek. The Paria River drains directly to the Colorado River, as does Kanab Creek. Johnson Wash is tributary to Kanab Creek.

Most lakes on this district are small. Tropic Reservoir is the largest lake in this ranger district, collecting primarily snowmelt runoff from the headwaters of the East Sevier River. Its capacity is approximately 3,600 acre-feet (Utah Division of Water Quality 2007).

Most of the stream reaches, with the exception of the East Fork Sevier River, are small first-order streams and have not been gaged. The East Fork Sevier River was gaged between 1962 and 1995 at a site near Ruby's Inn upstream of Johns Valley, where the drainage area is about 72 square miles. According to that data, flows typically peak in May or June (USGS 2007). Annual averages ranged from 6 cubic feet per second in 1977 to 45 cubic feet per second in 1980. USFS (1986) notes that snowmelt runoff can cause more extensive and/or prolonged flooding on this river than occurs in some of the other streams on this ranger district.

3.7.9.3 Groundwater

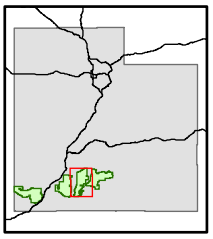
The high plateaus area, of which the Powell Ranger District is part, provides recharge to several water-bearing regional geologic units comprised of Mesozoic sandstones that are found at depth and overlain by Tertiary igneous extrusives. This ranger district also provides recharge to alluvial aquifers associated with the off-Forest Sevier and East Fork Sevier River valleys.



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.7-3
Water & Watershed Resources of the Powell Ranger District



1:320,000	1 in = 5 miles

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

Legend

- Cities
- Highways
- Minor Roads (1)
- Streams
- Major Streams & Rivers
- 300-foot Riparian Buffer
- Water Bodies
- Watersheds (HUC 10)
- Municipal Watersheds

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM (2)
- National Park Service
- Private
- State of Utah
- Tribal

NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument Managed by the Bureau of Land Management.

Though topographically within the Sevier Basin, the Paunsaugunt Plateau also provides groundwater to the Kanab Creek Basin to the south, via transbasin outflow (Utah Division of Water Resources 1993).

3.7.9.4 Water Quality

According to the 2006 303(d) list, some streams in the Powell Ranger District are currently listed as impaired (Utah Division of Water Quality 2006). Included in this most recent list are the tributaries to the Paria River (which are listed for TDS).

Based upon Dixie National Forest GIS data, there is a substantial area in the southern half of this ranger district that is considered as unstable or as a high erosion area; streams crossing this area may be more susceptible to sediment-related water quality problems.

3.7.9.5 Water Uses

All of the stream reaches within the Sevier Basin portion of the Powell Ranger District have beneficial use designations of 2B, 3A, and 4, as does the portion of the ranger district within the Johnson Wash and Kanab Creek watersheds (State of Utah 2007). The small portion of the ranger district within the Paria River watershed is designated as 2B, 3C, and 4.

Groundwater and surface water in the Kanab Creek and Johnson Wash watersheds are considered completely appropriated (Utah Division of Water Resources 2006).

A single municipal watershed (6,471 acres within the Powell Ranger District) has been designated on the northeast corner of the Powell Ranger District to protect municipal culinary water for Antimony (a very small portion of Antimony's municipal watershed is located on the Escalante Ranger District). This watershed is shown on Figure 3.7-3.

3.7.10 Escalante Ranger District

3.7.10.1 Watershed Resources

There are 1,318.9 miles of streams and 219 springs mapped on the Escalante Ranger District. In addition, there are 311 lakes and reservoirs covering 1,147.1 acres. The 300-foot buffer applied to all waterbodies covers approximately 92,775 acres, or 21 percent of the Escalante Ranger District. Roads and recreational use on Carcass and Pleasant creeks have impacted riparian areas and led to stream channel widening (USFS 2004e). Figure 3.7-4 shows the 300-foot buffer applied to streams, springs, lakes, and reservoirs on the Escalante Ranger District.

3.7.10.2 Surface Water

The majority of streams on the Escalante Ranger District drain into the Escalante River, which is in the Upper Colorado River Basin. Tributary streams that head in this ranger district include Deer Creek, Boulder Creek, Birch Creek, Upper Valley Creek, and Pine Creek (Figure 3.7-4). In addition, some areas in the southwest corner of the ranger district drain into the Paria River drainage, and some streams on the northwestern side of the ranger district drain into the East Fork Sevier River.

While some of these stream reaches have been gaged at various times, most have fairly short periods of record. Pine Creek is an exception, as it has been gaged essentially continuously since 1951 (USGS 2007). Pine Creek flow typically peaks in May and is at its lowest during the

winter months. Annual averages vary widely, and have ranged from 0.77 cubic feet per second in 1955 to 13.4 cubic feet per second in 2005.

One of the prominent features in this district is Boulder Mountain, which is one of the largest high elevation plateaus in the United States. This plateau is dotted with hundreds of small lakes at elevations from 10,000 to 11,000 feet. Some of the larger lakes and reservoirs include Pine Lake, Cyclone Lake, Jacobs Valley Reservoir, Roundy Reservoir, Grass Lake, and North Creek Reservoir (USFS 1995a). Jacobs Valley Reservoir was constructed in 1911 and has a capacity of 1,967 acre-feet. It is located in the Pine Creek watershed. Also in the Pine Creek Basin, Roundy Reservoir is much smaller, with a capacity of 150 acre-feet (Utah Division of Water Resources 2000).

3.7.10.3 Groundwater

The high plateaus area, of which the Escalante Ranger District is part, provides recharge for several water-bearing regional geologic units comprised of Mesozoic sandstones that are found at depth and overlain by Tertiary igneous extrusives. Outcrops of the Straight Cliffs Aquifer (which includes the Straight Cliffs, Wahweap, and Kaiparowits Formations) occur in the Paunsagaunt Plateau within the Escalante District. A 1995 Forest Service report (USFS 1995b) notes that the Aquarius Plateau, including the Escalante Ranger District, overlies highly transmissive igneous rock, which results in a large percentage of precipitation leaving the Plateau as groundwater in bedrock aquifers. There is essentially no alluvial groundwater found in this ranger district.

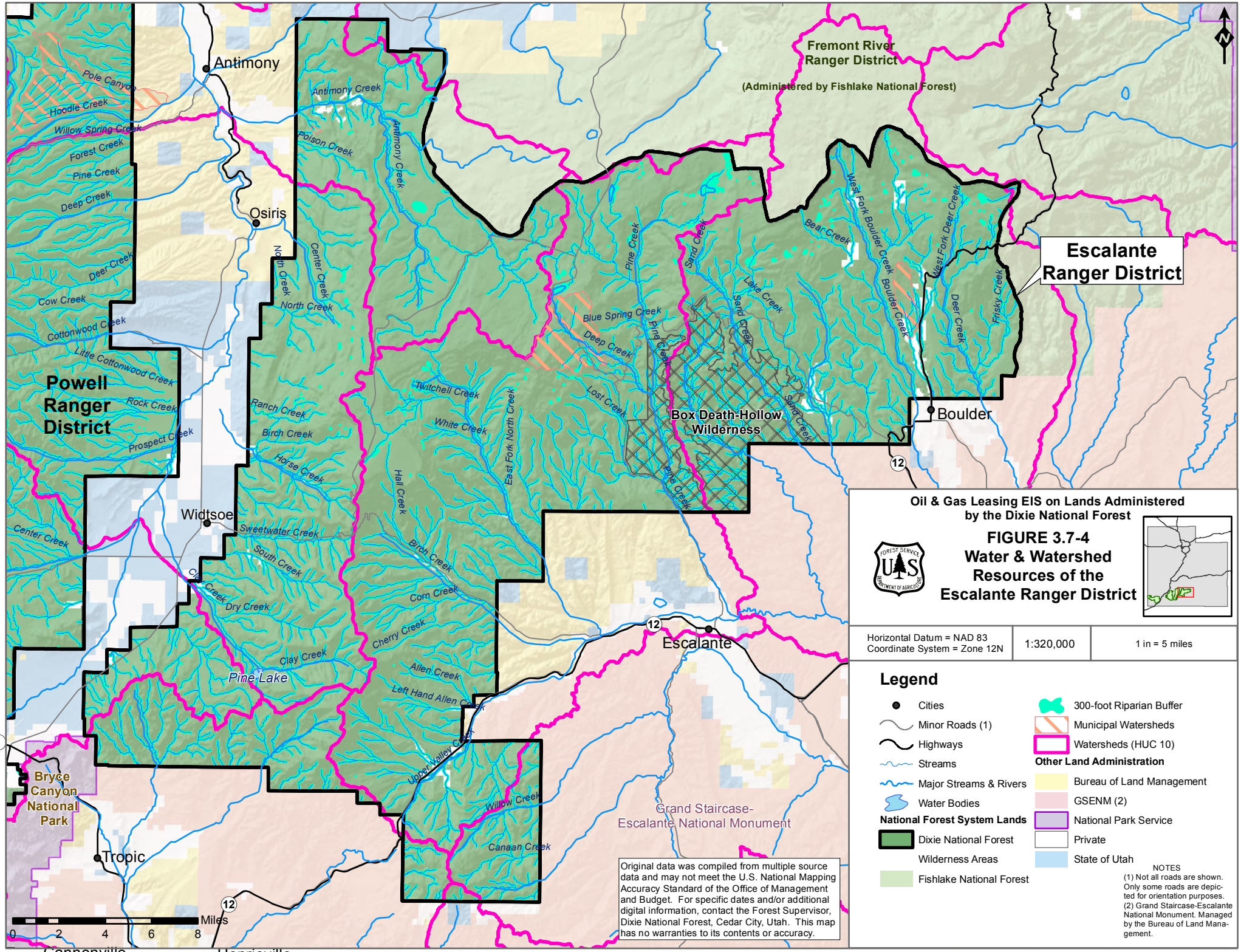
3.7.10.4 Water Quality

Water quality monitoring by the Dixie National Forest in portions of the Escalante River drainage indicates that phosphorous is above state limits in both the East and West Forks of Boulder Creek (USFS 2004e). From the few samples taken, it is difficult to establish a link to the source; however, igneous geology in the area could lead to high background phosphorous levels (USFS 2004e). In addition, many of the more western streams draining into the Escalante River drainage have higher sediment concentrations due to less vegetated watersheds overlying shale and siltstone (USFS 1995b).

According to the 2006 303(d) list, some streams in the Escalante Ranger District are currently listed as impaired (Utah Division of Water Quality 2006). Included in this list are some reaches of the Escalante River and its tributaries, which are listed for temperature downstream of the Dixie National Forest. The Escalante River Watershed Water Quality Management Plan (Millennium Science and Engineering, Inc. 2005) is awaiting EPA approval; that document assessed reaches of Birch Creek and North Creek, including stretches within the Dixie National Forest, as potential contributors to the downstream temperature problem.

3.7.10.5 Water Uses

The stream reaches within the Sevier River watershed and the majority of the Escalante River portions of the Escalante Ranger District have beneficial use designations of 2B, 3A, and 4 (State of Utah 2007). The small portion of the very southeast corner of the ranger district within Alvey Creek that is tributary to the Escalante River and the Paria River watershed in the southwest portion is designated as 2B, 3C, and 4. Jacob's Valley Reservoir is protected under 2B, 3C, 3D, and 4 classes of beneficial use.


Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest
FIGURE 3.7-4
Water & Watershed Resources of the Escalante Ranger District
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
1:320,000
1 in = 5 miles
Legend
Cities
Minor Roads (1)
Highways
Streams
Major Streams & Rivers
Water Bodies
National Forest System Lands
Dixie National Forest
Wilderness Areas
Fishlake National Forest
300-foot Riparian Buffer
Municipal Watersheds
Watersheds (HUC 10)
Other Land Administration
Bureau of Land Management
GSENM (2)
National Park Service
Private
State of Utah
NOTES
(1) Not all roads are shown. Only some roads are depicted for orientation purposes.
(2) Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
Escalante Ranger District
Powell Ranger District
Fremont River Ranger District
(Administered by Fishlake National Forest)
Box Death-Hollow Wilderness
Grand Staircase-Escalante National Monument
Bryce Canyon National Park
Antimony
Osiris
Widtsoe
Boulder
Escalante
Tropic
Cannonville
Henrieville
Pine Lake
Pole Canyon
Hoodle Creek
Willow Spring Creek
Forest Creek
Pine Creek
Deep Creek
Deer Creek
Cow Creek
Cottonwood Creek
Little Cottonwood Creek
Rock Creek
Prospect Creek
Center Creek
Antimony Creek
Poison Creek
North Creek
Ranch Creek
Birch Creek
Horse Creek
Sweetwater Creek
South Creek
Dry Creek
Clay Creek
Twitchell Creek
White Creek
East Fork North Creek
Hall Creek
Corn Creek
Cherry Creek
Allen Creek
Left Hand Allen Creek
Upper Valley Creek
Willow Creek
Canaan Creek
Blue Spring Creek
Lost Creek
Sand Creek
Lake Creek
Bear Creek
West Fork Boulder Creek
Boulder Creek
West Fork Deer Creek
Frisky Creek
12
0 2 4 6 8 Miles

3.8 Soils and Geologic Hazards

3.8.1 Introduction

This section describes five soil and landform categories by ranger district, including steep slopes, erosive soils, unstable slopes, rockfall areas, and caves. The data used to identify areas of soils and geologic hazards comes from completed Order 3 soil surveys of the Dixie National Forest (unpublished) as well as the State Soil Survey Geographic Database (STATSGO) data (NRCS 2005). These surveys encompass a spatial GIS coverage, which includes a National Soils Information System (NASIS) database, mapping unit, and taxonomic unit descriptions. These Order 3 soil surveys have soil boundaries plotted by interpretation of aerial maps and remotely sensed data. Boundaries were verified by traversing representative areas (USFS 2004f). In addition, steep slope analysis used 98.4x98.4 feet (30x30 meter) Digital Elevation Model projections using both analog and stereo aerial imagery. These data were used to determine the acreage of areas with steep slopes, areas of erosive soils, areas with unstable slopes or soils, and areas prone to rockfall. These soil and geologic features were noted as concerns because they can be unstable and prone to erosion, landslides, or mass wasting. Oil and gas development in these areas can lead to potentially hazardous conditions, and reclaiming disturbance that occurs on sensitive soils/geologic hazards can be slower than on more forgiving lands leading to long-term scars, potential invasion of noxious weeds, and degradation of vegetative resources.

Also included in the analysis of geologic conditions are cave resources. These diverse and sensitive subterranean landforms support flora, fauna, and unique geological resources, and are significant sources of culinary water and stream flow from the Dixie National Forest. Potential resource concerns related to oil and gas exploration, drilling, and production include water pollution; air pollution; changes to the temperature, barometric pressure, and humidity of cave ecosystems; collapse of caverns causing surface subsidence; and explosions due to build-up of trapped natural gas (BLM 2006c).

Soils and geologic hazards and cave resources are presented and discussed in this report by ranger district. Table 3.8-1 lists the number of acres with sensitive soils and geologic hazards in each ranger district and includes the percentage of those lands within each ranger district. Figure 3.8-1 shows the location of these areas on the Dixie National Forest.

3.8.2 Soils Resources

Soils are composed of a complex mixture of mineral matter, organic matter, and living organisms. Surface soil horizons (i.e., layers) differ from underlying geologic/rock material as the result of geologic processes and interactions of geologic materials with the climate and living organisms. Soils on the Dixie National Forest are diverse and are a reflection of soil parent material, landform processes, vegetation, and a mountainous, continental climate characterized by variable precipitation and temperature extremes (USFS 1995a). Soils on many slopes can be limited, or shallow, and in general, soils are deepest along low gradient slopes, valley bottoms, and in glacial basins (USFS 1986).

3.8.3 Geological Resources

The geology of the Dixie National Forest has been discussed thoroughly in USFS (1995a). The following provides a summary of that information. The Dixie National Forest extends from southwestern Utah to south central Utah just west of Capitol Reef National Park. It spans a

zone of geologic transition from the block faulting and complex rock types of the Basin and Range physiographic province in the west to the gently warped plateau and sedimentary strata of the Colorado Plateau physiographic province in the east. The boundary between the provinces in southwest Utah generally parallels Interstate 15 between the towns of St. George and Parowan (USFS 1995a). Elevations are generally greater than 6,000 feet and include the Pine Valley Mountains and the Kolob-Markagunt, Sevier-Paunsaugunt, and Aquarius-Kaiparowits Plateaus (USFS 1995f).

The Basin and Range province is characterized by steeply faulted horsts (an upthrown area between two parallel faults) and thick, sediment filled grabens (a downthrown block between two parallel faults). The Pine Valley Ranger District is located in the Basin and Range province (USFS 1995e). The remaining portions of the Dixie National Forest are located in the Colorado Plateau province, which consists of a series of plateaus, mesas, and buttes formed from horizontal to gently dipping strata with major faults, monoclinal folds, anticlines and synclines, domes, and basins. Streams have eroded deep canyons and escarpments occur in many areas. Extrusive igneous rocks occur around the province while volcanic cones and flows are common. Some alpine glaciations have occurred in a few of the highest areas such as around Boulder Mountain and the Aquarius Plateau on the Escalante Ranger Districts and in the Brian Head area on the Cedar City Ranger District (USFS 1995e). Short growing seasons limit soil development in these areas.

Table 3.8-1 Acres of Sensitive Soils and Geologic Hazards on the Dixie National Forest, by Ranger District

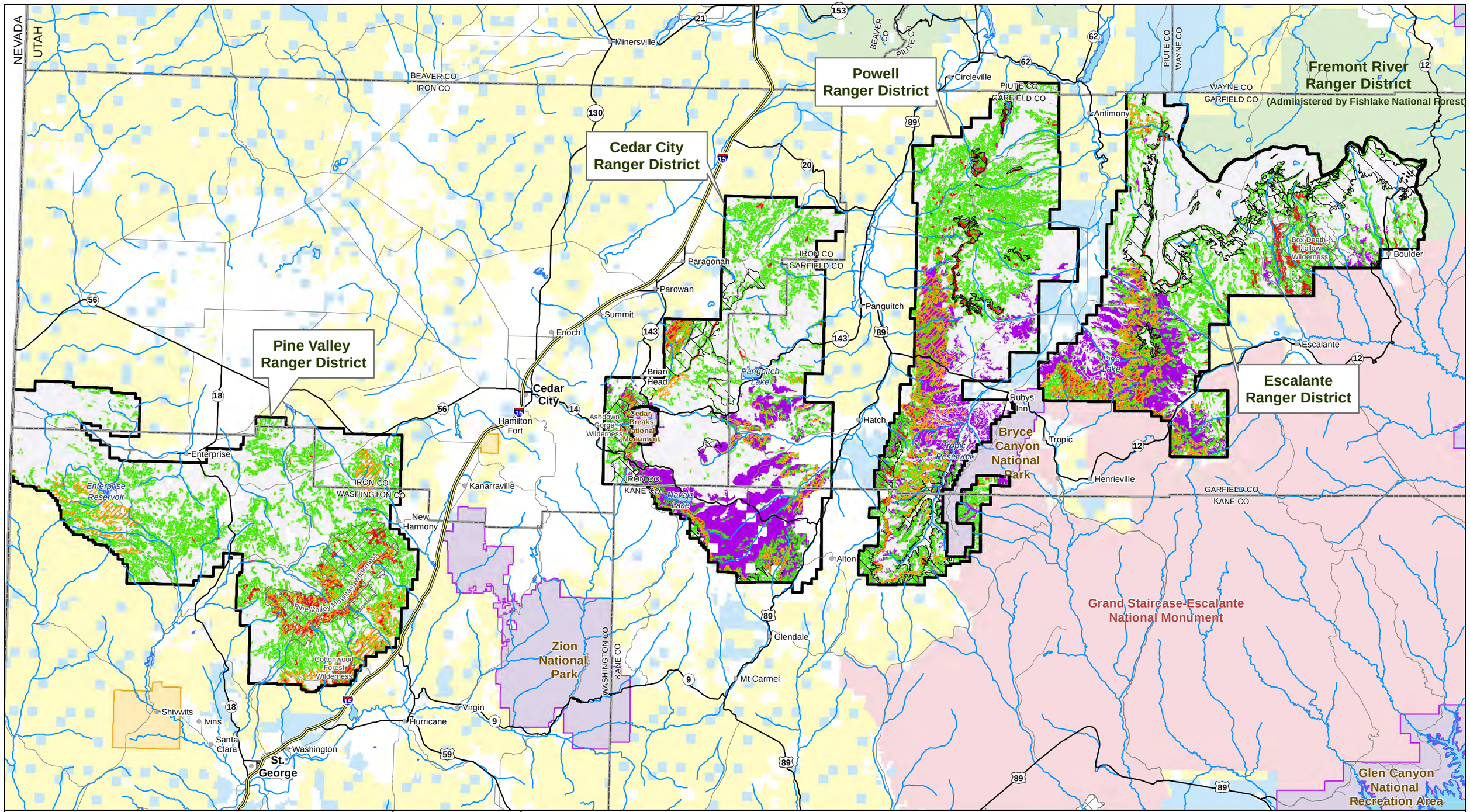
Ranger District	Acres of Public Land Defined As Having Sensitive Soils, Not Taking Into Account Any Overlap:					Total Acres of Public Land	
	Steep Slopes	Erosive Soils	Unstable Soils	Prone to Rockfall		Sensitive Soils in Ranger District, with each acre counted only once	All Lands in Ranger District
Pine Valley	126,058	35,410	0	7,857		**144,023**	463,020
Cedar City	56,174	12,085	13,758	1,373		**79,201**	353,424
Powell	108,476	26,357	8,041	2,865		**126,415**	383,899
Escalante	91,769	22,111	22,190	5,058		**112,193**	430,897
TOTAL Acres[1]	**382,477**	**95,964**	**43,988**	**17,153**		**461,831**	**1,631,240**

[1]Note that Total Acres of Steep, Erosive, Unstable, and Rockfall soils is 539,582 acres, but there are only 461,831 acres of sensitive soils. This is because there is some overlap: some areas are both steep and erosive. The column "Sensitive Soils in Ranger District …" counts each acre of sensitive soils only once.

3.8.4 Soil and Geologic Conditions Identified for further evaluation

The following soil and geologic conditions were used to identify sensitive areas on the Dixie National Forest. Their definitions are explained below.

Steep slopes: Steep slopes are defined as those slopes that are at 35 percent (20 degrees) or steeper, based on analysis of Digital Elevation Models. For this EIS, these projections used



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.8-1
Sensitive Soils & Geologic Hazards

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:590,000

1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

- Areas of High Erosion Potential
- Claron Formation
- Rockfall Hazard
- Slopes >35%
- Unstable Areas

0 4 8 12 16 Miles

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

both analog and stereo aerial imagery to create contour lines. Approximately 382,477 acres of the Dixie National Forest are comprised of slopes at or steeper than 35 percent.

Erosive soils: Erosive soils "consist of steep slopes, shallow soils, sparse vegetation, and are subject to rapid runoff." Runoff rates are determined by factors including previous human impacts, vegetative cover (less cover generally equals more runoff), water infiltration rate, soil texture, and the soil erodibility factor (K factor, as used by the Natural Resources Conservation Service (NRCS)).

A given soil may have a high inherent erodibility, but if it occurs on flat or low gradient slopes and has a rapid permeability, it would have a low erosion hazard ranking (BLM and USFS 2001). However, wet soils can be unstable and prone to slumping even on relatively flat ground if the inherent strength of soils is low. Soils derived from swelling clays become slippery and are prone to failure along planes of weakness, such as where a slope steepens, or along the edges of gullies and washes. Volcanic ash, when loose and granular in texture, is prone to slippage when wet or dry. The same is true for shale-derived channers: flat, platy rocks from less than one inch to several inches across. Steep slopes, large particle size, very small particle size, minimal vegetation coverage, water infiltration, and road cuts all aggravate weak soil structure.

Where the underlying C horizon or bedrock forms a relatively smooth surface dipping in the same direction as the slope, water can act as a lubricant on this sliding plane, allowing overlying layers to slip. This typically happens after prolonged wet periods. Two examples of massive slides occurring in the Intermountain West due to water and sliding planes are at Thistle, Utah and Gros Ventre, Wyoming.

The Dixie National Forest estimates that 95,964 acres are covered with highly erodible soils (see Table 3.8-1).

Unstable Slopes: Unstable slopes are "lands which are prone to mass failure under natural conditions..., and where human activities...are likely to increase landslide distribution in time and space" (Reid et al 1994). The GIS data depicting unstable soils used in this EIS are based on an analysis of areas that show "evidence of recent mass movement, fresh cracks are discernible, and probability of increased additional movements is high." These GIS data also include "areas that show discernible evidence of past landslide activity [that are] gaining stability but [may include] areas subject to reactivation of mass movements." Landslides occur anywhere the cohesiveness of the soil or bedrock cannot hold the material against gravity, often due to high precipitation, high elevation, steep slopes, and slide-prone geologic materials (USFS 1995a). They can be natural or human triggered and can occur when the slope has been steepened or when the moisture regime has changed. These areas are unsuited for road and well pad construction due to the high likelihood of slope failure. According to GIS data provided by the Dixie National Forest, unstable slopes may occur on approximately 43,988 acres of the Dixie National Forest (see Table 3.8-1).

The geologic units that commonly have slope failure in southwestern Utah include the Sevier River Formation; Tertiary volcanic rocks including the Bullion Canyon volcanics, Mt. Dutton Formation, and Mt. Belknap volcanics; Claron Formation; Tropic Shale; Carmel Formation; Chinle Formation, primarily the Petrified Forest Member; Moenkopi Formation; Wheeler Shale; and the Chisholm Formation. These formations include abundant clay weathered from parent shales and tuffs, and are affected by weathering and erosion. They are particularly prone to

landslides where slope angle, precipitation, aspect, and geologic structure are favorable (USFS 1995f).

Rockfall areas: According to the GIS metadata, areas mapped as having a high potential for rockfall have steep slopes of over 80 percent, or 38 degrees, covering at least five acres. Typically, rockfall occurs where there is exposed and poorly cemented rock. Rock fragments detach from parent bedrock along joints, bedding planes, or other zones of weakness. Newly detached or previously detached rockfall can roll or bounce downslope, causing damage. Rockfalls are abundant in southwestern Utah, especially in the Navajo Sandstone, the sandstone members of the Kayenta and Moenave formations, and in the upper Cenozoic basalts and rhyolites (USFS 1995f). The Dixie National Forest estimates that 17,153 acres (see Table 3.8-1) have high rockfall hazard.

Caves and Cave Resources: A cave is any naturally formed void, cavity, recess, natural pit, sinkhole, or other feature that is large enough to permit a person to enter, whether or not the entrance is naturally formed or human-made. The term includes any extension or component of a cave or system of interconnected cave passages that occur beneath the surface of the earth or within a cliff or ledge, and/or natural subsurface water and drainage systems. The Federal Cave Resources Protection Act of 1988 protects cave and cave resources identified by federal agencies as significant based on the following six categories: biota, cultural, geologic/mineralogic/paleontologic, hydrologic, recreational, and educational or scientific. Cave resources include any material or substance occurring naturally in caves, such as animal life, plant life, paleontological deposits, sediments, minerals, speleogens (relief features on the walls, ceiling, and floor of any cave that are part of the surrounding bedrock), and speleothems (any natural mineral formation or deposit occurring in a cave; USFS 2003b). Cave resources on the Dixie National Forest have not been thoroughly mapped.

3.8.5 Soil Terminology Used in the Text

Alluvium: Sediment deposited by running water on which a soil then develops. It may occur on terraces well above present streams or in the normally flooded bottomland of existing streams. Remnants of very old stream terraces may be found in dissected country far from any present stream (NRCS 2007a).

Badland: A moderately steep to very steep barren land dissected by many intermittent drainage channels. Ordinarily, the areas are not stony. Badland is most common where streams cut into soft geologic material. It is often found in steep, deep arroyos, up to 600 feet or more deep. Potential runoff is very high and erosion is active (NRCS 2007a).

Channers: Small, cobble-sized rocks that are angular instead of rounded due to being derived from shale or limestone.

Colluvium: Poorly sorted debris that has accumulated at the base of slopes, in depressions, or along small streams through gravity, soil creep, and local wash. It consists largely of material that has rolled, slid, or fallen down the slope under the influence of gravity. Accumulations of rock fragments are called talus. The rock fragments in colluvium are usually angular, in contrast to the rounded, water-worn cobbles and stones in alluvium and glacial outwash (NRCS 2007a).

Epipedon: A diagnostic soil horizon (identifiable layer) used to characterize a soil that has formed at the surface of the earth and occurs nowhere else in the soil, unless the soil is buried under water, wind, or volcanic deposits. An epipedon is defined mostly in terms of soil color,

content of organic matter and base saturation (relative amounts of base ions such as calcium, magnesium, sodium, and potassium as compared to the acidic ion, hydrogen). Two common epipedons found on the Dixie National Forest are called “mollic” and “ochric” (NRCS 2007a).

Mollic epipedon: A dark colored, rich, loamy surface horizon with at least 2.5 percent organic matter and at least 4-10 inches depth before other soil horizons, such as a clay or calcium-rich horizon, are encountered (NRCS 1998). This is a good cropland soil.

Ochric epipedon: A soil that is lighter colored (often reddish or yellow-brown) than the mollic epipedon. It is too thin, dry, or lacks enough organic material to be classified as mollic. It is common on the Dixie National Forest. The surface layer is well developed and easily identifiable because it is generally darker than deeper horizons when viewed in a soil test pit, road cut, etc., (NRCS 1998). Other common epipedons in southwest Utah are the Entic or Aridic epipedons. The layering in these soils is less obvious as the soils are less developed (NRCS 2007c).

Residuum: The term "residuum" is used when the properties of the soil indicate that it has been derived from rock that underlies it and when evidence is lacking that it has been modified by movement. The surrounding landscape and elevation are often helpful in identifying whether material has weathered in place and is thus residuum (NRCS 2007a).

Rock outcrop: Exposures of bare bedrock other than lava flows and rock-lined pits. Some areas are large, broken by small areas of soil while others are extensive (acres in size). Most rock outcrops are hard rock, but some are soft (NRCS 2007a).

Soil complex: A group of two or more dissimilar soil types occurring in a regularly repeating pattern. Each time the soil complex is mapped, one can assume that each major component is present, though their proportions may vary (NRCS 2007a).

Soil map unit: The delineation of a soil or group of soils marked on a soils map. Different soil maps have different levels of detail, depending on map scale, but whatever the scale, the basic grouping of soils is considered the map unit (NRCS 2007a).

3.8.6 Pine Valley Ranger District

The Pine Valley Ranger District is located on the west side of the Dixie National Forest in the Basin and Range province and covers 463,020 acres of public land. There are 126,058 acres (27 percent) on the ranger district that are considered steep (greater than 35 percent slopes), 35,410 acres (eight percent) listed as erosive, and 7,857 acres (one percent) listed as prone to rockfall. There are seven main areas of steep, erosive, or rock-fall prone soils on the ranger district. No areas of unstable soils or slopes have been identified on the Pine Valley Ranger District.

Pine Valley Mountain is a prominent landmark on the southeast side of the Pine Valley Ranger District, which contains the majority of steep slopes, erosive soils, and rockfall areas within the ranger district. The steep, southeast-facing escarpment of Pine Valley Mountain is the only part of the ranger district identified as having rockfall hazard. This escarpment is dominated by soil map unit number s8175 (Rock Outcrop-Pinitos family-Montez-Canlon family soils association). The Pinitos soils are very deep, well-drained, moderately permeable soils that developed in eolian and alluvial material derived from sandstone and shale on hills, fan terraces, cuestas, and mesas. The Montez series consists of deep, well-drained soils that formed in granite

colluvium and residuum at high elevations on slopes. Canlon series consist of shallow, well-drained and somewhat excessively drained, moderately permeable soils derived from lime-cemented sandstone and caliche on ridgelines and slopes. Rock outcrops occur on slopes and ridge tops. These soils have either a clay or rock layer below the A horizon and are moderate to excessively drained with areas of rapid runoff. Precipitation ranges from 15 to 23 inches, and elevations range from 6,700 to 9,500 feet (NRCS 2007b). Table 9.4-2 in Specialist Report 9.0 (Soil Resources) summarizes characteristics for these and other soils described in this report.

The north side of the Pine Valley Mountains is labeled as s8176 (Rock outcrop-Olot family-Gralic family-Falcon family-Eyre family soil association). Most of this area is within designated wilderness. These soils are derived from volcanics and sandstone, tend to be quite steep (2 to 90 percent) and range from 4,000 to 10,000 feet in elevation. The Olot and Gralic series are moderately deep, well-drained soils that formed in volcanic ash, colluvium, and residuum weathered from basalt and are somewhat acidic. The Falcon and Eyre families of soils are shallow and weathered from fractured sandstone and arkosic materials and are neutral to acidic. There is very little clay accumulation in these soils. The A horizon is typically a fine to coarse sandy loam with a weak, granular structure. Pumice and volcanic ash are common. Deeper layers are blockier but lack stickiness or plasticity. Precipitation ranges from 17 to 37 inches annually (NRCS 2007b).

The low elevation southeast corner of the ranger district is dominated by soil map unit numbers s8186 (Rock outcrop-Redbank family-Mespun-Caval), s362 (Rock outcrop), and s8219 (Tobish-Tacan-Nehar-Collbran family). These soils are sandstone-derived and include mostly fine sandy loams and some stony loams. These soils are associated with red soils typical of Wingate and Moenkopi formations and the blonder Navajo, Kayenta, and Dakota formations. These soils are very deep, to deep, moderately to rapidly permeable, with slow runoff. Although they are deep, there are shallow areas (in some areas depth to rock friable sand, or unaltered gravels is only about five inches) indicating association with alluvial deposits. These soils have many steep and erosive areas due to their association with recent floodplains, dune formations, and fine, poorly cemented parent material. Elevation ranges from 3,500 to 7,000 feet and precipitation ranges from 8 to15 inches annually (NRCS 2007b).

To the west of the Pine Valley Mountains are the Bull Valley Mountains. These are on the west side of the Pine Valley Ranger District and are also dominated by steep slopes. West of the crest of the Bull Valley Mountains, south of Upper Enterprise Reservoir and Pine Park Campground, the land is a finely dissected upland of Tertiary volcanic flows and ash deposits. This soil map unit is numbered s5598 (Pioche-Motoqua-Gabvally map units). Soils are very shallow to shallow, well drained, with very high runoff and slow permeability. They are associated with hills and mountainsides and have slopes of 2 to 70 percent. They are formed from residuum and colluvium of volcanic rocks, including andesite, rhyolite, and tuff. The typical soil is a gravelly to stony loam with a mollic epipedon, a clay horizon starting between about 8 to 16 inches, and welded tuff or other volcanic rock parent material at about 15 or 16 inches. Elevation ranges from 5,500 to 8,600 feet and precipitation is about 13 inches per year (NRCS 2007b).

The hills around Ox Valley, located north of the Bull Valley Mountains and east of Lower Enterprise Reservoir, also contain steep slopes. These valleys are somewhat broader and are filled in with alluvial material from surrounding volcanic and shale rocks. Quaternary basaltic flows are also present here. This soil map unit is numbered s8178 (Security family-Podmor family-Pastorius family-Fughes family-Dalcan family soil complex). Soils are moderately deep, to deep, well drained, and moderately permeable with rapid to very rapid run-off. Most of these

soils are associated with hills and mountainsides and have slopes of 0 to 65 percent. The Pastorius soils are found on flat river terraces. The other soils are formed from residuum and colluvium of basalts (Dalcan), granite and gneiss (Security), shales (Fughes), and quartzite (Podmor) and are on more sloping terrain. Soils range from loams to cobbly loams and have a mollic epipedon. There is often a clay horizon below about 20 inches. The C horizon ranges from 23 to 60 inches or more in depth. Elevation ranges from 6,500 to 10,000 feet and precipitation is 18 to 20 inches per year (NRCS 2007b).

To the east of Ox Valley and north of Pine Valley Mountain, at the north end of the Pine Valley Ranger District is a highland cut by Spring Creek and South Fork Pinto Creek. Harrison Peak is the most prominent peak in this area. Soil map unit number s8180 (Wye family-Sampson family-Pastorius family-Nehar family-Muzzler family-Mokiak family-Bernal family soil complex) dominates this area. The Sampson, Pastorius, and Bernal soils are flat lying. The first two are found in stream channels and flat river terraces and the last is found on mesa tops. The Wye, Nehar, Muzzler, and Mokiak soils components more likely to be associated with steep areas are typically found on mountain slopes and rolling hills with between 15 to 70 percent slope. Nehar soils are on alluvial fans and are formed alluvium and residuum weathered from coarse-grained acid igneous rock, quartzite conglomerate, and with minor influence from basalt. The Muzzler soils are shallow while Mokiak soils are moderately deep, to deep. All three are well-drained soils that formed in place above igneous bedrock on mountain and hillsides. The Wye soils are deep, well-drained soils formed in material weathered from limestone. There is often a clay horizon and run-off is slow to moderate, with moderate permeability. Elevations are between 4,300 and 7,300 feet, with precipitation between 13 to 16 inches annually (NRCS 2007b).

The northeast corner of the ranger district contains another area of steep slopes and erosive soils, dominated by soil map unit number s8179 (Rock outcrop-Motoqua family-Falcon family-Dotsero family-Bernal family soil association). The mountains in this area include Flat Top Mountain, Granite Mountain, Stoddard Mountain, and Iron Mountain. These peaks are made up of Quaternary and Tertiary intrusive and extrusive volcanics, with soils derived from basaltic tuffs and sandstone. Soils range from loams to sandy or cobbly loams that are shallow to very shallow and medium to excessively drained with moderate permeability. These soils are found on mountainside slopes, sloping mesas, and benches and have slopes ranging from 1 to 64 percent. The Falcon series is the highest elevation soil in this soil map unit and is very shallow. It is found on ridgelines and has excessive drainage and moderate permeability to the rock layer, which is about 14 inches from the surface. Precipitation ranges from 13 to 17 inches and elevation ranges from 4,000 to 9,000 feet (NRCS 2007b).

3.8.7 Cedar City Ranger District

The Cedar City Ranger District lies east of Interstate 15. There are a total of 353,424 acres of public land on the ranger district. Within the ranger district there are 56,174 acres (16 percent) of steep slopes, 12,085 acres (3 percent) of erosive soils, 13,758 acres (4 percent) of unstable slopes, and 1,373 acres (less than 1 percent) prone to rockfall. This ranger district has most of the documented caves, which are discussed at the end of this section.

The west side of the ranger district is the same north-south trending escarpment, the Markagunt Plateau, which makes up Cedar Breaks National Monument. The land drops off to the west from a high point of over 11,000 feet at the rim to 6,000 feet near Vermillion Castle. The most widespread soils issue in this area is unstable slopes, while areas of steep slopes are confined to ridgelines and escarpments. This band of steep and unstable slopes is dominated by the Winnemuca-Seth-Faim soil map unit (s8216), which is characterized by volcanically derived

(basaltic) soils with moderate to rapid run-off and moderate to slow permeability. All soil map units have a mollic epipedon with clay horizon below. Annual precipitation ranges from 15 to 20 inches (NRCS 2007b).

Stout Canyon, draining out of the south end of the plateau, and Little Creek Peak, Bear Creek, and the Hurricane Cliffs at the north end of the ranger district areas of steep, rockfall-prone, unstable soils, and/or erosive soils. These soils are derived from sedimentary sandstones and shales, basaltic volcanics, and pyroclastic materials. Soils map units in these areas are s8232 (Syrett-Swapps-Skutum-Pahreah-Badland) and s8231 (Toman-Harol-Fughes-Dalcan-Bushvalley). These soils are moderately deep, well-drained, moderately permeable soils of gently to steeply sloping benches and the sideslopes of mesas. They formed in colluvium and residuum weathered from sedimentary rocks. Elevation ranges from 6,500 to 10,000 feet and precipitation ranges from 13 to 25 inches (NRCS 2007b).

The central and eastern portions of the ranger district are on top of the plateau, are flat lying, and dominated by stable soils. Lava fields, discussed in Section 3.7 (Water Resources) and shown in Figure 3.7-2, are associated with Tertiary volcanics and are only present on the Cedar City Ranger District.

Caves and Cave Resources: There are several lava tubes and limestone caves located on the Cedar City Ranger District. Some have been mapped. Two caves are open to the public. Ice Cave is a lava tube that is open most of the year and supports icicles year-round. Mammoth Cave is a large limestone cave that is closed during spring to protect a nursery of Townsend's big-eared bats, but re-opens in June. Both caves have gates to protect cave resources.

3.8.8 Powell Ranger District

The Powell Ranger District is located east of Panguitch, Utah. Of the 383,899 acres of public land on this ranger district, there are 108,476 acres (28 percent) of steep slopes, 26,357 acres (7 percent) of erosive soils, 8,041 acres (2 percent) of unstable slopes, and 2,865 acres (less than 1 percent) prone to rockfall, mostly located on the southwest side and the central northern portion of the ranger district. The ranger district is dominated by the Paunsaugunt Plateau on the south and the Sevier Plateau on the north.

The rim of the Paunsaugunt Plateau is near the western and southern boundaries of the Powell Ranger District. This rim itself has many areas of high rockfall potential. Virtually all the slopes to the west of and below the plateau rim are listed as steep and/or unstable. The soil map unit found here is the same as that found near Stout Canyon on the Cedar City District (s8232), and is described above.

East Fork Creek and its tributaries drain northward through the Paunsaugunt Plateau. This steep-sided drainage basin is outlined with a thin band of steep slope areas, which are surrounded by larger areas of unstable or erosive soils along the rim and in the canyon bottom. Bryce Canyon National Park is east of the East Fork and separates almost entirely a small segment of the ranger district that is located east of the National Park. This distinct area is highly dissected and riddled with steep slope areas. In short, most of the southern third of the Powell Ranger District is dominated by unstable soils. Soil map unit s8234 (Syrett-Swapps-Skutum-Sheege-Pahreah-Badland soil map unit) is similar to that found at the south end of the Cedar City Ranger District at Stout Canyon (NRCS 2007b).

North of the Paunsaugunt Plateau is an area of lower elevation. The western half of this area, centered around Red Canyon, is dominated by, and contains the most extensive area of erosive soils. Red Canyon is eroding back into the Paunsaugunt Plateau, creating a narrow, incised canyon of deep but poorly cemented red soils at its headwaters. This soil map unit, s8233 (Zyme-Vanet-Syrett-Rock outcrop-Badland map units), is made up of shallow to very shallow, well-drained soils. These soils range from 6,700 to 8,800 feet elevation. They generally have an ochric or mollic epipedon and are typically gravelly loams derived from limestone and shales. A clay horizon may occur at a depth of about 7 to 11 inches (Vanet). Lithic contact is between 23 to 38 inches and is typically shale or limestone (Syrett). Badlands soils are found on the slopes of benches and the sideslopes of mesas and range from 3 to 80 percent slope. Precipitation ranges from 13 to 22 inches (NRCS 2007b).

The Sevier Plateau, on the north end of the Powell Ranger District, is dominated by Mount Dutton to the north, Cottonwood Peak in the middle, and Adams Head to the south. These peaks form a narrow plateau that is dissected by several ephemeral drainages on the west, north, and east. The west-facing side of the escarpment is rimmed with rockfall areas that extend from the north end to the center of the ranger district. Both sides of the peaks are dominated by steep slope areas, although the west side is consistently steep, while the east side is more of a mosaic of steeper and flatter ground. The entire plateau is grouped within soil map unit s8237 (Winnemucca-Echard-Callings-Behanin-Beardall map units; NRCS 2007b). All these soils are deep, well drained, and slowly permeable. All are formed in alluvium and colluvium from volcanic materials except the Beardall, which is formed from limestone-derived glacial colluvium and residuum. Slopes range from 1 to 65 percent, with steep slopes being common. These higher-elevation soils receive 18 to 35 inches of precipitation (NRCS 2007b).

The largest areas of stable soils on the Powell Ranger District are found in the east central portions.

3.8.9 Escalante Ranger District

The Escalante Ranger District is located east of Johns Valley and north of the Grand Staircase-Escalante National Monument. Of the 430,897 acres of public land on this ranger district, there are 91,769 acres (21 percent) of steep slopes, 22,111 acres (five percent) of erosive soils, 22,190 acres (five percent) of unstable soils, and 5,058 acres (one percent) prone to rockfall, mostly located on the southern and southeastern sides of the ranger district.

The Aquarius Plateau dominates the north central portion of the Escalante Ranger District and is made up of mostly flat, stable lands located above 10,500 feet elevation. However, the rim of the plateau is steep, and the slopes just below the rim, to the south and west of the plateau, have extensive areas of unstable soils made up of alluvium and colluvium eroded principally from the volcanic rocks and ash of the plateau above. This is the most common soil concern on the ranger district. These areas fall almost exclusively within one soil map unit, s8172 (Tatiyee family-Security family-Scout family-Quilt family-Parkay family-Jemez family-Hesperus family soil map units). These soils are moderately to very deep and well to excessively drained. Slopes range from 5 to 70 percent. Precipitation ranges from 18 to 34 inches annually (NRCS 2007b).

At about 9,000 feet elevation at the east end of the Escalante Ranger District, and nearly 10,500 feet on the southwest end of the ranger district the igneous lava flows and erosional alluvium, colluvium, and residuum give way to sedimentary rocks of Eocene (Wasatch Formation), Paleocene (Currant Creek Formation), and Cretaceous age (Dakota, Mancos, Mesa Verde group) that are the headwaters of the canyons of the Escalante River. These lands extend

across the southern third of the ranger district. Steep slopes and rockfall areas are common, especially within and to the east of the Box-Death Hollow Wilderness (USFS 1995f)

The eastern third of these sandstone/shale bedrock areas is dominated by the s8225 (Yenlo-Mikim-Lazear-Clapper-Cannonville-Bayfield) soil map unit. These soils are derived from sandstones and shales and are typically loamy to sandy loam in texture. Soils are relatively deep (NRCS 2007b). The middle third of the sandstone/shale bedrock areas, located to the west of Box-Death Hollow wilderness, is dominated by soil map unit s8174 (Windwhistle family-Telephone family-Seleez family-Security family-Rock outcrop-Bond family-Atchee family). These soils are typically shallower and more sandy to cobbly in texture with more granitic parent material derived from erosional forces. There are sloping dune areas and cuestas (NRCS 2007b). The western third of the sandstone/shale bedrock areas includes the Escalante Mountains, a relatively narrow ridgeline that is being eroded from both east (Escalante drainage) and west (Sevier River). The two most prominent peaks are Table Cliff Plateau (10,300 feet) and Barney Top (10,450 feet). The lowest elevation lands on the eastern flanks of the Escalante Mountains are covered by the same s8225 soil map unit noted above and have numerous isolated areas of steep slopes associated with canyon rims (NRCS 2007b).

The Escalante Mountains ridge crest is dominated by the s8234 (Syrett-Swapps, Skutum, Pahreah-Badland) soil map unit. Soils are both steep and erosive. In areas other than the barren, eroding Badlands, soils are generally moderately deep, well drained, and moderately permeable sandy to gravelly loams. They are found on gently to steeply sloping benches and the sideslopes of mesas. These soils are both steep and erosive. A ring around the summit of Barney Top also has unstable soils. Precipitation ranges from 19 to 25 inches (NRCS 2007b).

The last area of steep and erosive soils is found in the southwest corner of the Escalante Ranger District at the headwaters of East Canyon, which drains to the Paria River. This soil map unit, s8233 (Zyme-Vanet-Syrett-Rock outcrop-Badland map units), is made up of shallow to very shallow, well-drained soils. These soils range from 6,700 to 8,800 feet in elevation. They generally have an ochric or mollic epipedon and are typically gravelly loams derived from limestone and shales. A clay horizon may occur at about 7 to11 inches depth (Vanet). Lithic contact is between 23 to 38 inches and is typically shale or limestone (Syrett). Badlands soils are found on the slopes of benches and the sideslopes of mesas and range from 3 to 80 percent. Precipitation ranges from 13 to 22 inches annually (NRCS 2007b).

3.9 Vegetation

3.9.1 Introduction

The Dixie National Forest contains 1.8 million acres of diverse vegetation across a wide range of elevations, from 2,800 feet near St. George to over 11,000 feet on Mount Dutton. Vegetation is characterized mainly by low-growing shrub, pinyon pine and juniper, mixed stands of aspen and conifers (pine, spruce, and fir), and high elevation plateaus that contain sagebrush and grassland meadows, high-altitude forests, and gently rolling hills (USFS 1995d:2; Utah Office of Tourism 2007).

In addition to major vegetation communities, there are several unique vegetation areas or those with special designations that serve specific purposes on the Dixie National Forest. These include soil crusts, the Red Canyon Botanical Area, the Side Hollow Study Area, and five Research Natural Areas.

3.9.2 Major Vegetation Communities

Vegetation communities on the Dixie National Forest can be broadly classified into eight types: pinyon-juniper, aspen/conifer, ponderosa pine, mountain brush, sagebrush steppe, spruce-fir, grassland/meadow, and desert scrub (Figure 3.9-1). The number of acres of each major vegetation community occurring within each ranger district is described in Table 3.9-1; communities are described in more detail below.

Table 3.9-1 Acres of Major Vegetation Communities on the Dixie National Forest

Ranger District	Pinyon-juniper	aspen conifer	pine wood	moun-tain brush	sage steppe	spruce fir	grass meadow	desert scrub	Other[1]	TOTAL[2]
Pine Valley	234,615	33,465	4,032	142,193	16,875	0	479	10,904	20,287	462,850
Cedar City	33,743	96,313	66,450	36,511	47,543	33,683	12,647	0	26,146	353,036
Powell	56,655	49,428	26,283	0	117,774	35,530	24,032	0	74,175	383,877
Escalante	97,668	69,096	76,423	5,361	49,517	53,631	12,364	488	66,309	430,857
Total	422,681	248,302	173,188	184,065	231,709	122,844	49,522	11,392	186,917	1,630,620

[1] Includes water bodies and rocky areas with little vegetation.
[2] Total acreage of vegetation includes all areas within the administrative boundary not including private lands. The totals do not match the overall acreages in each ranger district (i.e., listed in Chapter 2) due to the differing sources of data.

PINYON-JUNIPER

Single needle or two-needle pinyon pine-Utah juniper (*Pinus monophylla* or *P. edulis* - *Juniperus osteosperma*; "pinyon-juniper") woodland is the most abundant vegetation type on the Dixie National Forest, covering 422,681 acres (26% of the Dixie National Forest). *P. monophylla* lies within the Great Basin, mainly west of Enterprise, Utah, on the Pine Valley Ranger District. Two-needle pinyon (*P. edulis*) is found on the Colorado Plateau, mainly east of Enterprise, within the Pine Valley, Cedar City, Powell, and Escalante Ranger Districts. Pinyon-juniper woodland occurs on most lower slopes and hillsides and usually includes a prominent shrub component of sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus nauseosus*), curleaf mountain mahogany (*Cercocarpus ledifolius*), prickly pear (*Opuntia polyacantha*), blackbrush (*Coleogyne ramosissima*), or antelope bitterbrush (*Purshia tridentata*). The relatively larger pinyon tends to favor higher elevations, while Utah juniper becomes dominant at lower elevations. Similar to ponderosa pine (*Pinus ponderosa*), pinyon-juniper is greatly affected by human disturbance because of its presence at low elevations. Stands of pinyon-juniper may be dense or open, even or mixed age, and multi- or single-stemmed. Common associates include rockcress (*Arabis perennans*), sulfur buckwheat (*Eriogonum umbellatum*), snakeweed (*Gutierrezia sarothrae*), Indian ricegrass (*Achnatherum hymenoides*), Carpet phlox (*Phlox hoodii*), trumpet gilia (*Gilia aggregata*), and red paintbrush (*Castilleja chromosa*; USFS 1995d:4).

ASPEN/CONIFER

Aspen/conifer vegetation covers 248,302 acres (15% of the Dixie National Forest). Lower elevations of the subalpine zone are characterized by aspen (*Populus tremuloides*) stands and mixed coniferous forest of subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), scattered ponderosa pine, and Douglas-fir (*Pseudotsuga menziesii*). Aspen is an aggressive pioneer species that usually occurs in swales or along drainages. In general, seral aspen stands are being replaced by spruce-fir over time due to changes in disturbance patterns (i.e., fire suppression and livestock grazing). Aspen forest may contain mature trees, but well-developed stands are usually characterized by a prominent spruce-fir understory. Other

understory species include mountain snowberry (*Symphoricarpos oreophilus*), currant (*Ribes spp.*), common juniper (*Juniperus communis*), and lupine (*Lupinus argenteus*). Limber pine (*Pinus flexilis*) characterizes dry, rocky ridges, often in conjunction with scattered patches of common juniper. Other conifers that characterize the transition zone between high elevation spruce-fir forest and lower elevation ponderosa pine forest include white fir (*Abies concolor*), Douglas-fir, limber pine, and ponderosa pine. Small meadows and rock outcrops occur throughout this vegetation type (USFS 1995d:3, 11).

PONDEROSA PINE AND WOODLAND

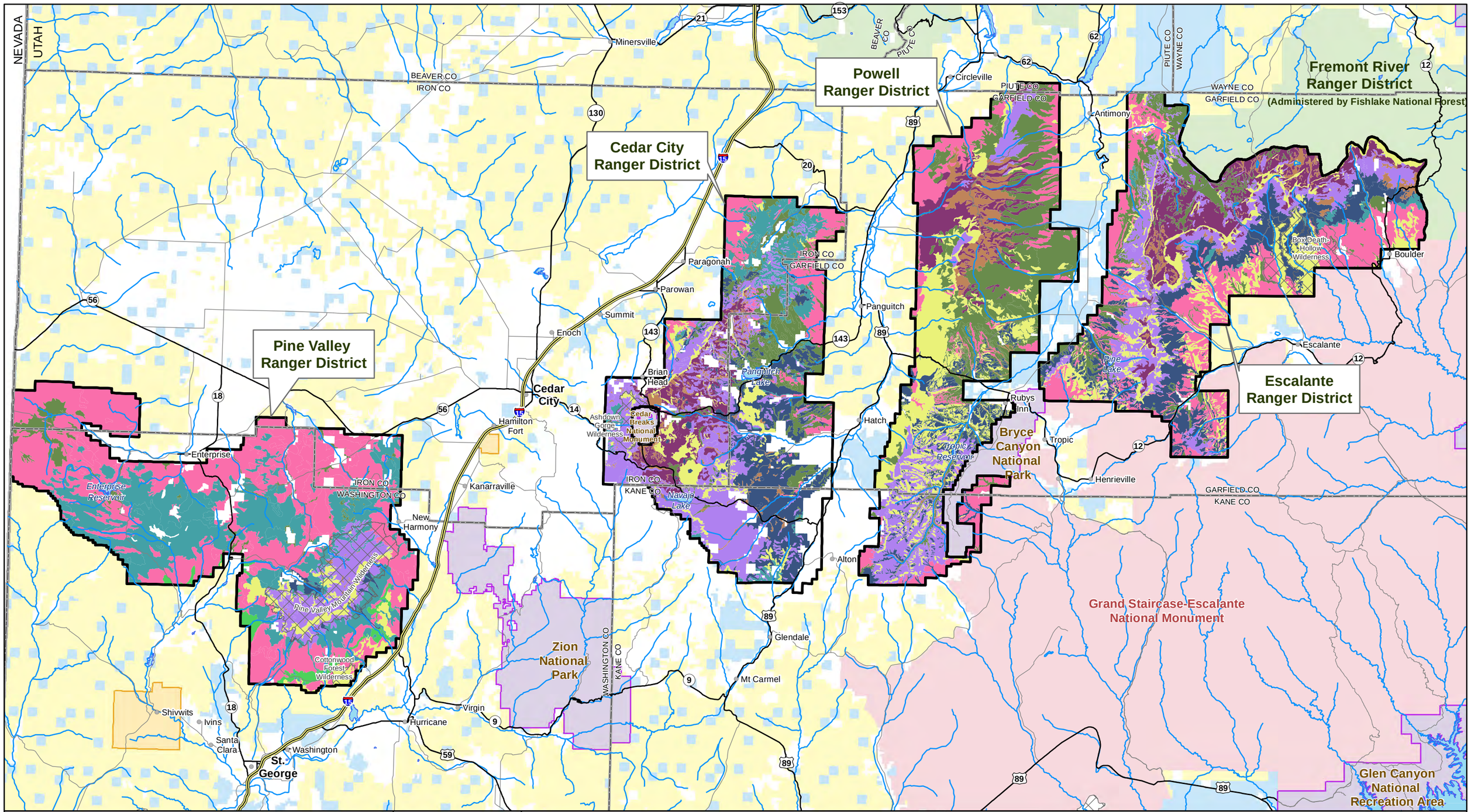
Ponderosa pine forest and woodland covers 173,188 acres (11% of the Dixie National Forest) across much of the montane zone, especially on the drier plateaus and south-facing slopes. Like aspen, it is both a seral and climax community, but relatively more disturbed by humans due to its location on lower elevations. Where ponderosa pine is the climax species within a community, a more open, park-like density occurs, in contrast to seral ponderosa pine forests, which are denser. In general, the understory is open and contains a few shrubs, including Ross's sedge (*Carex rossii*), June grass (*Koeleria cristata*), wild buckwheat (*Eriogonum spp*.), stemless goldenweed (*Hymenoxys acaulis*), and scattered patches of Gambel oak (*Quercus gambelii*). Ponderosa pine ranges from 10 to 24 inches and up to 40+ inches diameter at breast height (DBH) and from 60 to 80 feet in height on many sites. Larger trees (40 to 50 inches DBH) occur on the more mesic areas (USFS 1995d:3, 11).

MOUNTAIN BRUSH

Mountain brush vegetation covers 184,065 acres (11% of the Dixie National Forest). This community is most commonly transitional vegetation between pinyon-juniper woodlands and cooler, high elevation forests, and occurs mainly in the Pine Valley Ranger District. Over 55,000 acres (30%) of the mountain shrub type is dominated by Gambel oak. Mountain mahogany (*Cercocarpus* spp.) -dominated communities, scattered throughout the Dixie National Forest, are also included in the mountain brush type. Within the mountain brush type, there is the hard-leaved chaparral area that is unique in Utah and occurs only on the east-facing slopes of Pine Valley Mountain, from approximately Leeds Canyon north through the Browse Research Natural Area (see discussion under Browse Research Natural Area).

SAGEBRUSH STEPPE

Sagebrush steppe covers 231,709 acres (14% of the Dixie National Forest), and most often occurs on sideslopes. Sagebrush species on the Dixie National Forest include mountain big sagebrush (*Artemisia tridentata var. vaseyana*), basin big sagebrush (*A. tridentata var. tridentata*), Wyoming big sagebrush (*A. tridentata var. wyomingensis*), black sagebrush, (*A. nova*), and silver sagebrush (*A. cana*). Sage steppe usually contains several grass and shrub associations. Common grasses include mountain wheatgrass (*Agropyron dasystachyum*), needlegrass (*Stipa comata*), sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), Letterman's needlegrass (*Stipa lettermanii*), western wheatgrass (*Agropyron smithii*), Indian ricegrass, galleta (*Hilaria jamesii*), and cheatgrass (*Bromus tectorum*); shrub associations include rabbitbrush (*Chrysothamnus* spp.), snakeweed (*Gutierrezia sarothrae*), winterfat (*Krascheninnikovia lanata*), horsebrush (*Tetradymia canescens*), and antelope bitterbrush (UDWR 2005).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.9-1
Major Vegetation Communities on Dixie National Forest

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:590,000

1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Vegetation Types***

- Aspen/Conifer
- Desert Shrub
- Grassland/Meadow
- Mountain Brush
- Other
- Pinyon-Juniper
- Ponderosa Pine/Woodland
- Sage Steppe
- Spruce Fir

Miles: 0 4 8 12 16

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.
***SOURCE: Dixie National Forest. 4/17/2007. Vegetation types condensed.

SPRUCE-FIR

Engelmann spruce and subalpine fir ("spruce-fir") stands cover 122,844 acres (eight percent of the Dixie National Forest) and are found at higher elevations where the climate is cooler and more humid. Spruce-fir vegetation on the Dixie National Forest is composed of relatively large and longer-lived Engelmann spruce (up to 40 inch DBH, 70 feet tall) and relatively smaller subalpine fir, which is somewhat shade-tolerant and usually dominates the understory. If the site is moist, Engelmann spruce is most abundant, while in drier areas pure stands of subalpine fir may occur. Above 11,000 feet elevation, Engelmann spruce may or may not contain a subalpine fir understory. Other understory species vary depending on substrate and elevation, but commonly include arnica (*Arnica cordifolia*), bluebell (*Mertensia* spp.), meadowrue (*Thalictrum* spp.), Ross's sedge (*Carex rossii*), and vetch (*Vicia americana*; USFS 1995d:3).

GRASSLAND/MEADOW

Grassland/meadow vegetation covers 49,522 acres (three percent of the Dixie National Forest), and occurs over a wide elevation range depending on site history (logging, fire) and moisture regimes. In general, wet and semi-wet freshwater meadows are frequently encountered on mountain rangelands where water concentrates and spreads, occurring in conjunction with springs and plateaus where rapid drainage is impeded. Sedges *(Carex spp.*) generally dominate these areas with rush (*Juncus arcticus*), dandelions (*Taraxacum officinale*), phlox (*Phlox spp.*), starlily (*Leucocrinum montanum*), and wild iris (*Iris missouriensis*). High elevation meadows are characterized by grasses and sedges, as well as scattered shrubs of currant (*Ribes spp.*), cinquefoil (*Potentilla fruticosa*), and elderberry (*Sambucus racemosa*; USFS 1995d:4).

DESERT SCRUB

Mojave desert scrub vegetation on the Dixie National Forest occurs mainly in the Pine Valley Ranger District and covers 11,392 acres (one percent of the Dixie National Forest); major species include blackbrush (*Coleogyne ramosissima*), desert peach (*Prunus fasciculate*), and Mormon tea (*Ephedra sp.*). Blackbrush dominates the desert scrub areas of the Dixie National Forest.

3.9.3 Gypsum Soils and Biological and Chemical Soil Crusts

In many dry areas where vegetation is sparse, such as in the Pine Valley Ranger District of the Dixie National Forest, biological soil crusts are present in the open spaces between plants. Biological soil crusts are a complex mosaic of cyanobacteria, lichens, and mosses. Crust components form a matrix that stabilizes and protects soil surface from erosion, retains soil moisture, discourages annual weed growth, fixes atmospheric nitrogen, and contributes organic matter to the soil. Soil crusts of the Colorado Plateau are generally composed of non-heterocystic cyanobacteria (*Microsoleus*) and nitrogen-fixing lichens (*Collema*). Calcareous and gypsiferous soils, or outcrops comprised of fine-textured soils with high concentrations of sulfate and calcium, generally support a high coverage of species-rich crust (BLM 2001). Biological crusts are most likely to occur at sites with salt desert shrub, blackbrush, pinyon-juniper, or sagebrush vegetation; low herbaceous plant density but dominated by bunchgrasses; low annual precipitation (less than 12 inches); fine silt loams and clays; stable embedded rocks; relatively long fire interval (greater than 50 years); and mid- to late-seral succession conditions (Rosentreter and Pellant *draft*). Because biological soil crusts take a relatively long time to develop, the presence, absence, and abundance of early- or late-successional taxa in the crust can provide information regarding a site's disturbance history (BLM 2001). Biological soil crusts on the Dixie National Forest have not been mapped.

Physical and chemical soil crusts are formed by different processes than biological soil crusts and tend to form a hard, impermeable layer on the soil surface that lacks the biological characteristics discussed above. Chemical crusts do not contain nutrients that make the soil more fertile or contain photosynthetic life, but generally indicate that the amount of organic matter in the soil has decreased or that erosion has occurred. They seal the soil surface, reduce the rate of water infiltration, and can increase runoff, often impeding seedling emergence. Physical crusts are most common on soils containing silt, clay, and loam (USFS 2001). Physical and chemical crusts on the Dixie National Forest have not been mapped.

3.9.4 Special Areas

RED CANYON BOTANICAL AREA (2001)

The Red Canyon Botanical Area measures 203.3 acres and is located on the Powell Ranger District (Figure 3.9-2), on the eastern fringe of Red Canyon, south of Highway 12. It is three miles south/southwest of the Red Canyon Research Natural Area, which is administratively separate and does not overlap the Red Canyon Botanical Area. The Red Canyon Botanical Area is a small watershed characterized by soils derived from the pink Tertiary Claron (Limestone) Formation and seven endemic, rare plant species that are confined to these substrates (discussed in Section 3.6). Bristlecone pine (*Pinus longaeva*) trees are present in the area, which is characterized by barren slopes, hills, plateau, and cliffs with limited vegetation cover and soils derived from the highly erosive Claron Limestone (USFS 2000b).

The Red Canyon Botanical Area is under management prescription 10C, which was added to the 1986 Land and Resource Management Plan by amendment in 2001. Ensuring the persistence of sensitive plants is the main objective of the Red Canyon Botanical Area. Management objectives of the greater Red Canyon area include monitoring the impacts of off-highway-vehicles and regulating recreational activities and road construction (USFS 2000b). The Red Canyon Botanical Area itself contains no trails and is mainly a viewing site, although walking in the area is permitted.

SIDE HOLLOW PONDEROSA PINE PROVENANCE STUDY AREA (1987)

The Side Hollow Ponderosa Pine Provenance Study Area (Side Hollow Study Area) measures 4.5 acres and is located on the Escalante Ranger District (Figure 3.9-2) within an IRA. The Side Hollow Study Area contains ponderosa pine trees of various origins that are part of a genetic study that began in 1987, using seed collected from 97 stands in Arizona, Colorado, Idaho, New Mexico, and Utah. The purpose of the Side Hollow Study Area is to provide a common environment for the growth of ponderosa pine trees from various seed sources. Specific objectives of the study include identifying stands in southern Region 4 forests based on seed source data, refining seed transfer systems and performance data in the Forest Vegetation Simulator model, and evaluating seed performance in response to global warming (USFS 2006b).

3.9.5 Research Natural Areas

Research Natural Areas are part of a national network of ecological areas designated for research, education, or to maintain biological diversity on federal lands (FSM 4063). The management objectives associated with Research Natural Areas are to preserve and maintain the biological and genetic diversity within “exemplary” vegetation types, and over the long term (and beyond the Dixie National Forest), to set aside at least one example of all the habitat or vegetation community types represented on Region 4 National Forest lands. As “examples” of

common or important vegetation, Research Natural Areas provide baseline reference sites for assessing long-term ecological changes as well as the effects of management techniques and practices applied to similar ecosystems. As such, natural physical and biological processes are allowed to prevail in order to maintain natural conditions, and human intervention is used only if it is deemed necessary to maintain what the Research Natural Area was established to protect (USFS 2007j). Within these areas, leasing for mineral development, including oil and gas, is at the discretion of the Regional Forester and Station Director (FSM 4063). The location (Figure 3.9-2) and size (Table 3.9-2) of Research Natural Areas on the Dixie National Forest are provided in more detail below. All Research Natural Areas occur within "Very High" Scenic Integrity Objective areas. All are surrounded by, within, or adjacent to designated Wilderness or IRAs.

Table 3.9-2 Location and Size (acres) of Research Natural Areas on the Dixie National Forest

Research Natural Area	Pine Valley Ranger District	Cedar City Ranger District	Powell Ranger District	Escalante Ranger District
Red Canyon	-	-	531	-
Timbered Cinder Cone	-	225	-	-
Table Cliff	-	-	-	1,445
Browse	2,055	-	-	-
Upper Sand Creek	-	-	-	540
TOTAL (4,796 acres)	**2,055**	**225**	**531**	**1,985**

The following information was taken from USFS (1986) and Establishment Records for each Research Natural Area.

RED CANYON RESEARCH NATURAL AREA (1987)

The Red Canyon Research Natural Area encompasses an entire small watershed containing xeric forests, woodlands, and shrublands near the lower western edge of the Paunsaugunt Plateau. The Red Canyon Research Natural Area does not include any part of the Red Canyon Botanical Area (Section 3.9.4). Two major geologic and physiological types occur in the eastern and western portions of the Red Canyon Research Natural Area, characterized by limestone and basalt, respectively. The eastern area is a highly dissected terrain with steep gravelly slopes, hoodoos, low cliffbands, and small washes, with some small mixed conifer forested flats in the extreme northeast. The main understory plant is greenleaf manzanita (*Arctostaphylos patula*). The nearly barren habitats in the eastern portion support most of the rare plant populations in the Research Natural Area. The area contains at least thirteen plant taxa that are endemic or otherwise rare; four are sensitive species (*Cryptantha ochroleuca, Eriogonum aretioides, Penstemon bracteatus,* and *Silene petersonii*) (discussed in Section 3.6). The western portion of the area is comprised of the gentle to moderately steep basalt slopes of Black Mountain. These slopes are little dissected by drainage courses, unlike in the east. The Red Canyon Research Natural Area is completely within an IRA. The main objectives of the Red Canyon Research Natural Area are to preserve the biotic features of the area and support research or educational uses (USFS 1987). Regarding oil and gas, the potential for development was deemed medium at the time of designation as the Research Natural Area occurred within two simultaneous offering tracts. These leases could be leased in the future with appropriate protective stipulations.

TIMBERED CINDER CONE RESEARCH NATURAL AREA (1990)

The Timbered Cinder Cone Research Natural Area is an untouched and little-known stand of spruce-fir that occupies a small cinder cone (lava field) on the Markagunt Plateau east of Cedar City. It is within an Inventoried Roadless Area and underlain by a sensitive aquifer. The Timbered Cinder Cone has been protected from livestock and human disturbances due to its inaccessibility. The consequent integrity of this location led to its designation as a Research Natural Area. The major objective of the Timbered Cinder Cone Research Natural Area is to preserve a typical, yet uncommon landform and the commercial forest types that occur in the area. Regarding oil and gas, new leases were viewed as a potential conflict at the time of designation although none were or have been made to date. When the establishment record was approved, the Research Natural Area was to be withdrawn from mineral entry (USFS 1990b); however, it has not yet been withdrawn.

TABLE CLIFF RESEARCH NATURAL AREA (1991)

The Table Cliff Research Natural Area is located on the Escalante Ranger District and encompasses a portion of the Henderson Creek drainage at the southern end of the Aquarius Plateau. Approximately 90 percent of the Table Cliff Research Natural Area is within an IRA. The major features of the Table Cliff Research Natural Area include pristine subalpine forests (primarily Engelmann spruce and subalpine fir), old bristlecone pine groves, extensive mixed-conifer woodlands that are unusually diverse, and expansive cliffs below the Table Cliff Plateau. The area is practically undisturbed due to its rugged and densely forested lands. The major objectives of the Table Cliff Research Natural Area are to preserve: 1) an erosional and depositional landform unique to this part of the Colorado Plateau, 2) bristlecone pine trees, 3) commercial and noncommercial forest, and 4) rare plant species. Regarding oil and gas, areas surrounding the Research Natural Area have a number of mineral developments, including oil, and the Table Cliff Plateau itself is underlain with coal at a very great depth (USFS 1991).

BROWSE RESEARCH NATURAL AREA (1998)

The Browse Research Natural Area is located near the Browse Guard Station on the eastern side of the Pine Valley Mountains, and contains evergreen chaparral vegetation (which resembles communities in the South and West) and a diversity of other vegetation types. Two thirds of the Browse Research Natural Area is within an IRA. To the east, the Pine Valley Mountain Wilderness Area is adjacent and overlaps two acres of the Browse Research Natural Area. The exterior boundary corresponds with generally well-defined ridge crests and drainage courses for most of its length. The major objectives of the Browse Research Natural Area are to: 1) preserve and maintain the terrestrial forest, woodland, and shrubland habitat types, riparian woodlands, and distinctive landform, soil, and geology; and 2) provide a reasonably accessible reference site for basic, non-manipulative studies of biotic patterns, ecological processes, natural disturbance regimes, and community succession (USFS 1998a). Regarding oil and gas, the withdrawal of the Browse Research Natural Area from mineral entry was not deemed necessary at the time of establishment. Mineral lease applications, including oil and gas, were to be reviewed and recommendations made to the BLM regarding necessary measures and leasing options to protect surface resources. Regarding existing leases, the Forest Service was to honor all existing and lawful renewals of mineral or oil and gas leases, and manage them as the priority land management feature for as long as the leases existed which would have violated the direction in the Land and Resource Management Plan (1986; for NSO in Research Natural Areas). Those leases have not been renewed.

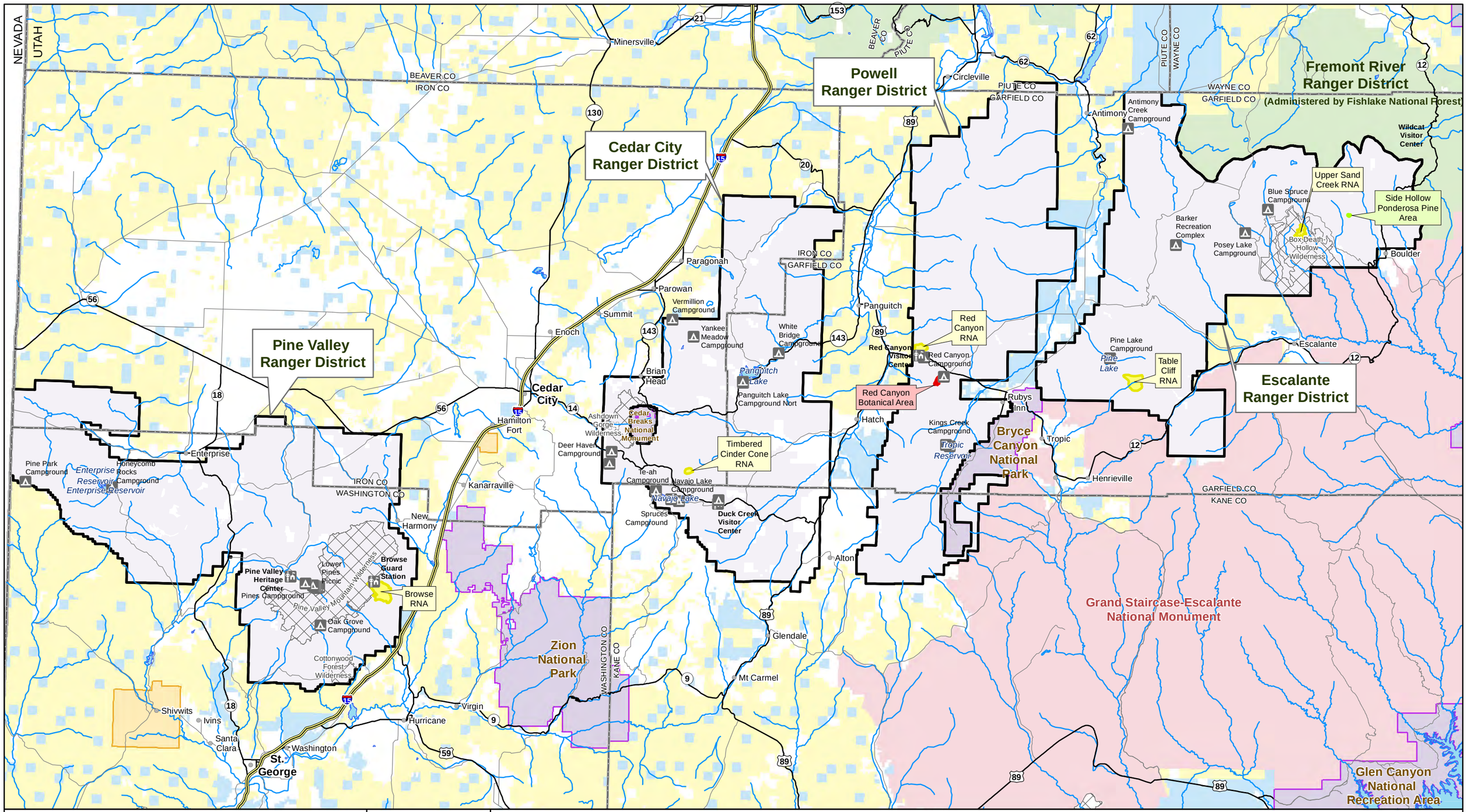
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.9-2
Locations of Special Areas & Research Natural Areas

Horizontal Datum = NAD 83
Coordinate System = Zone 12N

1:590,000

1 in = 9 miles



Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

Forest Sites

- Campgrounds
- Visitor Centers

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Vegetation: Special Designations

- Red Canyon Botanical Area
- Research Natural Areas
- Side Hollow Ponderosa Pine Area

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

The hard-leaved chaparral area that occurs only on the east facing slopes of Pine Valley Mountain, from approximately Leeds Canyon north through the Browse Research Natural Area, is the only true evergreen chaparral in the state. Hard-leaved chaparral in Utah resembles a vegetation type more common in central Arizona and California. Chaparral vegetation dynamics are closely linked to stand replacement disturbances such as fire, and tend to regenerate on a 50-100 year cycle. Despite a recommendation from the Nature Conservancy in 1985, the area was not carried forward as a Research Natural Area in the 1986 plan due in part to altered conditions from the 1986 fire and political uncertainties about water use. Later, recreation pressures (mid-1990s) and issues with private land holdings within the area (2006) prevented the designation of RNA status. The Pine Valley Ranger District has an interest in minimizing human impacts in the area, limiting access beyond primitive recreation, and allowing natural ecosystem processes to occur.

UPPER SAND CREEK RESEARCH NATURAL AREA (1998)

The Upper Sand Creek Research Natural Area is a broad ridge crest/peninsular bench 11 miles north of Escalante, perched above the deep sandstone canyons of Sand Creek and Death Hollow. The Box-Death Hollow Wilderness Area nearly surrounds the Upper Sand Creek Research Natural Area; 15 acres of the Upper Sand Creek Natural Area is within Wilderness. The remaining portion of the Upper Sand Creek Natural Area is reserved for carbon dioxide gas development. The Area is most distinguished by the presence of open, park-like stands of mature ponderosa pine with low, shrubby, and grassy understories. Lower elevations contain open forests of ponderosa pine and manzanita on sandstone substrates, and pinyon-juniper woodlands on south-facing slopes. The main objectives of the Upper Sand Creek Research Natural Area are to: 1) preserve and maintain the moderately productive ponderosa pine forest, typical examples of mixed-conifer, less-productive ponderosa pine, and pinyon-juniper communities, and distinctive landform, soil, and geology; and 2) provide a reference site for basic, non-manipulative studies (USFS 1998b). Regarding oil and gas, the Dixie National Forest was to honor all existing and lawful renewals of mineral or oil and gas leases at the time of Research Natural Area designation, and manage such activities as the priority land management feature for as long as the leases existed, which would have violated the direction in the Land and Resource Management Plan (1986; for NSO in Research Natural Areas). The portion of the Upper Sand Creek Research Natural Area within a CO_2 lease is not available for leasing because the lease expired in 1999. The Upper Sand Creek Research Natural Area is not available for future leasing.

3.9.6 Invasive Nonnative Plants and Noxious Weeds

Invasive nonnative plants are species that have been introduced to an area and have survived and reproduced to the point that their presence causes economic or environmental harm to the native plant communities. Noxious weeds are either native or nonnative species that are legally prohibited or restricted at the federal, state, or county level, due to their harmful economic and environmental effects.

Invasive nonnative plants and noxious weeds ("invasive plants") are found on the Dixie National Forest, especially on disturbed ground. Disturbed soils along roads are the most vulnerable areas to invasions, although grazing (by livestock and wildlife) and recreation also contribute to proliferation. Invasive plants tend to appear along disturbed road banks because many invasive species can tolerate exposed and disturbed sites more effectively than natives can. Invasive plants displace native plant communities by out-competing native grasses, forbs, and shrubs for water, space, and nutrients. The largest number of invasive plant infestations occurs on the Pine Valley Ranger District (Table 3.9-3; Section 3.9.7). Species listed as noxious weeds are

officially designated and published as noxious by the State of Utah under Section 4-17-3 of the Utah Noxious Weed Act. These species are noted in Table 3.9-3. Other noxious weeds on the state list that may occur on the Dixie National Forest, but that have not been mapped include Bermudagrass (*Cynodon dactylon*), diffuse knapweed (*Centaurea diffusa*), Johnsongrass (*Sorghum halepense*), musk thistle (*Carduus nutans*), quackgrass (*Agropyron repens*), Russian knapweed (*Centaurea repens*), and yellow starthistle (*Ceantaurea solstitalis*; Belliston et al. 2004).

Utah counties also maintain noxious weed lists of additional species, which are not on the state list. County-listed noxious weeds that may occur on the Dixie National Forest include western whorled milkweed (*Asclepias subverticuillata*; Washington and Iron Counties), silver leaf nightshade (*Solanum elaeagnifolium*; Washington County), puncturevine (*Tribulus terrestris*; Iron County), bull thistle (*Cirsium vulgare*; Iron County), saltcedar (*Tamarix ramoissima*; Iron County), and Russian olive (*Elaeagnus angustifolia*). Garfield County has no noxious weeds currently listed, but saltcedar and Russian olive are being considered for listing.

Table 3.9-3 Mapped acres of Invasive Plant Infestations on the Dixie National Forest

Species	Invasive type	Acres			
		Pine Valley	Cedar City	Powell	Escalante
Whitetop *Cardaria draba*	noxious weed[1]	5	37	2	2
Nodding plumeless thistle *Carduus nutans*	nonnative	16	41	28	0
Spotted knapweed *Centaurea maculosa*	noxious weed[1]	25	2	0	4
Field bindweed *Convolvulus arvensis*	noxious weed[1]	158	2	0	0
Broad-leaved pepperweed *Lepidium latifolium*	noxious weed[1]	56	0	0	0
Scotch cottonthistle *Onopordum acanthium*	noxious weed[1]	1,423	0	0	0
Dalmation toadflax *Linaria genistifolia ssp. dalmatica*	nonnative	0	17	0	0
Hardheads *Acroptilon repens*	nonnative	0	0	1	0
Canadian thistle *Cirsium arvense*	noxious weed[1]	0	0	0	1
TOTAL (1,819 acres)		**1,683**	**99**	**31**	**7**

[1] Officially designated and published as noxious by the State of Utah under Section 4-17-3 of the Utah Noxious Weed Act

3.9.7 Pine Valley Ranger District

The upper slopes of the Pine Valley Mountains, reaching 10,000 feet in elevation, are comprised of ponderosa pine, Douglas-fir, and aspen on north-facing slopes, with mountain brush (antelope bitterbrush, mountain mahogany) and sagebrush on south-facing slopes. Additional ponderosa pine interspersed with occasional aspen, Engelmann spruce, and

subalpine fir communities occur at higher elevations. Most of the ranger district (51%) is comprised of steep hills covered by pinyon-juniper woodland in addition to mountain mahogany scrub at higher elevations and mountain brush (31% of the ranger district) throughout. There are extensive areas of oak brush near Browse, New Harmony, and Ox Valley. Benchlands and bottomlands contain scattered ponderosa pine, aspen, and Douglas-fir including extensive sagebrush, antelope bitterbrush, and perennial grassland vegetation (USFS 1995d:4-5). The hard-leaved interior chaparral area is located between the Browse Research Natural area and Leeds Canyon.

The Browse Research Natural Area occurs along the eastern flank of the Pine Valley Mountains. The highest concentration (92 percent) of invasive plants on the Dixie National Forest is within the Pine Valley Ranger District (Table 3.9-3). Scotch cottonthistle covers 1,423 total acres. Invasive plant occurrences in the Pine Valley Ranger District are scattered throughout the District, and include Grass Valley (field bindweed), Browse (scotch cottonthistle), Old Irontown (scotch cottonthistle), Willow Spring (scotch cottonthistle), Moody Wash (scotch cottonthistle), Ox Valley (field bindweed), Page Ranch (scotch cottonthistle), Rocky Top (scotch cottonthistle), and Page Ponds (scotch cottonthistle). The Pine Valley Ranger District appears to contain the largest potential for gypsum beds that contain biological crusts, such as along Forest Road 031, but these areas have not been mapped.

3.9.8 Cedar City Ranger District

The Cedar City Ranger District is dominated by the Markagunt Plateau, reaching over 11,000 feet in elevation, which contains lava rock, spruce-fir, and aspen/conifer forest. Grassland on the plateau is characterized by alpine grasses at higher elevations and sagebrush at lower elevations, with a prominent forb component in both communities. Barren lava flows contain sparse stands of mixed conifer, and slumplands containing mixed conifer and aspen forest also occur on the high plateau (USFS 1995d: 5). There are many dry meadows along the plateau sideslopes, along with sagebrush and perennial grasslands (USFS 1995d:5, 6). Most of the Cedar City Ranger District is composed of aspen/conifer (27%) and ponderosa pine woodland (19%). Whitetop, nodding plumeless thistle, and dalmatian toadflax infestations occur in this ranger district (Table 3.9-3). The Timbered Cedar Cone Research Natural Area occurs within the Cedar City Ranger District.

The Cedar City Ranger District has received, to date, the most impact of the spruce beetle outbreak over the past 10 years (Figure 3.9-3). High levels of Engelmann spruce mortality have changed both the physical appearance of the landscape (Figure 3.9-4) and the development of vegetation communities over time. Mortality rates in some places on the Cedar City Ranger District are as high as 100 percent of all Engelmann spruce over five inches in diameter. Due to spruce beetle mortality, many dead trees have an increasing risk of fall as this species is known to stand many years despite being dead, and there is an increasing risk of high severity fire as deadfall accumulates on the ground.

Figure 3.9-3 Acres of spruce mortality on the Dixie National Forest, 1995-2006

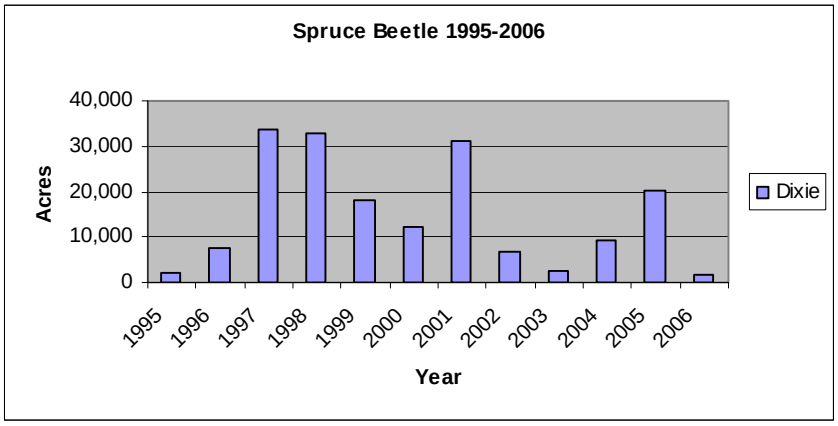


Figure 3.9-4 Visual Impact of Spruce Beetle Mortality on the Landscape

Rock garden/bristlecone pine is a unique vegetation area that occurs on 14,000 acres of the Dixie National Forest, within the Cedar City, Powell, and Escalante Ranger Districts (Figure 3.6-3). Rock garden/bristlecone pine areas contain the ancient Rocky Mountain bristlecone pine trees and few other shrubs or herbaceous plants. Rocky mountain bristlecone pine is an extremely long-lived tree that occurs on dry, upper montane and subalpine slopes. In the Mammoth Creek area (Cedar City Ranger District), bristlecone have been dated around 747 BC. Where limber pine and bristlecone pine co-occur, limber pine may dominate the rockier, drier ridges. The main mode of dispersal for bristlecone pine is by Clark's nutcrackers that bury the seed. Many sensitive plants on the Dixie National Forest (see Technical Report 6.0 – Sensitive Species) grow on the limestone "rock garden" substrate.

3.9.9 Powell Ranger District

The Powell Ranger District is dominated by the Paunsaugunt Plateau and the Sevier Plateau, which rise to over 11,000 feet. These plateaus are characterized by spruce-fir and aspen forest on north-facing slopes, with mountain brush and sagebrush on southern exposures (USFS 1995d:7). The vegetation of the Sevier Plateau is highly varied, with types such as riparian corridors and wet meadows, sage steppe in the lower elevations, boreal forests and old-growth ponderosa pine in the mid-elevations, and aspen/conifer and spruce-fir forest in the higher elevations. The lowest bottomlands and alluvial fans are characterized by sagebrush scrub (USFS 1995d:7), which is the dominant vegetation within the ranger district (25%). Nodding plumeless thistle is the dominant invasive plant in this ranger district (Table 3.9-3). The Red Canyon Botanical Area and Red Canyon Research Natural Area are located within the Powell Ranger District.

3.9.10 Escalante Ranger District

The lowest elevations in the Escalante Ranger District are composed of ponderosa pine benchlands and low hills with occasional aspen and mixed conifer vegetation. Pinyon-juniper woodland and oakbrush can be found on steep hills, rocklands, and badlands. Sagebrush scrub, containing widely dispersed ponderosa pine and antelope bitterbrush, is located on the bottomlands, alluvial fans, and pediments (USFS 1995d:7). The Escalante Ranger District is composed of many types of vegetation that are well represented: pinyon-juniper (23%), pine woodland (18%), aspen/conifer (16%), spruce-fir (12%), and sagebrush steppe (11%). There are relatively few invasive plant infestations in this ranger district (Table 3.9-3). The Side Hollow Study Area and both the Table Cliff Research Natural Area and Upper Sand Hollow Research Natural Area are located within the Escalante Ranger District. Rock garden and bristlecone pine communities also occur in this ranger district and some contain sensitive plant populations (Figure 3.6-3). Gypsum beds that contain biological crusts occur along Hells Backbone Road, but these areas have not been mapped.

3.10 Transportation

3.10.1 Introduction

The Dixie National Forest transportation system is essential in providing safe and efficient access to and through National Forest System lands. It provides access for the public and administration of land management objectives. The system provides a balanced mix of road and trail access for recreation, special uses, management, and fire protection activities while supporting forest management objectives. User experience, safety, and resource protection are emphasized in transportation system planning, design, and operation.

The transportation system provides the access needed to maintain facilities and infrastructure such as buildings, recreation facilities, municipal water systems, dams, reservoirs, range improvements, mine sites, oil and gas wells, electronic and communication sites, utility corridors, transmission lines, and gas and water lines. The roads of a transportation system affect nearly all other resources. Most improvements to existing roads result from the need by forest management for resource development and/or administration of a resource. In planning for the development of a resource, such as oil and gas, a roadway would be used for transportation and to accommodate overland and/or underground pipelines, and communication facilities (USFS 1986).

3.10.2 Transportation Terms

The following terms are used throughout this section. They are provided here so that readers may familiarize themselves with common Forest Service transportation terms and give the reader a better understanding of the information contained in this section (USFS 1986).

National Forest System Road: A forest road other than a road which has been authorized by a legally documented right of way held by a state, county, or other local public road authority.

Temporary Road: A road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a Forest System road and that is not included in a Forest Transportation Atlas.

Unauthorized Road: A road that is not a Forest System road or a temporary road and that is not included in a Forest Transportation Atlas.

Forest Transportation Atlas: A display of the system of roads, trails, and airfields of an administrative unit.

3.10.3 Road Maintenance Levels

Dixie National Forest roads are maintained to varying standards depending on the level of use and management objectives. Roads may currently be maintained at one level with plans for maintenance at a different level at some future date. The operational maintenance level is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. The objective maintenance level is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may, or may not be, the same as the operational maintenance level. The transition from operational maintenance level to objective maintenance level may depend on reconstruction. There are five maintenance levels used by the Forest Service to determine the work needed to preserve the investment in the road (USFS 2003c).

Level 1: Basic custodial maintenance is performed to protect the road investment and to keep damage to adjacent resources to an acceptable level. Drainage facilities and runoff patterns are maintained at Level 1; roads are administratively closed and sometimes physically blocked to traffic.

Level 2: Roads in this maintenance level are normally characterized as single lane, primitive type facilities intended for use by high clearance vehicles. Passenger car traffic is not a consideration. The functional classification of these roads is normally local.

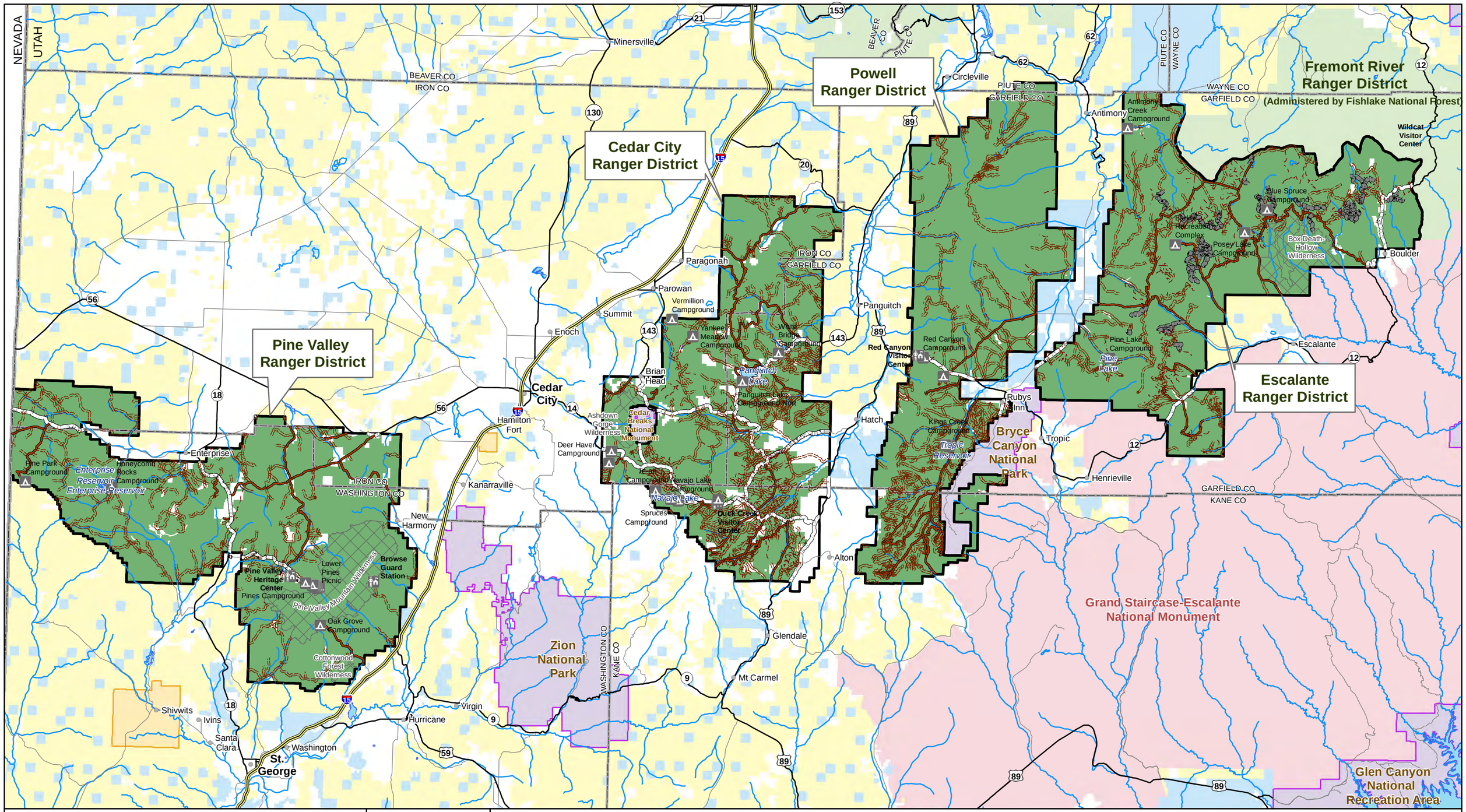
Level 3: Roads at this maintenance level are normally characterized as low speed, single-lane roads with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. The functional classification of these roads is normally local or minor collector. User comfort is not a consideration at this maintenance level.

Level 4: This level is assigned where management direction requires the road to provide a moderate degree of user comfort and convenience at moderate travel speeds. Traffic volumes are normally sufficient to require a double lane aggregate-surfaced road. Some roads may be single lane and some may be paved and/or dust abated. The functional classification of these roads is normally collector or minor arterial.

Level 5: This level is assigned where management direction requires the road to provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. Functional classification of these roads is normally arterial.

3.10.4 State and Federal Highways

Several federal, state, and county roads provide access to the Dixie National Forest. These roads are not part of the National Forest System and are not under the management directive of the Forest Service. These roads are under federal and state management and include: Interstate 15, US Highway 89, and State Highways 12, 14, 18, 20, 22, 56, 62, 143, and 148 (USFS 1995a).



Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 3.10-1
Transportation System

Horizontal Datum = NAD 83 Coordinate System = Zone 12N	1:590,000	1 in = 9 miles

Legend

- Cities
- Freeways
- Highways
- Minor Roads*
- Major Streams & Rivers
- Water Bodies
- County Boundaries
- State Boundaries

Forest Sites

- Campgrounds
- Visitor Centers

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal

Forest Roads

Maintenance Class

- 1 - Basic Custodial Care (Closed)
- 2 - High Clearance Vehicles
- 3 - Suitable for Passenger Cars
- 4 - Moderate Degree of User Comfort
- 5 - High Degree of User Comfort
- 6 - Seasonal Road

Miles: 0 3 6 9 12

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalanted National Monument. Managed by the Bureau of Land Management.

3.10.5 Existing Forest Transportation System: Motorized Travel Plan (2009)

The Record of Decision for the Dixie National Forest Motorized Travel Plan, signed in April 2009 (USFS 2009c), designated approximately 2,700 miles of roads on the Dixie National Forest open to public motorized use and approximately 1,000 miles of roads available for permited activities and for official resource activities (i.e., administrative use). Excluding the Teasdale Ranger District (administered by the Fishlake National Forest), there are approximately 2,400 miles of roads on the Dixie National Forest open to the public (i.e., Maintenance Level 2-5; Figure 3.10-1) and 900 miles open to administrative use only (i.e., Maintenance Level 1; Figure 3.10-1). Table 3.10-1 lists the miles of public road (Level 2-5) within each ranger district.

Table 3.10-1 Total System Miles (Maintenance Level 2-5) by Ranger District

Ranger District	System Miles
Cedar City	794
Escalante	499
Pine Valley	487
Powell	596
Total	**2,376**

3.10.6 Existing Oil and Gas Roads

Most oil and gas roads in the Upper Valley field are not physically closed to the general public and are classed as local roads. Roads from the local roads that provide access to individual well sites or tank batteries are managed under the field development plan. None of the roads within this production field are managed under special use permits. Oil pipelines and power lines that extend beyond the production field are covered by special use permits issued to the oil and gas leaseholders. The roads to the individual well sites or batteries are typically reclaimed or managed as intermittent service facilities after they are no longer needed for oil and gas activity. Intermittent service roads are closed to traffic, graded, and maintained for drainage; those with native surfacing are scarified and seeded during reclamation. Reclaimed oil and gas roads are rehabilitated to near-natural condition (USFS 1995a). Most of the existing oil and gas roads were permitted and opened in the late 1960s and are not typical of current forest management.

3.10.7 Traffic Volume

The Utah Department of Transportation collected traffic statistics on State Highway road sections throughout Utah during 2004-2006 (UDOT 2006). These data are summarized below by ranger district.

Table 3.10-2 Annual Average Daily Traffic on Utah Highways occurring on the Dixie National Forest

Highway	Pine Valley	Cedar City	Powell	Escalante
State Highway 18	1,640			
State Highway 14		838		
State Highway 148		527		

State Highway 143		820		
US Highway 89		1,398		
State Highway 12 Red Canyon			2,442	
State Highway 12 Upper Valley				1,190
State Highway 12 Boulder				547

Source: UDOT 2006

3.10.8 Gravel Sources

Gravel sources on the Dixie National Forest are not readily available. An active gravel pit exists on the Pine Valley Ranger District near Enterprise; this pit is used as a gravel source for Forest roads. Three small gravel pits occur on the Cedar City District, but the source material has nearly all been removed. Gravel sources are more readily available on lower elevation, BLM-administered lands adjacent to the Dixie National Forest.

3.10.9 Pine Valley Ranger District

Main access through the Pine Valley Ranger District is via the following roads (USFS 1995a): State Highway 18 (St. George to Beryl Junction), Interstate 15 (St. George to Cedar City), and State Highway 56 (Cedar City to Beryl Junction). Annual Average Daily Traffic on Highway 18 through the Pine Valley Ranger District from Central to Enterprise during the period 2004 – 2006 was 1,640 (UDOT 2006).

3.10.10 Cedar City Ranger District

Main access through the Cedar City Ranger District is via the following roads (USFS 1995a): Interstate 15 (Cedar City to State Highway 20), US Highway 89 (Glendale to State Highway 20), State Highway 143 (Parowan to Panguitch), State Highway 148 (State Highway 14 to State Highway 143 through Cedar Breaks NM), State Highway 14 (Cedar City east to US Highway 89), and State Highway 20 (Interstate 15 to US Highway 89). Annual Average Daily Traffic on State Highway 14 through the Cedar City Ranger District from the western boundary to the Iron – Kane County border during the period 2004 – 2006 was 838; on Highway 148 from State 14 to Cedar Breaks National Monument it was 527; on Highway 143 it was 820; and on Highway 89 from Glendale to Hatch it was 1,398 (UDOT 2006).

3.10.11 Powell Ranger District

Main access through the Powell Ranger District is via the following roads (USFS 1995a): State Highway 89 (Glendale to State Highway 20), State Highway 20 (Interstate 15 to State Highway 89), State Highway 12 (US Highway 89 to Torrey), State Highway 22 (Otter Creek Reservoir to State Highway 12), and State Highway 62 (US Highway 89 to Otter Creek Reservoir). Annual Average Daily Traffic on State Highway 12 through the Powell Ranger District during the period 2004 – 2006 was 2,442 (UDOT 2006). Much of this traffic is likely associated with visitation to Bryce Canyon National Park. Average annual visitation at the Park during the period 1997 – 2006 was 1,027,638 (NPS 2007b).

3.10.12 Escalante Ranger District

Main access through or to the Escalante Ranger District is via the following roads (USFS 1995a): State Highway 12 (US Highway 89 to Torrey), State Highway 22 (Otter Creek Reservoir to State Highway 12), and State Highway 62 (US Highway 89 to Otter Creek Reservoir). Annual Average Daily Traffic on State Highway 12 through the Escalante Ranger

District from Henrieville to Escalante during the period 2004 – 2006 was 1,190 and through Boulder was 547 (UDOT 2006).

3.11 Socioeconomic Resources

3.11.1 Introduction

This description of socioeconomic conditions is a summary of more detailed information contained in Specialist Report 12.0 (Socioeconomic Resources). Resources on National Forest lands serve agricultural, recreational, industrial, business, and residential uses. These can include grazing permittees relying on the availability of suitable forage for grazing livestock, outfitters/guides for various wildlife and recreation-related uses relying on Forest resources for all or part of their living, and many local communities relying on employment and income generated from the existence and/or use of Forest resources. Residents of the area and repeat visitors may also place intangible, heritage values on the natural resources of the Forest. Further, Native American Tribes use the Forest for the purposes of hunting animals or gathering traditional plant materials important to their cultural traditions.

The affected environment potentially impacted by oil and gas development on the Dixie National Forest extends beyond the Forest boundaries. Little economic activity actually occurs within Forest boundaries, but instead takes place in the nearby communities. Six Utah counties lie within or in proximity to the Dixie National Forest: Garfield, Washington, Iron, Kane, Wayne, and Piute. These counties make up the six-county analysis area for this EIS, with the majority of the Forest located in Garfield, Iron, and Kane Counties. The Pine Valley Ranger District is located in Washington County, although a portion extends north into the western part of Iron County. The Cedar City Ranger District lies in the eastern part of Iron County, the western part of Garfield County, and the northwestern corner of Kane County. The majority of the Powell Ranger District lies in Garfield County, although minor portions extend north into Piute County and south into Kane County. The Escalante Ranger District is the easternmost portion of the Dixie National Forest and lies in Garfield County. These counties, and their associated communities, would be those most immediately affected should oil and gas leasing lead to additional exploration and development on the Dixie National Forest.

The primary data sources used to evaluate the social and economic resources related to oil and gas leasing on the Dixie National Forest and anticipated impacts included economic data collected and published by government agencies. Data from the US Department of Commerce, Bureau of the Census, 2000 Decennial Census were used to characterize the area's population, age, race and ethnicity, household type, and housing.

Personal income data were obtained from the US Department of Commerce, Bureau of Economic Analysis. Agricultural production data were obtained from the US Department of Agriculture, National Agricultural Statistics Service.

Employment and income for the study area was characterized using data from the Utah State Department of Workforce Services; the US Department of Labor; Bureau of Labor Statistics (2008); and US Department of Commerce, Bureau of Economic Analysis.

The Utah oil and gas industry was described using data published by the Utah Division of Oil, Gas and Mining and the Bureau of Economic and Business Research at the University of Utah.

Economic impact modeling was conducted using the Regional Input-Output Modeling System (RIMS II) developed by the Bureau of Economic Analysis.

3.11.2 Counties

3.11.2.1 Garfield County

Garfield County is located in south central Utah. The western half of the county is characterized by high forested plateaus separated by populated valleys. The eastern half is lower in elevation and mostly desert with very little population. Garfield County is one of the most sparsely populated counties in Utah. Geographically, Garfield County is the fifth largest county in Utah, but it has the fifth smallest population. Most of the county's residents are clustered near the high alpine environment on the west side of the county where the majority of water and private land can be found (State of Utah 2003). Communities within close proximity to Dixie National Forest lands include Panguitch, Hatch, Tropic, Antimony, Escalante, and Boulder. Panguitch is the largest, with an estimated 2006 population of 1,485.

Garfield County is characterized by vast rangelands that include some of Utah's largest forest reserves, and a low rate of private land ownership. Only 5.1 percent of the county is privately owned. Nearly 90 percent of the land in the county is federally administered; of this the Forest Service oversees about 30 percent. Portions of three ranger districts administered by the Dixie National Forest lie in Garfield County, including nearly all of the Escalante and Powell Ranger Districts and about half of the Cedar City Ranger District.

Garfield County's economy is driven by tourism and agriculture (primarily cattle and lumber). The leisure and hospitality sector (tourism) accounts for more than 36 percent of all non-farm jobs in the county. Agriculture accounts for almost 11 percent of all jobs (farm and non-farm). The county's largest employer is Ruby's Inn, a resort located near Bryce Canyon that employs between 250 and 500 people. Bryce Canyon National Park currently receives approximately one million visitors annually, about 200 times the permanent population of the county.

The only oil production currently underway in the vicinity of Dixie National Forest, Upper Valley, is in Garfield County. The field is producing about 200,000 barrels per year.

3.11.2.2 Iron County

Iron County is located in the southwestern portion of the state, stretching from the arid West Desert to high mountain plateaus. Most of the county is high desert with shrub steppe vegetation such as juniper and sagebrush. At the eastern end of the county, the Markagunt Plateau rises to conifer forests. The southern border of the county is in the foothills of the Pine Valley Mountains.

Iron County has the highest proportion of land in private ownership of the six counties in the Analysis Area (35.7 percent). Federal agencies administer 57.5 percent of the land in the county. Approximately 240,000 acres of Dixie National Forest are located in the county and include small segments of the Pine Valley Ranger District and about half of the Cedar City Ranger District. Communities in close proximity to Forest lands include Brian Head, Parowan, Paragonah, Kanarraville, Newcastle, Summit, and Cedar City. Cedar City is the largest of these, with an estimated 2006 population of 25,665.

When the early attempts at iron ore mining in the Cedar City area were less than successful, the settlers turned to agriculture. Cedar City gradually evolved into a transportation hub for

supplying other communities in southwestern Utah and southeastern Nevada in addition to its natural position on the route from Salt Lake City to southern California. The Union Pacific Railroad extended a spur to Cedar City in the 1920s and after 70 years of planning, iron ore mining became successful in Iron County.

In the early 1960s, the federal government announced tentative plans that Interstate 15 might bypass Cedar City. This led to the business interests in Cedar City to devise ways to lure travelers off of the freeway and into the city. Fred Adams, a theatre professor at the then College of Southern Utah, has previously worked at the Shakespearean Festival in Ashland, Oregon and suggested a similar festival in Cedar City. The inaugural Utah Shakespearean Festival was held in 1962. The festival has since grown in size and has become a major economic driving force in the Iron County economy (Seegmiller 1998).

Since 1990, Iron County has been among the fastest growing counties in Utah. With a 2007 population of 44,813 it is the second largest county in the six-county analysis area. Iron County's population growth has been influenced by immigration of workers and retirees and the accreditation of Southern Utah University in 1991, with a subsequent increase in the county's student population.

Iron County has a balanced and broadly diversified economy. Cedar City is the most populated city in the county and is a regional trade center and supplier of services. Government is the largest sector of the economy. About 40 percent of government employment is Southern Utah University. The Iron County economy is influenced by the presence of Interstate 15, Southern Utah University and, to a lesser extent, the Utah Shakespearean Festival and the Utah Summer Games. There is also a noticeable manufacturing sector and major agricultural operations in the western part of the county.

3.11.2.3 Kane County

Kane County is located on the south central border of Utah, sharing its southern border with the State of Arizona. Similar to Garfield County, Kane County is also dominated by federal land (82.9 percent), most of which is managed by the BLM. Included in the county are portions of the Grand Staircase-Escalante National Monument, Glen Canyon National Recreation Area, the southern end of Bryce Canyon, and the southeastern corner of Zion National Park. Segments of the Cedar City Ranger District and Powel Ranger District lie in Kane County.

Communities closest to Forest lands include Alton, Glendale, and Orderville. Although the county's population has increased annually since 2003, with a total of 6,440 residents, the county is still largely rural and sparsely populated. Population in the county is concentrated in Kanab (population in 2006 was 3,754), located about 30 miles south of the Dixie National Forest.

Kane County was originally settled in the 1860s and 1870s and the population essentially relied on agriculture and ranching until well into the 20th century. Formation of several National Parks resulted in increased tourism in the 1930s and Kanab became a center for filming Hollywood westerns. The construction of Glen Canyon Dam just south of the state line in Arizona in the early 1960s was a major change in Kane County. Glen Canyon City was founded to house the construction workers and has since been renamed Big Water. With Lake Powell and the Grand Staircase-Escalante National Monument located partially within its borders, Kane County relies heavily on tourism, which accounts for almost 30 percent of non-farm jobs.

3.11.2.4 Piute County

Piute County is located in south central Utah and is centered on the Sevier River Valley. Its western boundary is near the crest of the Tushar Mountains. Grass Valley (Otter Creek) lies between the Sevier Plateau in the center of the county and the Parker Range on the eastern border.

Federal agencies administer about 74 percent of the land in the county, including the Fishlake National Forest and a very small segment of the Powell Ranger District of the Dixie National Forest. Circleville, Kingston, and Junction are the only communities in the county that are in close proximity to Dixie National Forest. Of these, Circleville is the largest, with an estimated 466 residents.

Piute County is small, largely rural, and sparsely populated. It is the sixth smallest county as measured by land area (484,652 acres) and second smallest by population (1,385 residents in 2007). From 2000 to 2007, population in the county declined by 3.6 percent. Although population growth has been positive since 2003, population is still below the 2000 census estimate.

Throughout most of the 19th and 20th centuries, the county's economy was reliant on agriculture and mining. Metals and minerals were a significant part of the local economy during World War I and World War II, but have since declined. Agriculture is still a mainstay of the economy. The latest available data indicate that farm earnings accounted for just over one-third of earnings in the county. Government is also a major contributor to employment in Piute County. Despite some job growth in the county, a large share of Piute County residents commutes to other counties for employment.

3.11.2.5 Washington County

Washington County lies in the extreme southwestern corner of Utah and is known for its hot, dry weather. Seventeen percent of the county is privately owned, the second highest rate in the six county area. Federal agencies administer nearly 75 percent of the land, which includes Zion National Park and 400,000 acres of the Dixie National Forest. The Paiute Tribe has a 28,000-acre reservation centered on Shivwits, northwest of St. George, which accounts for about two percent of the land in Washington County.

The largest portion of the Pine Valley Ranger District lies in Washington County. The communities in closest proximity to the Dixie National Forest are La Verkin, Leeds, Toquerville, New Harmony, and Enterprise. Of these, La Verkin is the most populous with 4,142 residents.

While it began as an agricultural region, tourism, retirement and the development of second homes changed the character of the county in the mid-1960s. This trend was encouraged by the completion of Interstate 15 freeway from Salt Lake City to St. George and on to Las Vegas, Nevada and Los Angeles, California in 1973. Presently, Washington County is the most urbanized of the six counties in the study area and closely resembles the economies of northern Utah counties.

Since the early 1970s, Washington County has experienced phenomenal growth, increasing in population from 13,900 in 1970 to 140,908 in 2007. This growth has occurred largely through net in-migration. Nearly 80 percent of the county's growth has come from net immigration over this 37-year period. With an estimated 2006 population of 67,614, St. George is the most populated place in the county.

After the 2000 Decennial Census, the county was declared a Metropolitan Area by the federal government. As with most metropolitan areas, the economy is well diversified. The largest sector is trade/transportation/utilities, followed by construction, a reflection of the county's strong population growth. Agriculture, once integral to the county's economy, now accounts for less than one percent of the area's jobs.

3.11.2.6 Wayne County

Located in southeastern Utah, Wayne County lies entirely within the Colorado Plateau, with dry plateaus and deep canyons in the eastern and central sections and high mountain peaks interspersed with agricultural valleys on the western end. Almost all of Wayne County (96.5 percent) is controlled by federal agencies, the second highest percentage of any county in Utah. Over half of these lands are administered by the BLM. The Forest Service administers about 10 percent, or about 160,000 acres, including portions of Fishlake National Forest, Glen Canyon National Recreation Area, Canyonlands National Park, and Capitol Reef National Park.

Communities closest to the Dixie National Forest include Torrey, Teasdale, Grover, Loa, and Bicknell. Bicknell is the larger of these, with an estimated 356 residents in 2006.

Because such a large amount of Wayne County is public land, its population density is among the lowest in the state. As such, the county is still largely rural and sparsely populated. In 2007, an estimated 2,635 people lived in Wayne County, an increase of just 126 residents from the 2000 census estimate.

Agriculture was a dominant industry in the county into the 1980s. In recent years, agriculture's share of employment has dropped sharply, but still accounts for 14 percent of all jobs in the county. The creation of National Parks and National Forest spawned a large tourism industry, which currently accounts for 20 percent of all jobs in the county. Over the last few years, youth rehabilitation/wilderness programs have helped diversify the county's economy. Presently, the health care and social assistance sector, which includes youth rehabilitation programs, is the largest employment sector.

3.11.3 Land Ownership

The federal government is the prominent land administrator in each of the subject counties. The combined acreage of counties in the study area totals 11,594,437, of which the federal government administers 9,242,293 acres, or about 80 percent. The majority of federal land in the study area is under the jurisdiction of the BLM (Table 3.11-1).

Garfield County has the most land administered by Forest Service at just over one million acres; all of which are on the Dixie National Forest. All of the Forest Service land in Iron and Washington Counties is also on the Dixie National Forest. In Piute and Wayne Counties, there are lands administered by both the Fishlake and Dixie National Forests. Glen Canyon National Recreation Area (Lake Powell), administered by the National Park Service, occurs within Garfield, Kane, and Wayne Counties. This acreage is in addition to that listed for National Parks in Table 3.11-1. The wilderness areas listed in Table 3.11-1 are administered by both the BLM and the Forest Service. This is in addition to the acreage listed for these respective agencies.

Table 3.11-1 Land Ownership by County

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Bureau of Land Management	1,489,829	957,731	1,633,909	163,947	629,170	893,447
USFS	1,011,544	236,507	125,342	196,026	345,188	159,976
National Recreation Area	305,563	0	381,627	0	0	98,370
Wilderness, USFS and BLM	25,100	7,083	21,426	0	54,744	0
National Parks	142,199	8,859	18,265	0	132,018	198,973
Bankhead-Jones Lands	8,094	0	0	0	0	0
Total Federal Lands	2,982,329	1,210,180	2,180,569	359,973	1,158,477	1,350,765
State Parks	1,520	0	1,746	0	6,297	0
State Wildlife Lands	684	5,804	0	4,340	0	753
State Trust Lands	159,544	136,558	107,466	58,594	97,628	170,151
Total State Lands	161,747	142,362	109,212	62,934	103,925	170,904
American Indian Lands	0	2,507	0	0	27,590	0
Private Lands	168,334	757,556	263,594	61,745	264,140	55,595
Total Acres	3,312,409	2,112,606	2,553,375	484,652	1,554,131	1,577,264

Source: Utah Governor's Office of Planning and Budget, Federal Land Payments in Utah.

3.11.4 Demographics

3.11.4.1 Population

Table 3.11-2 provides the population for each county in 2000, 2006, and 2007. There is considerable variation in population among counties, ranging from fewer than 1,500 persons in Piute County to nearly 141,000 persons in Washington County. Since 2000, some counties have experienced little or no growth (Piute and Garfield) while others expanded rapidly (Washington and Iron).

Within the study area, Washington County reported the largest population increase and has been one of the fastest growing counties in Utah for many years. Iron County experienced exceptional growth, increasing at a rate faster than the statewide rate since the mid-1990s.

Table 3.11-2 Population Statistics for Selected Years

County	Population 2007	Population 2006	Percent change from 2006 to 2007	Population 2000	Percent change from 2000 to 2007
Garfield	4,872	4,772	2.1	4,735	2.9
Iron	44,813	43,424	3.2	33,779	32.7
Kane	6,440	6,294	2.3	6,046	6.5
Piute	1,385	1,373	0.9	1,435	-3.5
Washington	140,908	134,899	4.5	90,354	56.0
Wayne	2,635	2,535	3.9	2,509	5.0
Total	**201,053**	**193,297**	**4.0**	**138,858**	**44.8**

Source: 2000, 2000 Decennial Census; 2006, 2007, Utah Population Estimates Committee.

While the population in all of the subject counties is projected to increase, Washington and Iron Counties will account for virtually all (97.7 percent) of the growth projected in the six-county area over the next decades. As shown in Table 3.11-3, Washington County is expected to sustain an average annual growth rate of 3.8 percent from 2000 to 2060, with a projected population of more of 860,000 by 2060. Iron County is projected to grow at an average annual rate of 2.7 percent, increasing to more than 168,000 by 2060. Population growth for the remaining counties is projected to be much lower, with the smallest gains occurring in Piute County, which is projected to increase at an annual rate of less than one percent from 2000 to 2060. Based on these projections, by 2060 96.6 percent of the population in the subject counties will be concentrated in Washington and Iron Counties, up from 65.1 percent in 2000.

Despite the perception that these places are rural, the majority of the population in the subject counties lives in urban areas due to the presence of St. George and Cedar City. The 2000 Decennial Census determined that 69.9 percent of the population lived in urban areas (Table 3.11-4). Five urban areas were identified by the 2000 Decennial Census. These are St. George with a population of 62,630, Cedar City (21,978), Hurricane (8,246), Kanab (2,734), and Colorado City (1,505). The US Bureau of the Census defines urban areas as census blocks with a population density of at least 1,000 persons per square mile, adjacent blocks with population densities of 500 persons per square mile, and adjacent blocks with lower population densities if they meet certain criteria established by the Bureau of the Census. Boundaries of urban areas do not correspond to the city limits for which the areas are named. The population figures given above are for the urban areas and are not the city populations.

Table 3.11-3 Population Projections, 2000-2060

County	2000	2010	2020	2030	2040	2050	2060	AAGR[1] 2000-2060
Garfield	4,763	5,092	5,843	6,823	7,656	8,738	10,356	1.3
Iron	34,079	50,601	68,315	87,644	110,257	137,240	168,383	2.7
Kane	6,037	6,893	8,746	10,394	12,034	14,267	17,276	1.8
Piute	1,436	1,396	1,526	1,690	1,817	2,035	2,404	0.9
Washington	91,104	168,078	279,864	415,510	559,670	709,674	860,378	3.8
Wayne	2,515	2,698	2,912	3,395	3,879	4,556	5,608	1.3
Total	**139,934**	**234,758**	**367,206**	**525,456**	**695,313**	**876,510**	**1,064,405**	**3.3**

[1] AAGR: Average Annual Growth Rate
Source: Utah Governor's Office of Planning and Budget, 2008 Baseline Projections; may differ from US Bureau of the Census projections

Table 3.11-4 Urban and Rural Population, 2000

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County	Six-County Total
Population	4,735	33,779	6,046	1,435	90,354	2,509	138,858
Percent Urban	0	65.1	45.2	0	80.1	0	69.9
Percent Rural	100.0	34.9	54.8	100.0	19.9	100.0	30.1

Source: 2000 Decennial Census, Summary File 1, data element P2.

As defined by the US Office of Management and Budget, there are two Core Based Statistical Areas in the study area. Washington County comprises the St. George Metropolitan Area and Iron County comprises the Cedar City Micropolitan Area. Metropolitan Areas are counties with at least 50,000 persons living in an urban area. Micropolitan Areas are counties with between 10,000 and 50,000 persons in an urban area. Adjacent counties may also be included in each classification if they meet criteria for commuting to or from the central counties.

3.11.4.2 Race and Ethnicity

The six-county analysis area is relatively homogeneous demographically. Overall, 91.5 percent of the population in the study area is white. Of the minority population in the area, 55 percent are Hispanic and about 18 percent are American Indian. Washington and Iron Counties had the largest minority populations at 8.9 percent and 8.7 percent of their total respective populations in 2000. The smallest minority population was in Wayne County.

3.11.4.3 Median Age

Within the subject counties, only Iron County has a median age lower than the state median of 27.1. The median age in the remaining counties is significantly higher than the state, ranging from 38.9 in Piute County to 33.8 in Garfield County. The comparatively low median age in Iron County is the result of a large student population due to the presence of Southern Utah University. The age structure of Garfield, Piute, and Wayne Counties is common to many rural communities: aging populations with under-representation of young working-age persons, which occurs when young people leave the community in search of economic and educational opportunities elsewhere. The high median age in Washington County is the result of retirement-age migration, which has been ongoing for several decades.

3.11.4.4 Households

Compared to the State of Utah, the six-county area has a slightly lower average household size, 2.98 persons per household compared to 3.13 persons per household for the state. Reflecting the large student population, the largest households in the area are in Iron County, with an average of 3.11 persons per household. Iron County also has the lowest percentage of one-person households in the six-county area. In comparison, Garfield, Kane, Piute, and Wayne have a higher than average percentage of single-person households, reflecting the aging populations in those counties.

3.11.4.5 Education

Each of the subject counties has a school district that is defined along county lines (Table 3.11-5). The school districts are governed by elected school boards and operate independently of county governments. Total enrollment in public schools in the six-county study area was 36,897 during 2007, up 28 percent from the 2000 enrollment of 28,791. The growth in school enrollment is concentrated in the Iron and Washington County School Districts. The other four districts have experienced flat or declining enrollments in recent years.

There are two state institutions of higher learning in the study area. Southern Utah University is located in Cedar City and Dixie State College in St. George. Southern Utah University offers associate's, bachelor's and master's degrees. Dixie State College was granted baccalaureate degree status in 2000. Formerly, the college was a two-year institution. Currently, the college offers 10 bachelor's degrees in addition to associate degrees and certificate programs.

Table 3.11-5 School District Enrollments, 1995-2007

School District	1995	2000	2005	2006	2007
Garfield County School District	1,167	1,115	940	938	933
Iron County School District	6,238	7,176	8,230	8,486	8,643
Kane County School District	1,491	1,335	1,194	1,188	1,178
Piute County School District	368	354	302	298	300
Washington County School District	17,418	18,261	23,189	24,297	25,295
Wayne County School District	602	550	514	531	548
Total	27,284	28,791	34,369	35,738	36,897

Source: Utah State Office of Education

3.11.5 Health Care

There are four hospitals located in the six counties. No hospitals are located in Piute or Wayne Counties, and there is one hospital in each of the remaining four counties. The Garfield Memorial Hospital and Clinics is located in Panguitch. The Dixie Regional Medical Center is located in St. George. The Valley View Medical Center is located in Cedar City. The Garfield Memorial Hospital and Clinics and the Valley View Medical Center are operated by Intermountain Healthcare, Inc., a nonprofit organization based in Salt Lake City. The Kane County Hospital is located in Kanab (Directory of America's Hospitals 2008).

3.11.6 Employment

Total employment in the six-county area reached 90,206 during 2006, up 42 percent from the 2000 figure of 63,370 (Table 3.11-6). The average unemployment rate in the study area is similar to that for Utah as a whole, although unemployment varies among the counties. Washington County and Iron County typically fare better than their counterparts in the six-county area as a result of having broad-based economies and strong population growth. As such, the unemployment rates in these two counties tend to parallel the Utah average. In contrast, employment in Garfield, Kane, Piute, and Wayne Counties tends to be concentrated in seasonal industries (tourism and agriculture), which results in an unemployment rate that is higher than the state average. Examining employment by industry provides information about important industries in the individual counties (Table 3.11-7).

Table 3.11-6 Labor Force and Unemployment for Selected Years

	1995	2000	2004	2005	2006
State of Utah					
Civilian Labor Force	1,014,959	1,136,036	1,230,539	1,263,774	1,311,073
Employment	979,367	1,097,915	1,169,163	1,211,803	1,272,801
Unemployment	35,592	38,121	61,376	51,971	38,272
Unemployment Rate	3.5%	3.4%	5.0%	4.1%	2.9%
Garfield County					
Civilian Labor Force	2,645	2,469	2,655	2,681	2,668
Employment	2,320	2,301	2,447	2,487	2,536
Unemployment	325	168	208	194	132
Unemployment Rate	12.3%	6.8%	7.8%	7.2%	4.9%
Iron County					
Civilian Labor Force	13,024	16,809	18,755	19,738	20,753
Employment	12,586	16,262	17,892	18,964	20,170
Unemployment	438	547	863	774	583
Unemployment Rate	3.4%	3.3%	4.6%	3.9%	2.8%

	1995	2000	2004	2005	2006
Kane County					
Civilian Labor Force	2,712	3,011	3,245	3,242	3,399
Employment	2,479	2,896	3,064	3,082	3,280
Unemployment	233	115	181	160	119
Unemployment Rate	8.6%	3.8%	5.6%	4.9%	3.5%
Piute County					
Civilian Labor Force	490	623	868	845	877
Employment	461	595	830	811	850
Unemployment	29	28	38	34	27
Unemployment Rate	5.9%	4.5%	4.4%	4.0%	3.1%
Washington County					
Civilian Labor Force	32,846	39,148	52,061	56,553	61,128
Employment	31,783	37,771	48,543	54,242	59,369
Unemployment	1,063	1377	2,518	2,311	1,759
Unemployment Rate	3.2%	3.5%	4.8%	4.1%	2.9%
Wayne County					
Civilian Labor Force	1,326	1,310	1,354	1,327	1,381
Employment	1,243	1,250	1,265	1,255	1,322
Unemployment	83	60	89	72	59
Unemployment Rate	6.3%	4.6%	6.6%	5.4%	4.3%
Six County Area					
Civilian Labor Force	53,043	63,370	78,938	84,386	90,206
Employment	50,872	61,075	74,041	80,841	87,527
Unemployment	2,171	2,295	3,897	3,545	2,679
Unemployment Rate	4.1%	3.6%	4.9%	4.2%	3.0%

Source: Bureau of Labor Statistics (2008), Local Area Unemployment Statistics.

In 2006, the number of non-farm jobs in Garfield County totaled 2,260. The county's economy is highly concentrated in tourism and government. In fact, Garfield County relies on tourism and recreation more than any other county in the state. In 2006, 36 percent of all non-farm employment in Garfield County was in the leisure/hospitality sector. The seasonal nature of the tourist economy explains the county's high unemployment rate, 4.9 percent compared with the statewide rate of 2.9 percent in 2006. Government is the second largest sector, accounting for 26 percent of all non-farm jobs. When combined, employment in these two sectors accounted for more than 60 percent of all non-farm jobs in Garfield County in 2006. Major employers in Garfield County include Ruby's Inn, Garfield County School District, South Central Utah Telephone, Garfield Memorial Hospital, and the federal government.

Non-farm jobs totaled 16,808 in Iron County in 2006. Government is the largest employment sector in Iron County, accounting for 25 percent of all non-farm jobs in 2006. A large portion of these jobs are with Southern Utah University. Iron County's population growth has generated strong housing demand, as reflected in the construction sector. From 2005 to 2006, employment in the construction sector increased 29 percent, averaging 1,839 during 2006. Almost 18 percent of all non-farm jobs in the county are in the megasector trade/transportation/utilities. Iron County also has a stronger than average manufacturing sector, which provided 1,839 jobs in 2006. Major employers in Iron County include Southern Utah University, Iron County School District, Valley View Medical Center, Wal-Mart, and Convergys.

With Lake Powell and the Grand Staircase-Escalante National Monument partially within its border, Kane County relies heavily on tourism. Of the 3,092 non-farm jobs in the county in

2006, 28 percent were in leisure/hospitality. Apart from retail trade, the only other large employment sector in Kane County is other services, which includes an animal rescue organization employing more than 250 people. Job growth in the county has remained strong over the past two years, fueled by an expanding construction sector, which increased 28 percent from 2005 to 2006. Major employers in Kane County include Best Friends Sanctuary, Kane County School District, Aramark, Kane County Hospital, and Stampin' Up.

Of the six counties, Piute County has the smallest number of jobs in the non-farm sector. Largely due to significant out-commuting, non-farm employment in 2006 totaled just 333. Government is the largest non-farm sector, accounting for 44 percent of all non-farm jobs. Most of these are in the public school systems. More so than the other counties, self-employment and agricultural employment are significant portions of the employment picture in Piute County, but are not captured in non-farm employment data. Major employers in Piute County are Piute County School District, Dalton Brothers Trucking, Storm Ridge Ranch School, Piute County, and the State of Utah.

Washington County's economy is large and well diversified. In 2006, total non-farm employment was 51,529. The largest sector is trade/transportation/utilities, which employed 11,785 people in 2006, about 23 percent of all non-farm jobs. Reflecting the strong housing market in the county, construction is the second largest sector in 2006 providing employment for 16 percent of all non-farm workers. Other important employment sectors in Washington County are education/health services (6,923 jobs), leisure/hospitality (6,566 jobs), and government (6,139 jobs). The largest employers in Washington County are the Washington County School District, Intermountain Health Care, Wal-Mart, Dixie State College of Utah, and St. George City.

Non-farm employment in Wayne County totaled 1,049 in 2006 and is concentrated in education/health services (primarily residential treatment facilities for troubled adolescents), government (education and local administration), and leisure/hospitality (tourism). In 2006, these three sectors accounted for 72 percent of all non-farm jobs in the county. From 2005 to 2006, the leisure/hospitality sector posted the strongest growth, increasing by 10 percent. In all other sectors but retail trade, job growth was flat or negative. In Wayne County, the largest employers are Aspen Ranch, Aspen Achievement Academy, Wayne County School District, the federal government, and Passages to Recovery (Utah Department of Workforce Services 2007).

Table 3.11-7 Employment by Industry, 2006

Industry	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Total Nonagricultural Employment	2,260	16,806	3,092	333	51,529	1,049
Mining	12	58	0	7	246	0
Construction	83	1,839	181	15	8,289	109
Manufacturing	98	1,785	187	3	3,276	11
Trade, Transportation and Utilities	239	3,022	448	70	11,785	132
Information	126	123	31	0	869	2
Financial Activities	35	784	120	5	2,248	8
Professional and Business Services	17	1,272	51	2	3,786	4
Education and Health Services	207	1,591	83	25	6,923	303
Leisure and Hospitality	821	1,804	863	52	6,566	174

Other Services	27	334	407	7	1,402	24
Government	595	4,194	721	147	6,139	282

Source: Utah Department of Workforce Services, Annual Report of Labor Market Information, 2006. Energy Information Administration (2007b)

3.11.7 Wages and Income

Wage and income data for each of the six counties were obtained from the US Bureau of Labor Statistics (2008) and the US Bureau of Economic Analysis. Table 3.11-8 shows information on wages (annual and total), total personal income, and per capita personal income. Personal income is income received by persons from all sources. Per capita personal income is the mean income computed for every person living in a geographical area. Household income is the sum of money income received in a calendar year by all household members, including household members not related to the householder, people living alone, and other non-family members.

3.11.7.1 Wages

With the exception of Piute County, wages in the six-county area grew at a rate faster than the statewide rate. Wayne County posted the largest increase, increasing at an annual rate of 4.3 percent from 2000 to 2005. Washington County has the highest average annual wage ($26,046), followed by Wayne County ($23,886) and Iron County ($23,867).

From 2000 to 2005, all counties in the six-county area, except Piute, experienced an improvement in their average annual wage relative to the state. Wayne County fared the best, increasing to 71 percent of the state average in 2005, from 61 percent in 2000.

Despite strong wage growth in the region, the average annual wage in all counties stayed significantly below the 2005 state average of $33,328. Relative to the state average, Garfield, Kane, and Piute Counties fare the worst. In each of these counties, the average annual wage is at least 33 percent below the state average. Even though Washington County has the highest average annual wage of the six counties, it is about 78 percent of the state average.

Table 3.11-8 Wage Data, Selected Years

	2000	2002	2003	2004	2005
Average Annual Wage ($)					
State of Utah	29,229	30,585	31,106	32,171	33,328
Garfield County	18,769	19,935	20,208	21,498	21,819
Iron County	20,258	21,768	21,980	22,929	23,867
Kane County	18,524	19,204	19,630	19,735	21,885
Piute County	19,933	19,833	19,048	19,944	22,286
Washington County	22,089	23,101	23,716	24,518	26,046
Wayne County	17,821	19,677	20,918	22,368	23,886
Total Wages Paid ($1,000)					
State of Utah	30,518,822	31,861,030	32,410,184	34,483,093	37,173,461
Garfield County	39,813	40,683	41,120	46,183	47,996
Iron County	274,612	295,200	298,604	324,733	361,660
Kane County	51,239	49,437	53,040	55,374	61,932
Piute County	4,714	4,786	5,183	5,986	6,560
Washington County	731,935	846,355	908,536	1,034,660	1,212,755
Wayne County	20,078	21,410	20,820	22,683	24,180

Source: Bureau of Labor Statistics (2008), Quarterly Census of Employment and Wages.

3.11.7.2 Personal Income

From 2000 to 2005, total personal income in the study area increased at an annual rate of 8.2 percent, totaling $3.8 billion by the end of the period. Of the six counties, all but Garfield and Wayne saw personal income increase at an annual rate higher than the state average of 4.9 percent. Washington County posted the largest annual increase at 8.2 percent, followed by Iron County (7.5 percent) and Piute County (7.2 percent). Personal income grew at an annual rate of 3.7 percent in Garfield County and 3.2 percent in Wayne County.

Although growth in per capita personal income in each of the counties exceeded the statewide rate from 2000 to 2005, with the exception of Kane County, per capita incomes in the area remain below the state average. In 2005, per capita personal income in Kane County was about $200 higher than the statewide average, $27,456 compared to $27,231. Per capita income in the remaining counties was significantly below the state average. The largest differential was in Iron County, where per capita personal income was $6,442 lower than the state average, or about 76 percent of the statewide figure (Table 3.11-9).

COMPONENTS OF PERSONAL INCOME

Earnings by place of residence made up 63.3 percent of total personal income in the six counties in 2005, and dividends, interest, and rent (investment income) accounted for 18.1 percent. Personal current transfer receipts, largely social security and retirement income, accounted for 18.6 percent of personal income.

Government is the single largest source of earnings in each of the six counties. Garfield County's reliance on government is the highest of the six counties, accounting for almost 35 percent of earnings in 2005. Washington County received the smallest share of earnings (13.9 percent) from government.

Within the individual counties, Garfield County is the second most reliant on earnings (66 percent) and the most reliant on transfer payments of the six counties. Earnings from employment in the government sector accounted for more than one-third of all earnings in the county in 2005. Notably, farm earnings were negative in 2005 and have been declining for over a decade (Bureau of Economic and Business Research 2008).

Table 3.11-9 Personal Income, Selected Years

Total Personal Income ($1,000)					
	Year				
	2000	2002	2003	2004	2005
State of Utah	53,561,211	58,171,715	59,412,078	63,477,769	68,038,514
Garfield County	87,016	88,299	90,753	99,560	104,439
Iron County	556,689	649,634	670,452	733,041	799,104
Kane County	131,553	139,388	148,209	158,148	171,106
Piute County	22,321	24,619	26,436	29,284	31,410
Washington County	1,751,940	1,985,387	2,108,039	2,420,709	2,689,441
Wayne County	46,389	48,268	49,145	52,927	54,374
Per Capita Personal Income ($)					
State of Utah	23,874	25,010	25,220	26,214	27,231
Garfield County	18,319	19,170	20,012	22,378	23,506
Iron County	16,387	18,381	18,797	20,117	20,789
Kane County	21,641	23,100	24,413	25,867	27,456
Piute County	15,522	17,840	19,170	21,083	22,910

Washington County	19,201	19,932	20,171	21,912	22,565
Wayne County	18,292	19,011	19,889	21,445	22,157

Source: Bureau of Economic Analysis, State and Local Area Personal Income.

Iron County derives the largest share of its personal income from earnings (68 percent) of any county in the study area. The largest sources of earnings are government (27.7 percent), manufacturing (11.8 percent), and retail trade (6.8 percent). Notably, in 2005, farm earnings totaled $43 million, the largest amount among the six counties; however, Iron County's economy is well diversified and as a share of total earnings, the farm sector accounted for 7.2 percent.

About 60 percent of personal income in Kane County comes from earnings. The county's share of personal income from investment income was 21.1 percent, higher than the six-county average. Transfer receipts accounted for 18 percent of the county's personal income. Almost half of all earnings in Kane County come from two sectors: government (30 percent) and other services (17.2 percent). Farm income in the county has been steadily declining for several decades, a trend reflected in the negative amount listed for farm earnings.

Transfer receipts are a more important component of personal income in Piute County than in other counties. In 2005, transfer receipts accounted for more than one-quarter of the county's personal income. Dividends, interest, and rent accounted for 13.2 percent of the total and earnings 60 percent. Piute County is one of the few counties in Utah where farm earnings are a significant percentage of income. In 2005, the farm sector provided 35.3 percent of all earnings in the county, the highest share among the six counties. Government provided the second largest amount. When combined, farm and government accounted for 63.5 percent of earnings in Piute County during 2005.

Almost 70 percent of all personal income in the study area is in Washington County. Earnings contributed 62 percent of the total, followed by dividends, interest, and rent (19.5 percent) and transfer receipts (18.5 percent). Contrary to every other county in the area, Washington derives a comparatively small share of its earnings from government. In Washington County, the largest share of earnings comes from construction (17.3 percent), reflecting the construction boom that was underway in 2005, and health care (12.3 percent). Retail trade and transportation are also important sectors in the county. Farm earnings were negative in 2005 and have been persistently negative since 1995 (Bureau of Economic and Business Research 2008).

Personal income in Wayne County derives largely from earnings (65 percent). The remainder is evenly split between dividends, interest, and rent and transfer receipts. The two most important sectors, as measured by contributions to earnings, are government (30.5 percent) and construction (11.2 percent). Farm earnings are also important in Wayne County, representing 10 percent of all earnings in 2005, a share second only to Piute County. In Wayne County, 17.4 percent of personal income came from personal current transfer receipts in 2005, the lowest of the six counties. Because Wayne County is so small, one-third of the county's earnings data was suppressed in 2005 to avoid revealing individual company data.

Median Household Income

Based on information from the US Bureau of the Census, the median household income of the six counties has been, and continues to be, significantly lower than the statewide median (Table 3.11-10). Washington County had the highest median household income in 2005 ($43,566), but was 90 percent of the statewide equivalent. Piute County had the lowest 2005 median household income of the six counties at $32,862, or 68 percent of the statewide median.

In recent years, household income has been rising faster in five of the six subject counties than in the state as a whole (Table 3.11-10). Only in Wayne County has the increase in household income failed to meet the state average. In 2001 and 2002, the median household income in the county actually declined. Washington County had the highest increase in household income from 2000 to 2005, gaining 15.1 percent.

Table 3.11-10 Median Household Income Estimates, 2000-2005

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County	State of Utah
2000	$35,079	$34,121	$34,937	$29,877	$37,854	$33,236	$45,934
2001	34,283	33,440	34,239	29,508	36,976	32,637	45,914
2002	33,964	34,096	34,455	28,399	37,850	31,545	46,165
2003	34,910	35,862	36,117	29,195	39,777	32,465	46,709
2004	37,454	37,495	37,613	32,225	42,726	34,129	47,224
2005	38,751	37,624	37,395	32,862	43,566	34,733	48,155
Percent Increase, 2000-2005	10.5	10.3	7.0	10.0	15.1	4.5	4.8

Source: US Bureau of the Census, Small Area Income and Poverty Estimates.

All counties in the study area have a larger share of low-income households than is the case statewide. Within the region, Piute County has largest share of households that reported making less than $10,000 in 1999 (14.9 percent). Almost 10 percent of the households in Wayne County and Iron County were in the lowest income brackets, while Washington County had the fewest low-income households.

At the other end of the scale, 13.8 percent of the households in Washington County had incomes greater than $75,000 in 1999, the highest of the six counties, but lower than the statewide rate of 22.5 percent. Piute County had the lowest share of high-income households in the study area.

3.11.8 Local Government Finances

Local government finances in 2002 for the six counties are summarized in Table 3.11-11. These data include all local governments—not only county governments, but also all municipalities, school districts, and special service districts within the counties.

Washington County has the highest population in the study area, and the highest revenue and expenditures. The highest per capita taxes are in Kane County ($1,213), followed by Garfield County (1,009). Per capita taxes in Piute County are the lowest at $611, followed by Wayne County at $678.

In each county, the largest share of general expenditures goes to education. The share spent in Piute County is 66 percent, the highest among the six counties. More than half of all general revenue in Garfield, Piute, Washington, and Wayne is spent on education. Iron and Kane are slightly less at 44.7 percent and 41.7 percent, respectively.

Of the six counties, Garfield County has the highest per capita public debt at $4,748, followed by Washington County ($3,335) and Iron County ($3,152). Piute County has the lowest per capita debt ($1,470) followed by Wayne County ($1,570).

Table 3.11-11 Local Government Finances, 2002

Description	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
General Revenue (millions)	$22.7	$90.6	$28.9	$5.3	$226.9	$7.6
Intergovernmental Transfers (millions)	$10.1	$39.3	$12.4	$3.9	$88.9	$5.1
Total Taxes (millions)	$4.6	$28.0	$7.4	$0.8	$83.6	$1.7
Per Capita Taxes	$1,009	$796	$1,213	$611	$840	$678
Per Capita Property Taxes	$655	$551	$900	$447	$536	$450
Direct General Expenditures (millions)	$23.4	$97.7	$27.0	$5.6	$210.3	$7.7
Per Capita Direct General Expenditures	$5,099	$2,776	$4,415	$4,079	$2,115	$3,012
Education	55.2%	44.7%	41.7%	66.0%	52.4%	55.9%
Health and Hospitals	1.6%	0.4%	24.8%	0.4%	0.4%	0.4%
Police	3.0%	5.0%	5.2%	4.8%	5.0%	5.4%
Public Welfare	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
Highways	9.6%	6.8%	5.4%	10.9%	6.9%	16.6%
Total Outstanding Debt (millions)	$21.8	$111.0	$16.8	$2.0	$331.7	$4.0
Per Capita Outstanding Debt	$4,748	$3,152	$2,745	$1,470	$3,335	$1,570

Source: Bureau of the Census, 2002 Census of Government, as cited in Gaquin and DeBrandt, 2007.

3.11.8.1 Property Taxes

Property tax data from the Utah State Tax Commission are shown in Table 3.11-12. Total 2006 property taxes paid range from $813,346 in Piute County to $102,116,227 in Washington County. Of the six counties, only Garfield County currently has property taxes levied against oil and gas properties. In 2006, this amounted to $167,041 and represented 3.6 percent of the county's total property tax payments (Utah State Tax Commission, 2006).

Table 3.11-12 Property Taxes Paid, 2001-2006

Year	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
2001	$3,242,290	$21,144,306	$4,947,813	$573,256	$55,666,192	$990,151
2002	3,566,835	21,425,718	5,591,662	585,330	64,822,974	976,752
2003	4,086,828	24,007,431	5,862,156	626,666	70,392,016	1,312,706
2004	4,166,925	24,889,692	5,645,788	748,422	74,992,373	1,298,548
2005	4,291,755	29,252,423	6,974,273	748,740	85,676,025	1,408,571
2006	4,689,272	36,079,871	10,448,643	813,346	102,116,227	1,423,295

Source: Utah State Tax Commission, Property Tax Division, Annual Statistical Reports, years as indicated (Utah State Tax Commission 2007)

3.11.8.2 Payments in Lieu of Taxes

The federal government makes payments in lieu of taxes to local governments to help offset losses in property taxes due to nontaxable federal land. During 2007, payments in lieu of taxes

for the six counties totaled $4,641,189 (Table 3.11-13). Payments in lieu of taxes are based on population, receipt-sharing payments, and the amount of federal land within a county.

Table 3.11-13 Payments in Lieu of Taxes, 2004-2007

Year	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
2004	$428,693	$1,525,195	$513,297	$113,302	$1,556,724	$240,126
2005	433,660	1,616,588	524,098	123,659	1,590,982	234,364
2006	433,510	1,643,542	535,585	127,275	1,618,587	240,198
2007	432,721	1,699,495	533,404	127,298	1,611,038	237,233

Source: US Department of the Interior.

3.11.8.3 Housing

Washington County has the highest housing occupancy rate of the six counties, followed by Iron and Piute Counties (Table 3.11-14). Many of the vacant housing units in the area are for seasonal, recreational, and occasional use. In Garfield and Kane Counties, over one-third of the housing units are for seasonal, recreation, and occasional use, reflecting the importance of tourism.

Washington County has the newest housing in the area, reflecting population growth that has occurred in the county over the past several decades. Washington County also has the highest median value of owner-occupied housing in the area. Piute County has the oldest housing in the area and the lowest value of owner-occupied housing. Iron, Kane, and Washington Counties have all experienced strong growth in new construction since 2000.

Table 3.11-14 Housing Occupancy, 2000

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Housing Units	2,767	13,618	3,767	745	36,478	1,329
Occupied	57.0%	78.0%	59.4%	68.3%	82.1%	67.0%
Vacant	43.0%	21.2%	40.6%	31.7%	17.9%	33.0%
For seasonal, recreational or occasional use	34.8%	15.0%	34.1%	25.5%	12.2%	24.5%

Source: Bureau of the Census, 2000 Decennial Census, Summary File 3, data elements H6 and H8.

Iron County has the highest rate of renter-occupied housing in the area as a result of Southern Utah University (Table 3.11-15). Washington County is second in the rate of renter-occupied housing.

Table 3.11-15 Occupied Housing, 2000

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Occupied Housing Units	1,576	10,627	2,237	509	29,939	890
Owner Occupied	79.0%	66.3%	78.1%	87.2%	74.0%	77.6%
Renter Occupied	21.0%	33.7%	21.9%	12.8%	26.0%	22.4%

Source: Bureau of the Census, 2000 Decennial Census, Summary File 3, data element H7.

Most housing units in the area are single-unit structures (Table 3.11-16). The highest percentage of single-unit structures is in Piute County. The lowest rate of single-unit structures is in Iron County, again reflecting the influence of student housing at Southern Utah University. In Kane County, nearly one-quarter of housing units are mobile homes or similar structures.

Table 3.11-16 Housing Units in Structure, 2000

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Housing Units	2,767	13,618	3,767	745	36,478	1,329
1 Unit	79.2%	65.9%	74.5%	86.3%	74.7%	81.2%
2-4 Units	1.4%	9.3%	2.4%	0.3%	5.2%	4.2%
5-9 Units	0.1%	3.7%	0.5%	0.0%	2.9%	0.0%
10 or More Units	0.0%	11.2%	0.2%	0.0%	5.1%	0.0%
Mobile Home/Other	19.4%	9.9%	22.3%	13.4%	12.2%	14.6%

Source: Bureau of the Census, 2000 Decennial Census, Summary File 3, data element H7.

Since 2000, 24,212 new housing units have been constructed in the six counties. The majority of these have been in Washington County, followed by Iron County. In Garfield and Kane Counties, a sizeable number of the new dwelling units are cabins and mobile homes. Since 2000, 49 percent of all new housing units in Garfield County have been cabins and mobile homes, while in Kane County 56 percent of new housing units have been cabins and mobile homes. Presumably, many of these are for seasonal or part-time use.

3.11.8.4 Agriculture

Since much of the six-county area is rural, agriculture and cattle ranching play a large part in the cultural identity of many of the residents. Iron County is the most significant of the six counties in agricultural production, accounting for over $77 million in agricultural products in 2002, 68 percent of the total for the six counties (Table 3.11-17).

Livestock, primarily cattle, accounts for more than one-half of the value of production in the area. In four of the counties, livestock was over 90 percent of the value of production. Although the breakout between crops and livestock is withheld for Kane County to prevent disclosure of individual data, the National Agricultural Statistics Service reported that $3.2 million worth of cattle and calves were sold by Kane County farmers in 2002. Hay accounts for most of the crop production in Iron and Washington Counties, although in Washington County, fruits and nursery production are sizeable.

Table 3.11-17 Value of Agricultural Production, 2002

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Value of Production (thousands)	$6,037	$77,402	$3,385	$9,028	$7,256	$10,523
Crops	8.1%	48.2%	D[1]	8.4%	41.6%	7.1%
Livestock	91.9%	51.8%	D[1]	91.6%	58.4%	92.9%

[1] Not disclosed.
Source: National Agricultural Statistics Service, 2002 Census of Agriculture.

The most profitable farms in the area are in Iron County, with average cash income of $57,920 in 2002 (Table 3.11-18). Farmers in Garfield and Washington Counties reported average net losses, on a cash basis, during 2002. Only in Wayne County did a majority of farms have sales

greater than $10,000, while in Washington County nearly three-fourths of the farmers (72.3 percent) had sales of less than $10,000.

Table 3.11-18 Agricultural Economics, 2002

	Garfield County	Iron County	Kane County	Piute County	Washington County	Wayne County
Number of Farms	225	438	131	108	481	173
Average Size (acres)	355	1,094	1,146	D[1]	451	245
Average Cash Income	-$6,926	$57,920	$1,711	$14,832	-$6,555	$14,420
Sales less than $10,000	60.0%	60.7%	62.6%	51.9%	72.3%	40.5%
Operators Principal Occupation in other than farming	43.6%	48.6%	45.8%	25.0%	53.4%	42.8%
Operators Work off the Farm	65.8%	63.5%	48.9%	45.4%	60.0%	61.8%
Operators Work more than 200 days off the Farm	47.1%	45.9%	32.1%	28.7%	42.6%	44.5%

[1] Not disclosed.
Source: National Agricultural Statistics Service, 2002 Census of Agriculture.

In most of the counties examined, most of the farmers have a principal occupation other than farming; however, in Piute County, a majority of the farmers consider farming to be their principal occupation. In Kane and Piute Counties, a majority of the farmers do not have outside employment. In the remaining four counties, the majority of the farmers have non-farm jobs in addition to their work on the farm. Although agriculture and ranching play a significant role in the culture and social makeup of the area, non-farm employment is necessary to augment farm earnings.

3.11.9 Utah Oil and Gas Industry

The Utah oil and gas industry began in 1891, when a water well being drilled in Farmington Bay near the Great Salt Lake encountered natural gas. Gas from several wells in this area was transported to Salt Lake City through wooden pipelines for several years until they were plugged by shifting sand in the lakebed. Oil was first discovered in the early 1900s near Rozel Point at the north end of the Great Salt Lake, near Mexican Hat in southeastern Utah, and near the town of Virgin in southwestern Utah. The first large-scale commercial oil well was drilled near Vernal in 1948. Since the early 1960s, Utah has consistently ranked in the top 15 oil-producing states and in recent years has experienced a dramatic rise in natural gas production. During 2005, Utah ranked 15th in crude oil production out of 31 states and two Federal Offshore Areas, and 11th in dry natural gas production out of 33 states and the Federal Offshore Area in the Gulf of Mexico.

The state's 2006 crude oil production of 17.9 million barrels was a 37 percent increase over the recent low of 13.1 million barrels produced in 2003. Although a substantial increase from the recent past, 2006's output was 44 percent of the all-time high of 41.1 million barrels produced in 1985. The distribution of oil production between the oil-producing counties (Carbon, Daggett, Duchesne, Emery, Garfield, Grand, San Juan, Sanpete, Sevier, Summit, and Uintah) changes over time as fields are initially developed, reach peak production, and then dwindle. In 2006

Duchesne County lead the state in oil production followed by Uintah, San Juan, and Sevier Counties. The other oil-producing counties trailed these four lead counties by a wide margin

There has been an even greater rise in natural gas production in Utah. In 2006, Utah's gross withdrawals of natural gas hit an all-time high of 357 billion cubic feet, up 69 percent from 211 billion cubic feet in 1985. In order of gas production, the gas-producing counties in 2006 were: Uintah, Carbon, Duchesne, Emery, San Juan, Summit, Grand, Daggett, Garfield, and San Pete. Not all gross withdrawals of natural gas are marketed to consumers. Low prices of natural gas during the late 1980s and early 1990s resulted in much of the gas produced in Utah at the time not being marketed. A large portion of the gas withdrawn from wells in Utah during this period was reinjected into the geologic formations to maintain pressure and oil production. The amount of gas used for repressuring in Utah reached a high in 1983, when 65 percent of gross withdrawals were reinjected to maintain pressure. Currently, approximately 95 percent of natural gas withdrawals in Utah are marketed.

During 2006, 129 different operating companies reported crude oil and natural gas production to the Utah Division of Oil, Gas, and Mining. Production occurred in 11 of Utah's 29 counties. Duchesne County had the highest oil production with 6,401,637 barrels, while Uintah County led natural gas production with gross withdrawals of 204 billion cubic feet.

A better gauge of oil and gas activity is the number of applications for permit to drill (APD) (Table 3.11-19). The number of APDs increased from 1,102 in 2004 to 2,061 in 2006 before dropping to 1,553 in 2007. While the majority of APDs were in the traditional oil and gas-producing counties, high prices are stimulating exploration in other areas. Four APDs were filed in the six-county area in 2007, two in Iron County and two in Piute County.

Table 3.11-19 Applications for Permit to Drill, by County (2004 – 2007)

County	2007	2006	2005	2004
Carbon	75	136	73	55
Daggett	0	0	0	1
Duchesne	371	447	254	211
Emery	34	36	21	7
Garfield	0	0	0	1
Grand	57	49	37	18
Iron	2	0	0	0
Juab	0	0	1	0
Piute	2	0	0	0
Rich	1	0	1	0
San Juan	24	18	7	5
Sanpete	2	5	3	0
Sevier	6	4	5	8
Summit	0	3	2	0
Tooele	1	0	0	0
Uintah	978	1,363	1,225	795
Utah	0	0	1	1
State Total	1,553	2,061	1,630	1,102

Source: Utah Division of Oil, Gas, and Mining.

Six different areas in Utah currently have significant production of oil and/or natural gas. These areas are defined by geology. Additionally, these areas are somewhat isolated from one another economically, especially in terms of the oil and gas exploration and production industry.

The major oil and gas producing area in Utah is the Uinta Basin in the northeastern part of the state. Vernal is the center of the oil and gas industry in the Uinta Basin and many of the production, drilling, and service companies maintain offices in the area. Other producing areas in Utah include both conventional and coalbed methane plays in Carbon and Emery Counties, the Paradox Basin in San Juan County, the Uncompahgre Uplift in Grand County, the Thrust Belt in Summit County, and the recently discovered Hingeline in the central part of the state. None of these plays are in the six-county area.

The Paradox Basin, Uncompahgre Uplift, and Thrust Belt all extend over state lines into adjacent states. Many of the workers involved in operating wells in these areas are actually employed in other states. Expanded gas operations in Carbon and Emery Counties and new oil production in the Hingeline are fairly recent discoveries. An oil service industry has not yet developed in these areas.

Despite the common perception of being vertically integrated, the oil and gas industry is highly fragmented, especially at the exploration and production stage. Many companies concentrate exclusively on oil and gas production and have no interest in downstream operations such as pipelines, refineries, and product distribution. Additionally, much of the work conducted in the producing fields is contracted to other companies that specialize in different aspects of drilling and maintaining the wells. Few of the operating companies operate their own drill rigs; instead they contract with companies that specialize in drilling. Other companies specialize in different operations such as grading well locations, well surveying, running and pulling well casings, cementing wells, perforating well casings, and reservoir treatment and stimulation. The operating, drilling, and service companies collectively constitute the oil and gas exploration and production industry. Other types of companies benefit from spending by the oil and gas industry. These include consulting geologists and engineering companies, environmental consultants, vendors of oil field equipment, and pipeline and trucking companies.

With numerous types of companies involved in the production of oil and natural gas, defining the oil and gas industry can be difficult. Economists use the numerical North American Industry Classification System (NAICS) developed by the Office of Management and Budget to classify industries for reporting employment and earnings. The two-digit NAICS codes are divided into 20 major industrial sectors. These major sectors are then further subdivided to reflect specialization within the primary industry.

The NAICS codes include three industrial subdivision classifications that apply directly to the oil and gas exploration and production industry. These are NAICS 211 - Oil and Gas Extraction, NAICS 213111 - Drilling Oil and Gas Wells, and NAICS 213112 - Support Activities for Oil and Gas Operations. Generally, these three industries are collectively considered the oil and gas exploration and production industry.

Total employment in Utah has been rising in these industries in response to increasing oil and gas prices (Table 3.11-20). Most of the employment is in the drilling and service companies, reflecting the fragmented nature of the industry. Total employment in the oil and gas industry in Utah increased 89 percent from 2001 to 2006, but still accounts for less than one-half of one percent of total employment in the state.

Table 3.11-20 Oil and Gas Industry Employment in Utah, 2001-2006

Year	NAICS 211 Oil and Gas	NAICS 213111 Drilling Oil	NAICS 213112 Support Activities	Total Oil and Gas Industry

	Extraction	and Gas Wells	for Oil and Gas Operations	Employment
2001	547	661	1,461	2,669
2002	563	492	1,506	2,561
2003	628	593	1,363	2,584
2004	730	691	1,581	3,002
2005	822	1,163	2,027	4,012
2006	1,096	1,427	2,532	5,055

Source: Bureau of Labor Statistics (2008), Quarterly Census of Employment and Wages

Although the oil and gas industry is small compared to other industries in Utah, it is very important in several areas of the state. In Duchesne and Uintah Counties, the oil and gas industry is directly responsible for approximately 20 percent of total employment and 35 percent of total wages. The oil and gas industry is also of noticeable size in Carbon, Emery, and San Juan Counties. Although there is significant natural gas production in Grand County, most of the workers involved live in Colorado. Similarly, the workers related to production in Summit County live in Wyoming.

Wages paid in Utah by the oil and gas industry have been rising along with employment in recent years (Table 3.11-21). The average wage paid by the industry in Utah during 2006 was $64,763, compared to a statewide average wage of $35,130 for all industries.

Table 3.11-21 Oil and Gas Industry Average Wages in Utah, 2001-2006

	NAICS 211 Oil and Gas Extraction	NAICS 213111 Drilling Oil and Gas Wells	NAICS 213112 Support Activities for Oil and Gas Operations	Total Oil and Gas Industry
2001	$63,157	$49,915	$43,216	$48,958
2002	55,448	48,327	39,921	44,938
2003	62,725	46,851	43,540	48,952
2004	67,828	53,296	50,254	55,219
2005	72,986	57,696	49,529	56,691
2006	79,518	67,481	56,849	64,763

Source: Bureau of Labor Statistics (2008), Quarterly Census of Employment and Wages.

3.12 Air Resources

3.12.1 Climate

Generally, the climate within the Dixie National Forest is dry with a high number of sunny days, but weather can change dramatically. Thunderstorms are common during the summer months and daytime temperatures are warm, with cool nighttime temperatures. With the Forest's mid-continent location including numerous canyons, plateaus, and mountainous terrain, it experiences wide temperature variations between seasons. Climates in the Dixie National Forest also vary greatly with elevation. During winter and spring, precipitation comes in the form of snow, with a moderate to heavy snowpack accumulating in many of the higher elevations. By late spring, temperatures warm up at the lower elevations, while the mountain snowpack begins to melt. Summer brings warm temperatures to most areas with hot temperatures in the more desert-like, lower elevation areas. Afternoon thunderstorms are common in June through September.

As discussed in Appendix SIR-2, warming of the climate system is unequivocal. The global warming observed over the past 50 years is due primarily to human-induced emissions of heat-trapping gases (i.e., greenhouse gases or GHG). These emissions come mainly from the burning of fossil fuels (coal, oil, and gas), with important contributions from the clearing of forests, agricultural practices, and other activities (USGCRP 2009). Through complex interactions on a regional and global scale, GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the net amount of heat energy radiated by the earth back into space.

Global mean surface temperatures have increased nearly 1.8 degrees F in the last 100 years, and the rate of warming over the last 50 years is double that over the last 100 (IPCC 2007b). In their latest report, the Intergovernmental Panel on Climate Change (IPCC) found a widespread reduction in the number of frost days in mid-latitude regions, an increase in the number of warm extremes, and a reduction in the number of daily cold extremes in 70-75 percent of the land regions examined (IPCC 2007b). In Utah, the average temperature during the past decade was higher than observed during any comparable period of the past century, and roughly 2 degrees F higher than the 100-year average. Utah is projected to warm more than average for the entire globe and more than coastal regions of the contiguous United States (BRAC 2007: Appendix A).

3.12.2 General Air Quality

The climate and climatic conditions within the Dixie National Forest are one of the major reasons for its very good air quality and why it is currently meeting all National Ambient Air Quality Standards (NAAQS). Active mixing of air and average precipitation for Utah, along with an absence of major air pollution sources results in low pollutant background values for the Forest. According to EPA Air Quality Index (AQI) reports (see Section 3.12.7) the air quality within the Forest is considered good to excellent. In addition, the majority of land use within the Dixie National Forest results in little man-made air pollution. Recreational use, residential heating for support facilities, and limited vehicle traffic constitute the main emission sources. Prescribed burns and wildfires are a significant source of air pollution within these areas. The Utah Smoke Management Plan (SMP) requires certain climatic and pollution level criteria prior to initiating prescribed burns.

The NAAQS are defined in the Federal Clean Air Act as levels of pollutants above which detrimental effects on human health and welfare may occur. There are seven criteria pollutants designated with NAAQS: ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM) with aerodynamic diameter less than or equal to 10 microns and 2.5 microns (PM_{10} and $PM_{2.5}$), and lead (Pb). The NAAQS are shown in Table 3.12-1.

Table 3.12-1 National Primary and Secondary Standards

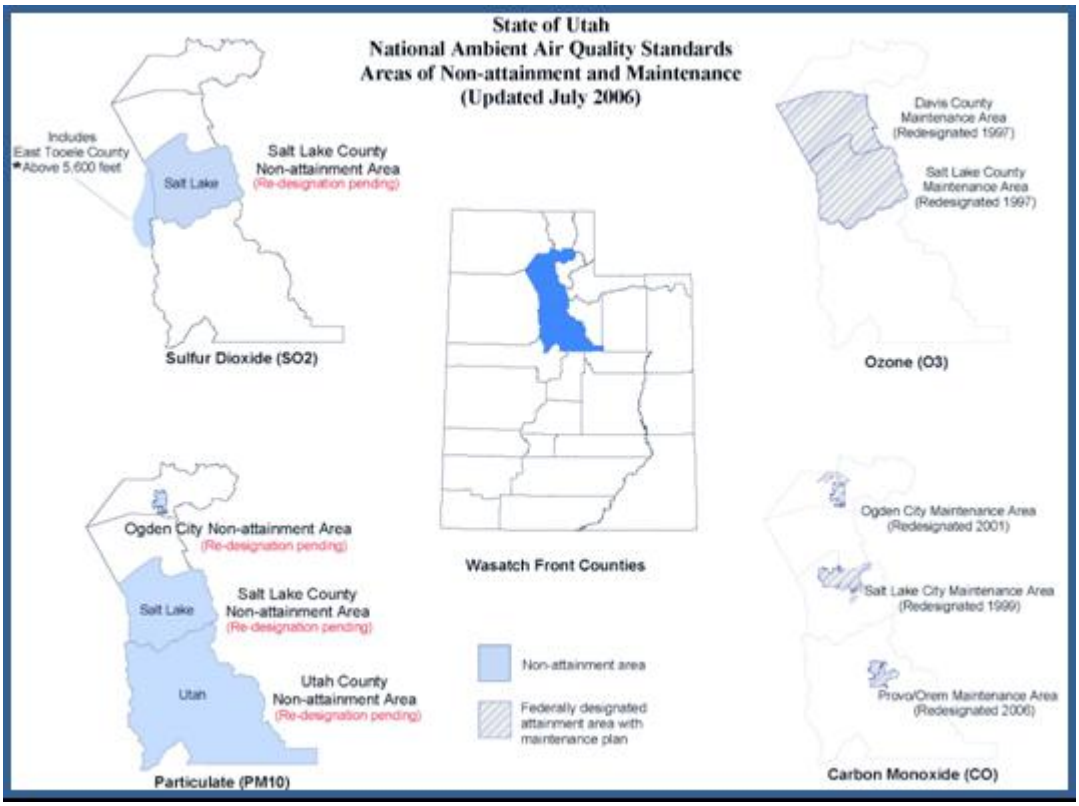
Pollutant	Averaging Time	Primary Concentration[1,2]	Secondary Concentration
Ozone	8 hours (5)	0.075 ppm 0.060-0.070ppm(6)	Same as primary
Carbon Monoxide (CO)	1 hour (1) 8 hours (1)	40,000 µg/m3 (35 ppm) 10,000 µg/m3 (9.0 ppm)	

Nitrogen Oxides (NO_x)	Annual Arithmetic Mean	100 µg/m3 (0.053 ppm)	Same as primary
	1 hour [2]	0.100ppm	None
Sulfur Dioxide (SO_2)	3 hours [1] 24 hours [1] Annual Arithmetic Mean	(0.14 ppm) (0.03 ppm)	1,300 µg/m3 (0.5 ppm)
Particulate Matter as PM_{10} (Aerodynamic diameter < 10 microns)	24 hours [2]	150 µg/m3	Same as primary
Particulate Matter as $PM_{2.5}$ (Aerodynamic diameter < 2.5 microns)	24 hours [3] Annual Arithmetic Mean [4]	35 µg/m3 15 µg/m3	Same as primary
Lead (Pb)	Quarterly Arithmetic Mean	1.5 µg/m3	Same as primary

[1] µg/m3 = micrograms per cubic meter
[2] ppm = parts per million
Source: Code of Federal Regulations, 40 CFR Part 50, National
[(1)] Not to be exceeded more than once per year
[(2)] Not to be exceeded more than once per year on three year average
[(3)] The 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors
[(4)] The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area
[(5)] The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year
[(6)] Proposed range for promulgation of new ozone NAAQS.

Regulations state that ambient air quality standards for NO_x, SO_2, and PM_{10} must not be exceeded at any time during the year in areas with general public access. Short-term standards for CO, NO_x, and SO_2 can be exceeded only once annually. Compliance with the 24-hour PM_{10} and $PM_{2.5}$ standards are based on the 98th percentile of 24-hour concentrations averaged over three years. Compliance with the new ozone standard is attained if the 3-year average of the annual 4th highest daily maximum 8-hour average at every ozone monitor does not exceed 0.075 ppm. Based on these federal regulations, Utah has several non-attainment areas within the State. Non-attainment areas, and the pollutant for which an area became non-attainment, are shown in **Figure 3.12-1**.

Figure 3.12-1 Non-Attainment Air Quality Areas in Utah



Source: Utah Department of Environmental Quality – subject to change in near future

None of these non-attainment areas affect the Dixie National Forest. Utah County, which is non-attainment for PM_{10}, is approximately 120 miles from the northernmost portion of the Dixie National Forest. Although the overall air quality in the Forest is rated good to excellent, there are portions of the Forest that lie near areas that have been closely reviewed and compared to the NAAQS. The UDAQ, EPA, and the SMP have designated the Forest area as Airsheds 2, 3, 4, 12, and 13, within the State of Utah. Utah Air Quality Control Rule 307-204 of the Air Quality Rules regulates the management of wildfires and prescribed burns. The SMP states that prescribed burns will not cause or significantly contribute to daily $PM_{2.5}$ or PM_{10} impacts or violate NAAQS. The purpose of the rules is to mitigate the impact on public health and visibility of prescribed fire and wildland fire. In some cases, air pollution generated in nearby urban Washington County has limited the ability of the Forest Service to implement prescribed burning.

3.12.3 Sensitive Areas

All areas of the state have been designated as either Class I or Class II for air quality. Pursuant to the Federal Clean Air Act, Class 1 areas include all National Parks greater than 6,000 acres and national wildernesses greater than 5,000 acres that were established as of 7 August 1977. Class I provides the most protection to these lands by severely limiting the amount of additional man-made pollution that can occur. Class II areas include all other areas of the country. Class II “Sensitive Areas” have been identified by the Forest Service, predominately as wilderness areas not considered Class I, although air quality regulators only distinguish between Class I and Class II. The regulations allow a specific increase or "increment" in pollution over and above the existing air quality "baseline" pollution levels. Facilities that may impact Class I areas

may be allowed to produce small increases in pollution, while facilities that impact only Class II areas are allowed somewhat larger increases. However, any facility that may increase pollution concentrations in these areas may not cause a violation of the NAAQS. The impact from a source is determined by using EPA-approved air dispersion models. Table 3.12-2 shows the allowable increases of pollution to the ambient air environment of Class I and II areas.

Table 3.12-2 Allowable Pollutant Increases in Class I and Class II Areas

Pollutant	Period	Class I	Class II
		Increment	Increment
SO_2	3-hour	25 ug/m3	512 ug/m3
	24-hour	5 ug/m3	91 ug/m3
	Annual	2 ug/m3	20 ug/m3
NO_x	Annual	2.5 ug/m3	25 ug/m3
PM_{10}	24-hour	8 ug/m3	30 ug/m3
	Annual	4 ug/m3	17 ug/m3
$PM_{2.5}$	24-hour	Undefined	Undefined
	Annual	Undefined	Undefined

µg/m3 = micrograms per cubic meter

These allowable criteria pollutants (SO_2, NO_x, and PM_{10}) are also the precursors to secondary pollutants that can contribute to acid rain, visibility, and regional haze. Based on the designation status from the State of Utah and several federal agencies, there are three Class I areas and six "sensitive" Class II areas that could be impacted by connected actions to leasing. The identified Class I areas are located within 100 kilometers (62 miles) of the Dixie National Forest. They include Bryce, Zion, and Capitol Reef National Parks. Table 3.12-3 presents selected Class I and Class II areas that are sensitive areas that may be considered when addressing impacts. EPA and state regulators have no authority to regulate sensitive Class II Areas any differently than other Class II Areas, but land managers can request consideration of their sensitivities. See Figure 5.12-1 in this report for Class I areas located within the Cumulative Effects Area (CEA).

Table 3.12-3 Sensitive Areas near the Dixie National Forest

Federal Class I & II Areas (unless otherwise specified)[1]	Managing Agency[2]	Class Category	State	Distance from Dixie National Forest (miles)
Bryce NP	NPS	Class I	UT	0
Zion NP	NPS	Class I	UT	0
Capital Reef NP	NPS	Class I	UT	9
Grand Canyon NP[3]	NP	Class I	AZ	68
Glen Canyon NRA[3]	NPS	Class II	UT	15
Cedar Breaks NM[3]	NPS	Class II	UT	0
Ashdown Gorge WA[3]	USFS	Class II	UT	0
Paria Canyon Vermillion Cliffs WA[3]	USFS	Class II	UT	25
Pine Valley Mountain WA[3]	USFS	Class II	UT	0
Box Death Hollow WA[3]	USFS	Class II	UT	0
Beaver Mountain WA[3]	USFS	Class II	UT/AZ	40
Moapa Valley NWR[4]	USFWS	Class II	NV	70

Federal Class I & II Areas (unless otherwise specified)[1]	Managing Agency[2]	Class Category	State	Distance from Dixie National Forest (miles)
Grosvenor Arch, Markaguat Plateau, Santa Clara, Bald Knoll[3]	Various	Class II	UT	0-20
Natural Bridges NM[3]	NP	Class II	UT	68
Grand Staircase-Escalante NM[3]	BLM	Class II	UT	0

[1] NP = National Park, NRA = National Recreation Area, NM = National Monument, WA = Wilderness Area, NWR = National Wildlife Refuge.
[2] NPS = US Department of the Interior, National Park Service, USFS = US Department of Agriculture, Forest Service, USFWS = US Department of the Interior, Fish and Wildlife Service.
[3] Sensitive Class II areas included in the analysis.
[4] Sensitive Class II areas not included in the analysis.

3.12.4 Air Quality Regulatory Considerations

The Land and Resource Management Plan for the Dixie National Forest (USFS 1986) requires compliance with all state and federal Air Quality Standards. The potentially applicable Air Quality Standards identified in the plan include:

- Utah Air Conservation Rules (Utah Administrative Code R307)
- Utah State Implementation Plan (SIP)
- National Ambient Air Quality Standards (NAAQS)
- National Standards of Performance for New Stationary Sources (New Source Performance Standards or NSPS)
- National Prevention of Significant Deterioration Standards (PSD)
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)

The State of Utah's policy is to "maintain levels of air quality that will protect human health and safety, prevent injury to plant and animal life, and facilitate the enjoyment of natural attractions of the State" (Utah Air Conservation Act, pp 19-2-101.2). To enforce this policy, the State of Utah has promulgated a comprehensive set of rules, regulations, standards, and policies that are implemented by the UDAQ. Regulatory authority of the UDAQ is derived from the Utah Administrative Code Chapter 19-2 and the rules adopted by the Utah Air Quality Control Board. The state has been granted Administrative Authority to implement the provisions of the Federal Clean Air Act by the EPA. The UDAQ requires owners and operators of pollution generating facilities to obtain permits, install pollution control equipment and procedures, monitor emissions, maintain records, and implement other air quality protective activities. The Air Conservation Rules (R307-401) apply to any person intending to:

- construct a new installation which will or might reasonably be expected to become a source or an indirect source of air pollution, or
- make modifications or relocate an existing installation which will or might reasonably be expected to increase the amount or change the effect of, or the character of, air contaminants discharged, so that such installation may be expected to become a source or indirect source of air pollution, or
- install a control apparatus or other equipment intended to control emissions of air contaminants.

- operate a qualified air emission source; person must submit a Notice of Intent (NOI) and receive an Approval Order (AO) prior to initiation of construction. The NOI must include plans, specifications, and other information as is necessary to determine whether the proposed installation will be in accordance with all applicable requirements.
- Adhere to Best Management Practices (BMPs; see Appendix C of the FEIS, Conditions(s) 40)

Prior to issuing the AO, the state must provide an opportunity for public review and comment. A copy of the proposed AO is also sent to the applicant, the EPA, and to officials having cognizance over potentially impacted locations, including other states, city and county executives, regional land use planning agencies, state and federal land managers, and Indian Governmental bodies. The comments and concerns of the general public and government entities must be considered before the AO is issued.

Several of the New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAPs) would apply to the equipment and process of oil & gas production. These promulgated standards require that certain thresholds, based on a mass emission rate, are not exceeded. Applicable NSPS requirements could include Subpart Kb: Storage Vessels for Volatile Organic Liquids (including petroleum liquids), Subpart GG or KKKK: Stationary Gas Turbines, Subpart KKK: Equipment Leaks of Volatile Organic Compounds (VOC) from Onshore Natural Gas Processing Plants, Subpart LLL: Onshore Natural Gas Processing; SO_2 Emissions; NESHAPs, Subparts HH (oil and natural gas production), HHH (natural gas transmission and storage), and other more recently promulgated standards. Compliance with these applicable regulations is implicit and required for development of production oil well fields. Some of these requirements are expressed in the BMPs listed in Appendix C of the FEIS. Adherence to and compliance with these regulations that limit air pollutant emissions are addressed in the permitting phase of an oil and gas project.

3.12.5 Criteria Pollutants

Statewide emission inventories are updated every three years, with the latest published inventory in 2005 (Annual Report, Utah Division of Air Quality, UDEQ 2005, 2007, and 2009). The Dixie National Forest is located in Garfield, Iron, Kane, Piute, Washington, and Wayne Counties. The tabulated emissions from state inventory surveys of all documented sources in these counties are shown in Table 3.12-4.

Table 3.12-4 Emissions Totals by County (tons per day)

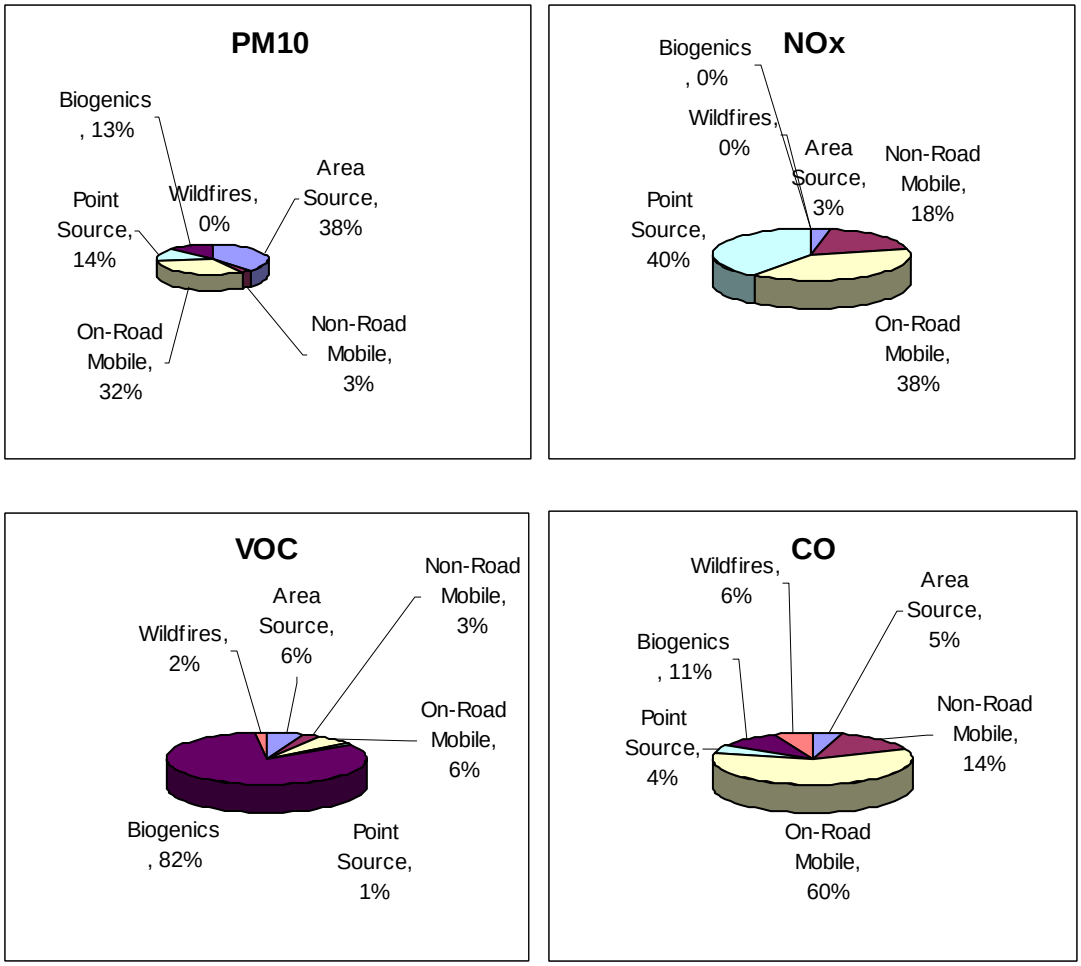
Year[1]	2002	2005	2002	2005	2002	2005	2002	2005	2002	2005
County	NO_x	NO_x	PM_{10}	PM_{10}	SO_x	SO_x	VOC	VOC	CO	CO
Garfield	4.5	1.78	13.80	4.70	0.26	0.16	140.6	125.0	139.6	44.30
Iron	11.00	8.98	5.60	5.83	1.50	0.82	112.3	111.0	101.5	79.16
Kane	1.50	1.79	2.00	2.45	0.20	0.15	134.0	135.4	44.9	45.44
Piute	0.50	0.38	0.90	0.70	0.10	0.05	35.7	32.07	11.3	8.25
Wash	12.70	17.26	2.10	17.40	0.80	0.75	160.9	171.7	155.4	21.30
Wayne	0.71	0.62	1.30	1.44	0.40	0.22	67.4	67.6	21.9	18.89

[1] The 2005 Annual Report listed 2002 emissions; the 2007 and 2009 Annual Reports listed 2005 emissions.

The different source-types are divided into six separate categories as seen in Figure 3.12-2. Point sources reference larger, stationary industry including manufacturing and power plants. Area sources are usually smaller stationary sources that, because of their greater number, are

accounted for by classes of sources operations, such as home heating units. Although biogenics and wildfires are area sources, they are separated in the following pie charts because they are non-anthropogenic (not produced by human activity). The following pie charts depict sources for all of Utah, but are representative of percentages of source-type emissions throughout the State of Utah.

Figure 3.12-2 Emission Source Type (2005 Data)



3.12.6 Existing Surrounding Sources

Industrial sources located to the southwest of the Forest are the most likely to impact the Forest due to prevailing winds. Prevailing winds are mainly from the south-southwest. Figure 3.12-3 shows the annual prevailing winds from the Cedar City meteorological station (National Climatic Data Center 2008). The major sources located in the urban areas of the state are associated with typical industrial operations such as peaking power plants, sand and gravel operations, mining, and general industrial manufacturing. Other upwind sources of pollutants can include emissions from wildfires in Arizona, Nevada, or California. Table 3.12-5 lists the major and significant sources that are located within the six county area of the Forest. “Significant” meaning the source is not major, but is in close proximity to the Forest boundary and emits measurable amounts of air pollutants. Major coal-fired power plants located outside the six-county area (west and south of the Pine Valley Ranger District and 125 miles to the northeast of the Escalante Ranger District) may also affect the air quality of the Forest. Coal mining

operations border the perimeter of the Forest but are not designated as major sources. These include the proposed Alton Coal Hollow operation located 10 miles south of the Cedar City Ranger District in Kane County, and the SUFCO and Emery Deep Mine (underground mines), which are located 35 miles northeast of the Escalante Ranger District.

Figure 3.12-3 Cedar City Windrose

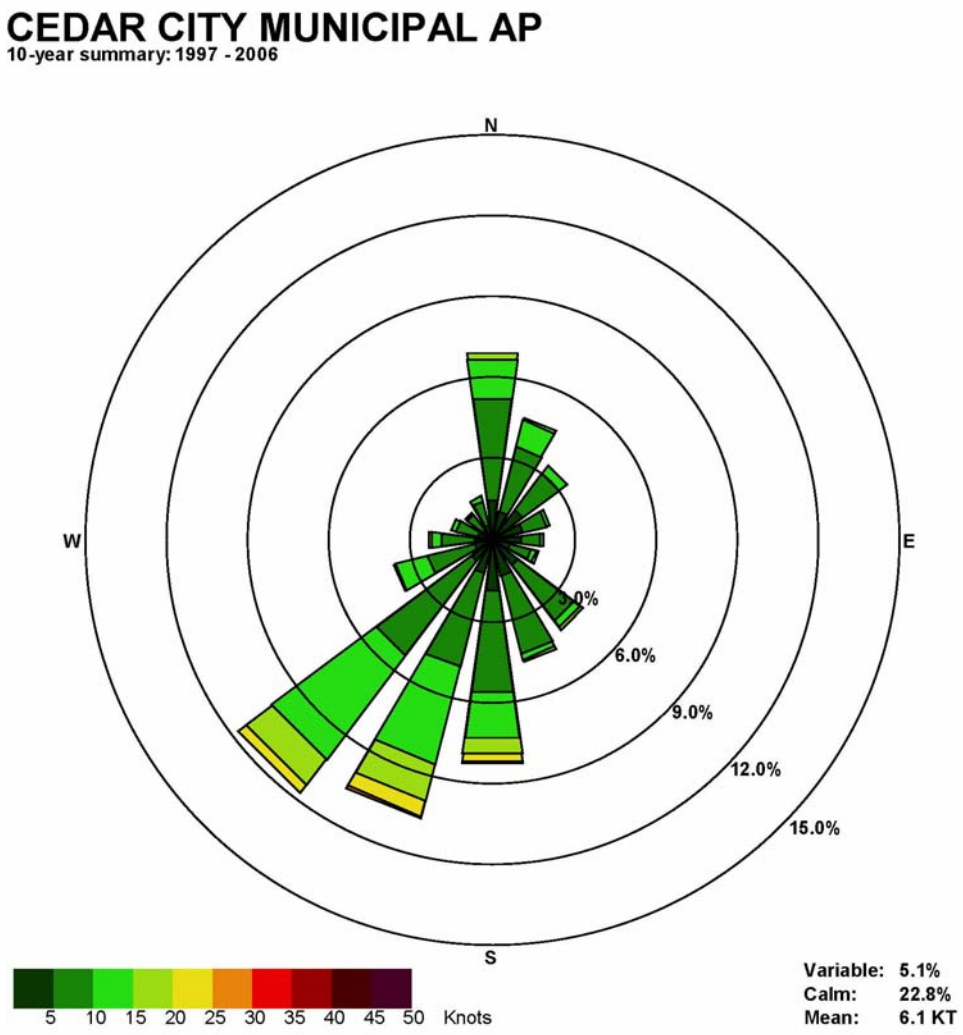


Table 3.12-5 Permitted Significant Sources in the Six County Area

Source	County, State
St. George Steel Fabrication	Washington, UT
Bear River Contractors	Washington, UT
Sorenson Pit	Washington, UT
Western Rock Products	Washington, UT
Washington County Landfill	Washington, UT
O'Sullivan Furniture	Iron, UT
OMG APEX	Washington, UT
Hilldale City Cogeneration	Washington, UT
Cedar City Yard	Iron, UT
City of St. George Power Plants Redrock, Millcreek & Bloomington	Washington, UT
Agrinautics	Iron, UT
Nuclear Fuel Service	Garfield, UT
USMX	Washington, UT
Bulldog Crushing/Hot Mix	Iron, UT
Cedar City Pit	Iron, UT
Panguitch Pit	Garfield, UT
St. George Pit	Washington, UT
GenPak Corporation	Iron, UT
Furniture Manufacturer	Iron, UT
Ft. Pearce Aggregate Plant	Washington, UT
NEVCO Energy 270 MW Coal-Fired Plant	Sevier, UT
Anderson Junction Aggregate Plant	Washington, UT
Reid Gardner Power Plant	Clark County, NV

In addition to permitted facilities located near the Forest, there are recreational activities within the Forest that are also sources of air pollution. These include motorized recreational vehicles such as powered watercraft, motorcycles, ATVs, and snowmobiles. While there is a national effort to improve emissions from these types of motors, the typical 2-stroke engine emits significantly more pollutants than those of more regulated highway vehicles. The criteria pollutants of concern from such recreational vehicles are NO_x, CO, and PM, and, to a lesser extent, VOCs and SO_2.

Minor stationary air emission sources within the Forest include residential heating sources (i.e., boilers and heaters) and propane-combustion electrical generators for remote cell towers. These sources are considered either minor or insignificant.

The Forest allows timber harvest activities in order to achieve management goals and provide opportunities for the local timber industry. Harvesting includes timber cutting, 2-stroke chainsaw engine emissions, miles of logging road reconstruction, and transportation of the timber. These activities result in particulate emissions from construction, timber harvesting activities, and haul road usage in addition to NO_x, CO, VOCs, and PM from logging truck exhaust.

Utah submitted its 2003 State Implementation Plan (SIP) and is in the process of developing an update to the current SIP. The current SIP addressed many issues including emissions from a wide variety of sources, including vehicles and anthropogenic fire. Smoke emissions are controlled with an Enhanced Smoke Management Plan. The updated SIP will address a backstop trading program for SO_2 from large industrial sources. The backstop trading program is essentially a "cap & trade" program, which would set a cap on the maximum amount of SO_2 emissions and allocate emission allowances to the affected sources. If the cap is not exceeded,

various emission controls and trading of emissions between sources may take place. The updated SIP will assess the impact of Utah sources of emissions on protected areas (Class I areas) in adjacent states, and the impact of emission sources in adjacent states on Utah's protected areas, and will set forth appropriate control measures as needed. The SIP update will address the effects of nitrogen oxide and PM emissions from Utah's large industrial sources on protected areas in Utah and adjacent states (UDEQ 2008).

3.12.7 Air Monitoring

The Forest area is designated as attainment/unclassifiable for all criteria pollutants. As can be seen in Figure 3.12-1, Garfield, Iron, Kane, Piute, Washington, and Wayne Counties are classified as attainment or unclassified for all criteria pollutants.

The UDAQ runs 27 monitoring stations within the state. Only one of these stations is located near the Forest, in an urban setting within Washington County (City of Santa Clara). The Dixie National Forest also has cooperated with the National Park Service in operating Interagency Monitoring of Protected Visual Environments (IMPROVE) air quality monitoring sites. Three monitors have been set up in Bryce Canyon; 1) Bryce Point records visibility, 2) Repeater Hill monitors deposition, and 3) Yovimpa Point takes pictures for visibility monitoring. An IMPROVE monitor for visibility has also recently been established near the entrance to Zion National Park. Short-term ambient air monitors have also been placed near the Dixie National Forest for specific projects.

The Air Quality Index (AQI) is a daily EPA rating system that accounts for all measured criteria air pollutants in a geographic area and assigns the rating a qualitative description. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, PM, CO, SO_2, and NO_x. For each of these pollutants, EPA has established national air quality standards to protect public health. For example, if an area has an AQI rating of 0 to 50 it is classified as good air quality; if the rating is 101 to 150, it is classified as “unhealthy for sensitive groups”. Table 3.12-6 displays the AQI over the last three years for the monitoring location in the St. George area.

Table 3.12-6 Air Quality Index Ratings

Condition	2006[1]	2005[1]	2004[2]
Good (0-50)	324	325	309
Moderate (51-100)	38	34	39
Unhealthy (101-150)	0	3	0
Very Unhealthy (201-300)	1	1	0
Hazardous (>300)	1	0	0

[1] Washington County 363 days with AQI
[2] Washington County 348 days with AQI
Source: EPA AQI Reports

Table 3.12-6 shows that the number of good days increased between 2004 and 2006. The total number of moderate to hazardous days shows little trend. Since the prevailing winds are westerly, the pollutants indicated for the Washington County monitoring location can enter the Dixie National Forest, but at lower concentrations than recorded at the monitoring location due to the effects of air mixing and pollutant dispersion. Note that the total numbers of days

recorded per year in the table may not sum to 365 due to monitoring equipment malfunction, recording, or data validation errors.

3.12.8 Regional Haze and Visibility

Regional haze is caused by fine particles in the air that settle out very slowly. Because of the impact that haze has on visibility in National Park Service units and Class I designated wilderness areas, many efforts to control and reduce man-made haze, and the air pollutants that cause it, are underway through national laws and regional collaboration. Such a collaboration, involving states, Indian tribes, industry, and environmental advocates, is being coordinated by the Western Regional Air Partnership (WRAP). The State of Utah along with United States Department of Agriculture (USDA) are members of WRAP and have been involved with developing visibility protection programs. Federal and state laws provide visibility protection for the 156 mandatory Class I areas in the U.S., five of which are located in Utah. Visibility protection programs are being developed for Class I areas in the western U.S. (WRAP 2010); these programs should also result in some visibility protection and improvement in the Class II wilderness areas on the Forest.

The Regional Haze Rule (RHR) requires that reasonable progress be demonstrated toward natural visibility conditions on the monitored "Worst 20 percent" of sample days, and no worsening of visibility for the monitored "Best 20 percent" of sample days be allowed at each mandatory federal Class I area. Baselines have been developed for Class I areas, although the data is still being checked for quality control. Glide rates or uniform rates of progress have been developed for each mandatory Class I area to measure the progress of the RHR. Figure 3.12-4 shows the mean visual range measured by the IMPROVE monitoring system at the Grand Canyon, Bryce Canyon, Zion, and Capitol Reef National Parks from 1993 to 2003, the most recent year for which data is available. Mean visual ranges generally trended upward over this period.

Figure 3.12-4 Trends in Mean Standard Visual Range in Nearby National Parks

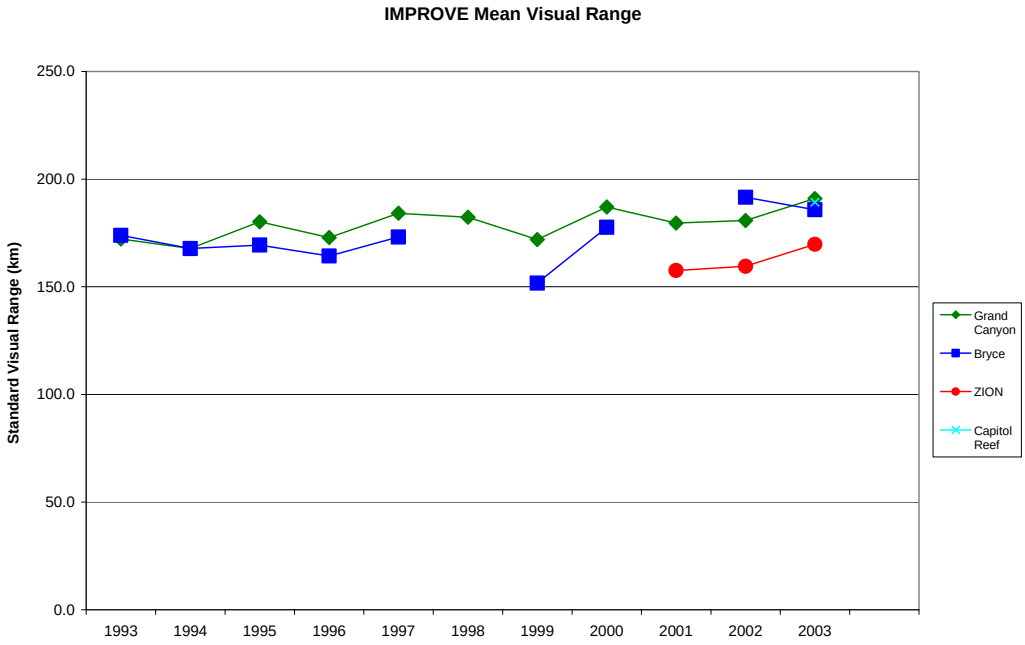
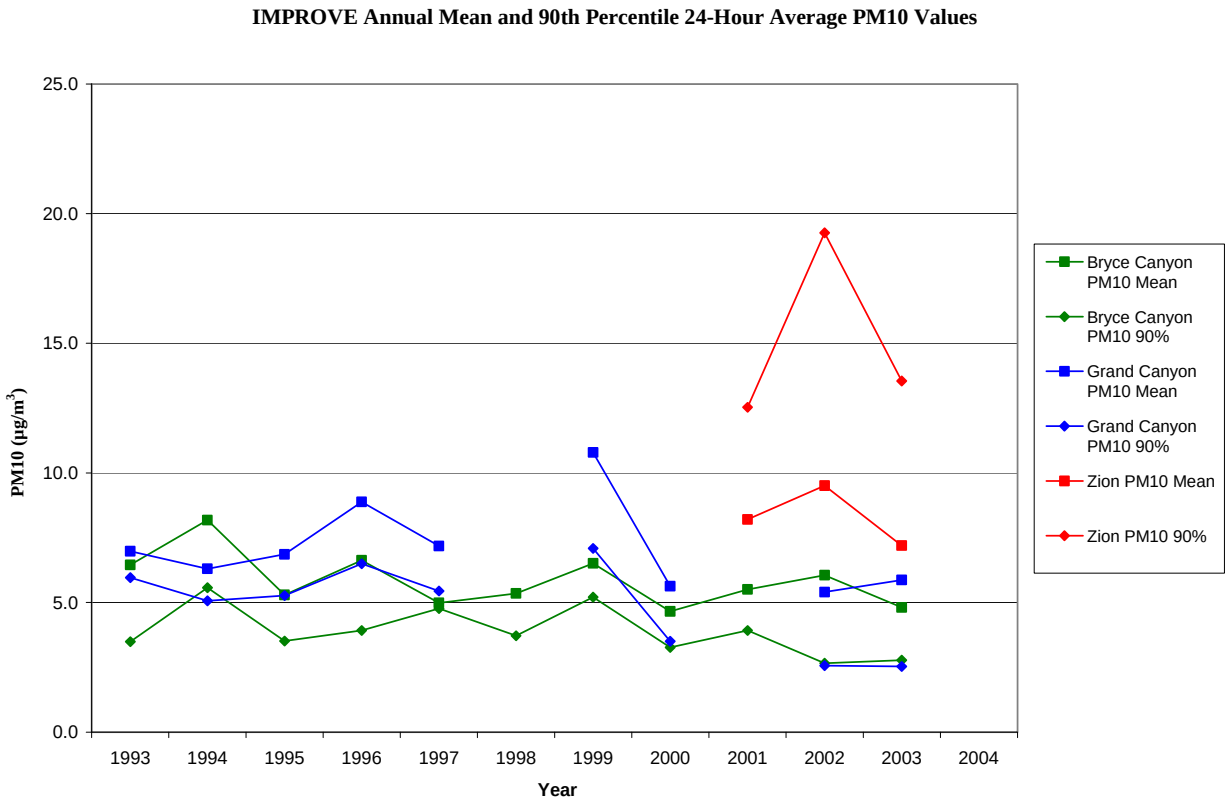


Figure 3.12-5 shows trends in particulate concentrations at nearby National park IMPROVE monitoring sites. The values show PM_{10} concentrations an order of magnitude or more below NAAQS standards. Trends over the decade from 1993 to 2003 have been flat to downward.

Figure 3.12-5 Trends in PM_{10} Concentrations in Nearby National Parks



The primary location in the vicinity of the Forest where ozone is routinely monitored is at Zion National Park, which has complete data since 2003. Table 3.12-7 shows that ozone levels have been flat and below the historic NAAQS of 0.08 ppm, and a little below the current NAAQS of 0.075 ppm in place since May 2008, with the exception of a spike above the NAAQS in 2005.

Table 3.12-7 Ozone Monitoring Data from Zion National Park

MONITORING SITE	AVERAGING PERIOD	CASTNET OZONE CONC. (PPB)
		8 HR AVERAGE
Zion National Park	2008	72
	2007	71
	2006	72
	2005	91
	2004	74
NAAQS		71 [1]

[1] Based upon a three year (2006-2008) average of the fourth highest daily maximum eight hour average, revised down in 2009 from 78.

The Air Quality Trends in National Parks 1994-2003 report assessed trends in Bryce Canyon NP. Pollutants that affect visibility, such as sulfate ion, nitrate ion, and ammonium ions were compared over this 9-year period. For Bryce Canyon National Park, overall visibility showed an improvement (i.e., a decrease in concentration), as did sulfate ion concentration. Nitrate and ammonium ion concentrations increased.

The Preliminary 2018 Reasonable Progress Visibility Target Values of the federal RHR report prescribes visibility for Bryce National Park as requiring 3-5 deciviews (dv) improvement for the "Best 20 percent" Days and 0-0.5 dv decrease in Haze Index to meet the 2018 glide rate. A deciview is a linear measurement of visibility impairment derived from calculated light extinction. Zion National Park will require a 5-7 dv improvement for the "Best 20 percent" Days and 0.5-1.0 dv decrease in "Worst 20 percent" Days Haze Index to meet the 2018 glide rate.

3.12.8.1 FLAG and Air Quality-Related Values

The Federal Land Managers' Air Quality-Related Values Work Group (FLAG) is a cooperative working group consisting of National Park Service, USDA Forest Service and the U.S. Fish and Wildlife Service. The FLAG was formed (1) to provide consistent policies and processes for identifying air quality-related values (AQRVs) and for evaluating the effects of air pollution on AQRVs, primarily in Federal Class I air quality areas and (2) to provide State permitting authorities and potential permit applicants consistency on how to assess the impacts of new and existing sources on AQRVs. AQRVs include Visibility, Deposition, and Ozone. FLAG guidance uses EPA's estimates of natural visibility conditions under its Regional Haze Rule as reference levels for Class I visibility analyses. For deposition, FLAG assesses sulfur and nitrogen deposition impacts using concern thresholds, pollutant exposures, and deposition analysis thresholds. Visibility and Deposition with regard to FLAG are evaluated in Sections 4.12.2.1 and 4.12.2.2. Ozone is discussed in Section 5.12.3.1.

3.12.9 Greenhouse Gas Emissions and Sinks

Appendix SIR-2 contains a detailed discussion of climate change, including greenhouse gas (GHG) emissions and sinks and is incorporated by reference into this EIS. The reader may refer to this document for a complete discussion of greenhouse gases. The following discussion is a summary of climate change, and specifically greenhouse gas emissions and sinks, as it relates to the baseline condition of air resources on the Dixie National Forest.

In 2005, activities in Utah accounted for approximately 68.8 million metric tons (MMt) of gross carbon dioxide equivalents (CO_{2e}) emissions, an amount equal to 1 percent of total U.S. gross GHG emissions. Utah's gross GHG emissions are rising at a faster rate than those of the nation as a whole (gross emissions exclude carbon sinks, such as forests). Utah's gross GHG emissions increased by about 40 percent from 1990 to 2005; national emissions rose by 16 percent during the same period. On a per capita basis, Utahns emitted about 27 metric tons (Mt) of CO_{2e} in 2005, slightly higher than the national average of 25 $MtCO_{2e}$ /yr.

The principal source of Utah's GHG emissions is electricity generation in power plants fueled by coal or natural gas, accounting for 37 percent of total State gross GHG emissions in 2005. The next largest contributors to total gross GHG emissions are the transportation sector (25 percent) and the residential, commercial, and industrial fossil fuel combustion sector (18 percent; CCS 2007).

Estimates of carbon sequestration have been prepared by the EPA for forest ecosystems in the U.S. (EPA 2008a; NRS 2009), which include the overall carbon stock balance of carbon sequestered in forest media, wood products in use, and wood in solid waste disposal facilities. These estimates predict that U.S. forests contained approximately 43,000 MMt of "sequestered" carbon in 2007. The Dixie National Forest has not conducted a Forest-specific estimate of GHG emissions from normal forest management activities. However, based on estimates from other western forests published in 2009 (and not including carbon sequestration; USFS 2009d), the Dixie National Forest probably emits between 400 and 2,000 Mt of carbon dioxide per year. Taken together with carbon sequestration, it is assumed that the overall carbon stock balance for the Dixie National Forest follows the national trend described by the EPA (see Appendix SIR-2), in that carbon is being sequestered in both the Forest ecosystem and harvested wood obtained from the Forest, and that this is resulting in a net sequestration of carbon dioxide (CO_2) on an annual basis.

In addition to forest management activities, a significant amount of GHG is emitted from forest fires (i.e., wildfires). GHG emission estimates that have been made nationally and in other states have shown that forest fires are significant sources of GHG emissions, and forest fires on the Dixie National Forest would also produce large quantities of GHG emissions. EPA (2008b) estimated that across the U.S., GHG emissions from forest fires in 2006 were 268 MMt of carbon dioxide, 25 MMt of methane, and 2.5 Mt of nitrous oxide (see Appendix SIR-2).

3.12.10 Pine Valley Ranger District

The Pine Valley Ranger District is the western section of the Forest. The air quality in the southern portion of this ranger district can be influenced by Washington County's area, mobile, and point sources. Washington County is currently in a rapid population growth mode and produces significant amounts of pollutants associated with a growing urban population. Fugitive and stack particulates are the main pollutant of concern being emitted from these activities. PM pollutants are mainly from aggregate producers, land clearing, and unpaved roads. Prevailing winds are from the west and can influence the existing air quality of this ranger district. Wind events form the south would impact this ranger district even more due to the juxtaposition of sources and receptors. Recreational activities such as vehicle sight-seeing, off-road vehicles, and campfires also impact the air quality.

Existing major air emission sources located near the Pine Valley Ranger District include the City of St. George's peaking power plants and the Reid Power Plant located near Moapa, Nevada. St George's diesel and gas-fired turbines and boilers, when considered as one facility, constitute a major source for NO_x emissions. Significant emissions of SO_2, CO, and PM_{10} also are released from these facilities when operating. The Reid Gardner Power Plant is a coal-fired electric generating facility located west of the Pine Valley Ranger District. Historically, this facility has emitted over 1,000 tons of NO_x, SO_2, and CO_2 emissions annually. NV Energy Company, in a joint settlement plan with the State of Nevada, has agreed to reduce NO_x emissions by 30 percent and to close the oldest units (1 – 3) when a new 1,500 Megawatt (MW) coal-fired power plant, the Ely Energy Center, begins operations. Construction of the Ely Energy Center power plant was placed on hold by NV Energy in 2009. Emissions of NO_x and SO_2 are of concern for both ozone-forming and acid rain potential in the cumulative effects area.

3.12.11 Cedar City Ranger District

The Cedar City Ranger District also has influences from urban growth, mobile sources, and associated industry. With prevailing winds from the west, air resources in this ranger district are currently impacted by emission sources located to the west including: Cedar City, Interstate-15, and a variety of light industrial sources. Light industrial sources include a polystyrene foam and industrial chemical manufacturer, which emits significant amounts of VOCs. Alton Coal Company, located southeast of this ranger district, may be restarting coal surface mining in the near future. Recreational activities such as vehicle sight-seeing, off-road vehicles, and campfires to some extent impact the air quality. Three wells on private lands near the southern tip of the Cedar City and Powell Ranger Districts were drilled to test coals in the Dakota Sandstone; all three wells have been plugged. There are no major air emission sources located in the Cedar City Ranger District.

3.12.12 Powell Ranger District

The Powell Ranger District has similar air resources issues as Cedar City Ranger District, but without the impacts from mobile sources from Interstate-15 and nearby population growth. The town of Panguitch has a population about one percent of St. George and seven percent of Cedar City. Other very small towns are located on the borders of this ranger district, and some mining activities are located directly south. With Bryce Canyon National Park located along the southeast border, the general air quality is considered excellent. There are no major air emission sources bordering the Powell Ranger District. However, there are several coal mines, and the NEVCO and Hunter Power Plants, all located within 70 miles of the borders of the Powell Ranger District. The proposed Alton Coal Hollow project is near the southern end of the ranger district.

3.12.13 Escalante Ranger District

The Escalante Ranger District has no nearby emission sources such as major urban areas, highways, or significant area sources. The Upper Valley Oil Field, located along the southeastern boundary of this ranger district, was discovered in 1964. The field has produced over 27 million barrels of oil and more than 61.6 million cubic feet of gas (likely vented) and is still producing. The Upper Valley Oil Field has been electrified, thus reducing emissions to a very low level. The air quality of the Escalante Ranger District is typically excellent. Air emission sources bordering the Escalante Ranger District are similar to the sources in the Powell Ranger District. Recreational activities such as vehicle sight-seeing, off-road vehicles, and campfires to some extent impact the air quality.

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4.1 Introduction

This chapter describes the changes to the human environment that could occur as a result of implementing the alternatives outlined in Chapter 2. Changes to the human environment are described using the terms "effect" and "impact," which are synonymous under the National Environmental Policy Act (NEPA). Effects may be direct, indirect, or cumulative in nature.

- Direct effects occur at the same time and place as the action.
- Indirect effects are reasonable foreseeable effects that occur later in time or are removed in distance from the action.
- Cumulative effects are those impacts to the environment that result from the incremental impacts of an alternative when added to other past, present, and reasonably foreseeable future actions.

In this chapter, the direct and indirect effects of an action are discussed in combination for all the affected resources under the general term "Impacts." Cumulative effects are described in Chapter 5.

NEPA requires that effects be discussed in terms of context and intensity. In this Environmental Impact Statement (EIS), context refers to the location, type, or size of the area to be affected relative to each resource component. Intensity refers to the severity or level of magnitude of impact. In this EIS, the intensity of effects are defined as Major, Moderate, Minor, or Negligible. In addition, the duration of effects can be temporary, short term, or long term. These terms are described more specifically in Table 4.1-1. In each resource section, an example of how these terms apply to the specific resource is given.

Table 4.1-1 Summary of Terms used to Describe Effects

Attribute of Effect		Description
Quality	Beneficial	An improvement of current conditions.
	Adverse	A degradation of current conditions.
Magnitude (Intensity)	Negligible	No measurable change in current conditions.
	Minor	A small, but measurable change in current conditions.
	Moderate	A moderate, measurable change in current conditions.
	Major	A big, easily measurable change in current conditions.
Duration	Temporary	Short-lived (i.e., during construction).
	Short-term	10 years or less.
	Long-term	More than 10 years.

4.1.1 Connected Actions

The alternatives described in Chapter 2 do not authorize surface disturbance. Therefore, environmental impacts in this chapter are analyzed as connected actions. Connected actions are defined by the Council on Environmental Quality (CEQ 1508.25) as actions that: 1) automatically trigger other actions that may require environmental impact statements, 2) cannot or will not proceed unless other actions are taken previously or simultaneously, and 3) are interdependent parts of a larger action and depend on the larger action for their justification. Forest Service regulations (36 CFR 228.102(c)(4)) require the Forest Service to consider the subsequent actions that would be authorized by a lease as connected actions. Connected actions are the basis of the environmental analysis from which leasing decisions would be

made. In this chapter, connected actions are the predicted disturbance from oil and gas leasing activity, which is discussed in Chapter 2.

4.1.2 Consideration of Available Science

The techniques and methodologies used in this analysis consider the best available science. The analysis includes a summary of the credible scientific evidence that is relevant to evaluating reasonably foreseeable impacts. In addition, the analysis also identifies the methods used and references the scientific sources relied on. When appropriate, the conclusions are based on a scientific analysis that shows a thorough review of relevant scientific information, a consideration of responsible opposing views, and the acknowledgment of incomplete or unavailable information, scientific uncertainty, and risk.

4.1.3 Indicators

In this chapter, effects will be described using indicators developed for each resource. Using the environmental conditions described in Chapter 3 as a baseline, indicators are used to predict or measure change in a resource related to effects of the alternatives. Some indicators are quantitative and measure effects based on numerical thresholds, while other indicators involve a narrative to qualitatively describe any changes relevant to baseline conditions.

4.2 Visual Resources

4.2.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.2-1 provides an example how these terms would apply to Visual Resources.

Table 4.2-1 Terms used to Describe Effects to Visual Resources

Attribute of Effect		Description relative to Visual Resources
Quality	Beneficial	An enhancement to the scenic value of the landscape.
	Adverse	A reduction in the scenic value of the landscape.
Magnitude (Intensity)	Negligible	A change in the scenic value of the landscape that is so slight it cannot be detected by the casual observer.
	Minor	A change in the scenic value of the landscape that can be detected by the casual observer, but the change appears relatively natural in the landscape.
	Moderate	Alterations in the scenic value of the landscape that are obvious to the casual observer, but borrow from natural attributes such as form, pattern, and edge effect. These alterations may begin to dominate the landscape view.
	Major	Heavy alterations in the scenic value that are dominant in the landscape view.
Duration	Temporary	A change in the scenic quality of an area (equipment onsite; traffic; etc.) during construction of a facility (i.e., road, well pad) that does not occur once construction is completed.
	Short-term	A change in the scenic quality of an area due to exploration activities (i.e., construction of exploratory well pads or access roads). The change is limited only to the time needed for exploration and reclamation, 10 years or less.
	Long-term	A change in the scenic quality of an area due to the construction of production facilities (i.e., a production field and associated roads). The life of the production field and the time needed for reclamation would exceed 10 years.

4.2.2 Measurement Indicators

- Measurement Indicator #1 PREDICTED LUMENS FOR VARIOUS PHASES
- Measurement Indicator #2 NARRATIVE OF POTENTIAL CHANGES TO THE LANDSCAPE ADDRESSING THE DURATION AND CHANGE FOR EACH VISUAL ATTRIBUTE
- Measurement Indicator #3 COMPLIANCE WITH THE SCENERY MANAGEMENT SYSTEM (SMS)/SCENIC INTEGRITY OBJECTIVES(SIO)
- Measurement Indicator #4 CONSISTENCY WITH THE 2000 DIXIE SCENERY MANAGEMENT SYSTEM LAND AND RESOURCE MANAGEMENT PLAN AMENDMENT

4.2.3 Impacts Common to All Action Alternatives

Under all alternatives other than No Action, it is assumed that the Reasonably Foreseeable Development Scenario (RFDS) would occur. The RFDS for oil and natural gas is based on the assumption that all potentially productive areas can be open under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation, or executive order. It assumes a time period of 15 years and includes all lands within the boundaries of the Dixie National Forest regardless of ownership, and adjacent non-Forest lands where oil and gas activity may impact Forest lands.

The RFDS activities may result in surface disturbance of up to 60 to 120 acres (depending on ranger district), associated with overland travel for seismic surveys; 80 to 330 acres (depending on ranger district) of land required for exploration roads and well pads, and 254 acres of land required for a production field. The locations of these activities cannot currently be predicted.

The primary concerns associated with energy development on the visual quality of the Dixie National Forest are the visibility of constructed features including roads, well pads, and pipelines; the presence of seismic or drilling equipment and transportation on Forest roads surrounding mobilization to seismic testing or drill sites; and the long-term presence of a production facility.

The direct effects of post-leasing activities in the Dixie National Forest on visual resources are generally related to surface disturbance, activity, and the presence of un-natural elements previously not part of a landscape or view. Any human activity or man-made feature could degrade the visual quality of an area. The degree of degradation is dependent upon the amount of contrast between the natural and constructed landscape, the viewing distance, and the concern of the viewer for visual quality. Viewing distances are typically described as foreground (within 0.5 mile), middleground (0.5 mile to 3-5 miles), and background (3-5 miles and beyond). Facilities sited in a relatively open, flat, desert shrub community near (in the foreground) a commonly-used Forest road would impact the landscape in a different way than facilities sited within pinyon-juniper forest, against a rock outcrop, or distant from an actively-used Forest road.

The visual impacts related to construction of roads and well pads are mainly caused by removal of vegetation and the resulting inconsistency in the natural landscape. The impacts of vegetation removal are described in Section 4.9. In addition, the traffic associated with well installation and the presence of the equipment on the well pad create direct visual impacts, which vary in intensity depending upon the distance a viewer might be from the activity and the

amount of disturbance. The visual impacts due to traffic activity for the purposes of seismic exploration or well installation would be temporary and could be major; the quality or degree of the impact would depend, again, on the sensitivity of the landscape (High SIO landscapes are more sensitive than Low), and the location of the activity in relation to roads and viewer access. The visual impacts of an exploratory drilling rig or an installed well depend upon the siting and location of the equipment or facility. Approximately 50 percent of Dixie National Forest lands are designated Moderate or Low SIOs (see Table 3.2-1 in Chapter 3). The diverse variety contained in the landscape on the Dixie National Forest will facilitate a high degree of alterations before middle ground or background Moderate SIOs or foreground to background Low SIOs are not achievable.

The potential impacts to visual resources associated with post-leasing activity (exploration, access, development) would include changes to scenic integrity based on the effects to scenic quality and scenic views. Although the diverse forest landscape has the ability to absorb some of the effects of exploration, there are some sensitive areas where it would be more difficult to meet scenic integrity objectives. The most sensitive areas are characterized as High SIO areas such as Red Canyon and the Scenic Byways. In these areas, depending upon the viewing distance, it most often would not be possible to meet the scenic integrity objectives under SLT. In addition, the Dixie National Forest lands are within view of neighboring National Parks and Monuments including Zion, Bryce Canyon, Capitol Reef, Cedar Breaks, and Grand Staircase-Escalante.

Exploratory drilling would result in strong visual contrasts resulting from vegetation removal, soil disturbance, the addition of linear road features in undeveloped areas, and the presence of equipment that does not easily blend into the landscape. The visual impacts of drilling would be greater in areas visible from scenic travel ways or viewpoints. These moderate to strong direct effects would, however, be temporary, lasting from approximately nine to twelve months per well site (USFS 1995b). Under the RFDS, this activity could be ongoing in several areas of the Dixie National Forest during any one year and ongoing for 15 years. Public access would be restricted from newly constructed drill roads, limiting views of some exploration areas, but others may be highly visible from existing roads and trails.

Once access roads are constructed and a well site is cleared and leveled, it is estimated that total one-way traffic volume would be up to 1,924 trips per exploration well (see Section 4.10). Traffic volume is directly correlated to estimated size of drill pads and amount of road construction/reconstruction. This concentration of traffic to/from a drill site location may cause dust and related visual quality issues, and/or may cause recreationists or Forest visitors to leave an area in search of a more pleasing Forest setting.

Drill rigs vary in height from 100 feet (single) to 136 feet (triple) (Barry Olsen, Sale Manager, IDM Equipment, LTD., Houston, Texas, Personal Communication). Depending on the height of the substructures, the mast of a drill rig may rise to 160 feet above ground surface, and is the most visible and noticeable part of a drill rig (USFS 1995a, Appendix D). Drilling operations typically continue 24 hours a day and 7 days a week. Nighttime lighting on the rigs can be controlled to reduce the nighttime visibility of the derrick from a distance. This can be done by shielding light fixtures to eliminate direct uplight and being careful that they shine inward to the working area of the rig and not outward (Luginbuhl et al. 2009a and 2009b; Dustin Doucett, Petroleum Engineer, Utah Division of Oil, Gas, and Mining, Personal Communication). Focus and illumination engineering can be utilized to make the rig less visible from outside of the drilling location at night (Barry Olsen, Personal Communication). In addition, limits on the timing of operations, height of light poles, and wattage intensities can be used to limit light pollution

(see mitigations in Appendix C). The potential for light pollution would be minor to moderate, depending upon the site, and temporary.

In the development and production phase of post-leasing activity, visual impacts would be minor to major adverse effects, depending upon the site, and they would be long term (at least 30 years of production). It is estimated that total one-way traffic volume would be up to 6,884 trips for development of a 20-well production field (Section 4.10). Average daily traffic is thus estimated to be 13 one-way trips during the production field development stage. The presence of an oil field, with all the associated activity, dust, and traffic, may cause some viewers or recreationists to abandon use of the area (USFS 1995a).

If the exploration does not result in discovery, the equipment would be removed, and the area reclaimed. The visual contrast from exploration disturbance and activity would likely be minor to negligible after several months, and over the long term would disappear entirely.

With regard to the lighting at the oil fields, many well sites are designed with adequate tank storage so there is not a need for nighttime pickups of oil and/or produced water by transporters; i.e. these operations only occur in the daytime. These types of well sites would typically not be lit at night. Those sites that are lit at night are not brightly lit to illuminate the whole location. Rather, the lighting is only placed where necessary for safety reasons and to operate specific equipment. When stray lighting is an environmental issue for such sites, the operator could reduce impacts using methods such as limiting height of light poles, timing of lighting operations, limiting wattage intensity, and constructing light shields Dustin Doucett, Petroleum Engineer, Utah Division of Oil, Gas, and Mining, Personal Communication) as presented in Appendix C.

The indirect effects of post-leasing activity are connected to recreation, use, access, viewpoints, and the more personal perspective and expectation of the viewer in the landscape. Therefore, indirect effects are variable, personal, and site-dependent but together influence the scenic experience of those who enjoy and use the Dixie National Forest. The direct and indirect effects of oil and gas leasing on the Forest may affect SIOs, depending upon the site and leasing option applied to these areas.

Table 4.2-2 lists the leasing options assigned to the various SIOs under each of the alternatives. The leasing options and associated impacts to visual resources are described in Section 4.2.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described in the RFDS) wherever the applicable resource component occurs on the Dixie National Forest.

Table 4.2-2 Leasing Options Assigned under each Alternative for Visual Resources

SIO	Alternative				
	A	B	C	D	E
Very High	NL	NSO-01	NSO-01	NSO-01	SLT
High	NL	NSO-02	NSO-02	CSU-01	SLT
Moderate	NL	CSU-02	CSU-02	SLT	SLT
Low	NL	SLT	SLT	SLT	SLT
SIO Unassigned	NL	CSU-03	CSU-03	CSU-03	SLT
NPS Protection	NL	NL	NSO-29	SLT	SLT

4.2.4 Impacts of Connected Actions by Leasing Option

Leasing options would dictate the conditions under which connected actions (described under the RFDS) may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to visual resources considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.2.5 (Impacts by Alternative).

4.2.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing and includes Brian Head Ski Permit Area, wilderness areas (which are designated as Very High SIO areas), and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing would occur in these areas and there would be no effects to scenic resources. This leasing option does not apply directly to visual resource components.

4.2.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing. A NL stipulation was applied in 1,284 acres surrounding Bryce Canyon National Park under Alternative B.

Under Alternative A, there would be no new leasing, so no connected actions to leasing and no visual effects would occur in addition to those within currently leased areas.

4.2.4.3 No Surface Occupancy (NSO)

Under the NSO option, there would be no surface disturbance due to construction or activities related to oil and gas exploration or development, other than seismic surveys. NSO prohibits use or occupancy of the land for fluid mineral exploration or development, in order to protect identified resource values. Under Alternatives B, C, and D, NSO applies to lands designated with Very High SIO. Under Alternatives B and C, NSO also applies to lands designated as High SIO (see Table 3.2-1 in Chapter 3). In addition, an NSO stipulation was applied after the analysis in 1,925 acres surrounding Bryce Canyon National Park under Alternative C.

Measurement Indicators

- Measurement Indicator #1 PREDICTED LUMENS FOR VARIOUS PHASES

There would be no effects to visual resources as a result of lighting conditions under NSO because there would be no occupancy, including areas surrounding Bryce Canyon National Park. Seismic exploration would have a negligible effect on lighting impacts to visual resources as these operations are performed only in daytime.

- Measurement Indicator #2 NARRATIVE OF POTENTIAL CHANGES TO THE LANDSCAPE ADDRESSING THE DURATION AND CHANGE FOR EACH VISUAL ATTRIBUTE

Under NSO, there would be minor and temporary effects to the landscape with seismic exploration activity. There would be no impacts to the SIOs under this option.

- Measurement Indicator #3 COMPLIANCE WITH THE SCENERY MANAGEMENT SYSTEM (SMS)/SCENIC INTEGRITY OBJECTIVES (SIO)

Under NSO, there would be negligible to minor and temporary effects to the landscape with seismic exploration activity. In Very High SIO areas, the landscape character would remain intact, with few, if any deviations – the definition of Very High SIO areas (USFS 1995g). Seismic exploration in Very High SIO areas may impact the SIO in the short term due to crushed vegetation trails, if exploration occurs in areas inaccessible by existing roads and trails. High, Moderate, and Low SIOs are not expected to be compromised in the short term or long term. There would be no long-term impacts to the SIOs under this option.

- Measurement Indicator #4 CONSISTENCY WITH THE 2000 DIXIE SCENERY MANAGEMENT SYSTEM LAND AND RESOURCE MANAGEMENT PLAN AMENDMENT

Under NSO, there would be no long-term effects to SIOs; NSO would be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment.

4.2.4.4 Timing Limitation (TL)

TL does not apply directly to visual resources.

4.2.4.5 Controlled Surface use (CSU)

CSU provides for controlled but generally allowed surface use on all or portions of a lease. Operations would be held to special operational constraints that may otherwise exceed the mitigation provided by SLT, and the regulations and operating orders.

CSU applies to High SIO areas under Alternative D, unassigned SIO areas under Alternatives B, C, and D, and to Moderate SIO areas under Alternatives B and C. CSU would require the use of the Bureau of Land Management's (BLM)-established Best Management Practices (BMPs) and Dixie NF requirements as listed in Appendix C in the location and design of oil and gas exploration sites, and prior approval by the Dixie National Forest of proposed designs to reduce visual effects of exploration and production. Refer to Appendix D for descriptions of each CSU.

Measurement Indicators

- Measurement Indicator #2 NARRATIVE OF POTENTIAL CHANGES TO THE LANDSCAPE ADDRESSING THE DURATION AND CHANGE FOR EACH VISUAL ATTRIBUTE

Under CSU, there would be minor to major temporary effects to the landscape with seismic exploration activity and exploratory drilling. Impacts to visual resources under a production scenario would be minor to major and long term dependant on location.

- Measurement Indicator #3 COMPLIANCE WITH THE SCENERY MANAGEMENT SYSTEM (SMS)/SCENIC INTEGRITY OBJECTIVES (SIO)

Under CSU, there would be minor to major (depending upon the availability of vegetative or topographic screening and distance from viewpoints) temporary effects to the landscape with exploration drilling activity. Drilling or production field activities would not comply with High SIOs, since the drilling rigs and production equipment would be difficult to screen. Once drilling is completed, and a drill site is reclaimed, it would again be in compliance with the SIO. In Moderate SIO areas, compliance is more likely to be maintained during drilling and production with BMPs such as siting to reduce visual impacts, painting of facilities to match the landscape,

and interim road reclamation. However, drilling in foreground locations would not meet the Moderate SIO until after reclamation is complete. In Low SIO areas, compliance with SIOs would be maintained.

- Measurement Indicator #4 CONSISTENCY WITH THE 2000 DIXIE SCENERY MANAGEMENT SYSTEM LAND AND RESOURCE MANAGEMENT PLAN AMENDMENT

Under CSU, the impacts to SIOs are described above. CSU in High SIO areas or Moderate SIO areas may not be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment.

4.2.4.6 Lease Notice (LN)

The LN does not impose new restrictions on oil and gas activities; it provides more detailed information concerning existing limitations, regulations, or orders, or addresses special considerations. LN does not apply directly to visual resources.

4.2.4.7 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT) and the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

The BLM and USFS (2007) document provides operators with a combination of guidance and standards for encouraging compliance with agency policies and operating requirements. For example, site selection and design are required to "minimize long-term disruption of the surface resources and existing uses, and to promote successful reclamation." Further, the operator must work towards compliance with the visual resource management objectives, or SIOs established in the land use plan for "all activities that alter landforms, disturb vegetation, or require structures. Site-specific mitigation practices may be required by the surface management agency to minimize visual impacts, while remaining consistent with the lessee's right to conduct operations under the lease." The BLM has outlined BMPs for Fluid Minerals (BLM 2007b) in consideration of visual resources. In visually sensitive areas, BMPs may include painting of facilities to blend with the surrounding landscape, locating structures to utilize topographic or vegetation screens, locating structures away from ridgelines or other prominent natural features, use of low-profile equipment, and completing interim reclamation of disturbed areas. Under SLT, BMPs are those reasonable measures taken by the operator to minimize undesirable impacts to the environment.

Alternatives B and C apply the SLT leasing option only to the Low SIO areas. Alternative D applies the SLT leasing option to Moderate and Low SIO areas, while Alternative E would apply the SLT leasing option to all visual SIO areas including Very High and High. Impacts to these visual resources under SLT are described below

Under SLT, leases within Very High and High SIO areas would be issued under the conditions of the standard federal oil and gas lease and subject to existing regulations. There would be no laws or regulations that would protect the visual resource from the effects of oil and gas post-leasing activity. This leasing option would not comply with Very High or High SIOs. Impacts to visual resources under SLT could be minor to major and short to long term.

Under SLT, leases within Moderate SIO areas would be issued under the conditions of the standard federal oil and gas lease and subject to existing regulations. There would be no laws or regulations that would protect the visual resource from the effects of oil and gas post-leasing activity. In areas of activity close to roads, the strong visual contrasts of exploration may not comply with this SIO until reclamation is complete. When activity occurs in background areas more easily screened from public views, uses under SLT incorporating BMPs (BLM 2007b) for visual resources management would comply with the visual resources objectives in Moderate SIO areas. Full production field development in foreground or middleground views would not comply with Moderate SIOs.

Under SLT, leases within Low SIO areas would be issued under the condition of the standard federal oil and gas lease and subject to existing regulations. There would be no laws or regulations that would protect the visual resource from the effects of oil and gas post-leasing activity. In these areas, the activity may be obvious in the landscape, but must borrow from existing natural shapes and colors in the background. Painting the facilities with non-reflective paint in a color to blend with the environment would be required, as well as other BMPs (BLM 2007b). Oil and gas activity under SLT would comply with Low SIO.

Measurement Indicators

- Measurement Indicator #1 PREDICTED LUMENS FOR VARIOUS PHASES

According to Barry Olsen, drill equipment manufacturing representative, the lumen ratings for derrick lights all vary. Based upon this, the total lumens for each phase would be completely variable depending upon equipment utilized. As noted above, the drill rig lighting can be mitigated to minimize the visibility of the site (Appendix C). However, minor to moderate impacts to dark night skies are still possible wherever oil and gas developments occur. These impacts would be short-term in the case of an exploration development and long-term in the case of a production development.

- Measurement Indicator #2 NARRATIVE OF POTENTIAL CHANGES TO THE LANDSCAPE ADDRESSING THE DURATION AND CHANGE FOR EACH VISUAL ATTRIBUTE

As noted above, exploratory drilling would result in major, short-term impacts, particularly in areas that have not been previously developed. Visual contrasts would be strongest initially, during surface disturbance and construction, and would lessen over time as activity decreases and reclamation is completed.

Development of a production field in the foreground of a viewpoint would create major, long-term impacts. A production field in the distance from a viewpoint would create moderate long-term impacts.

- Measurement Indicator #3 COMPLIANCE WITH THE SCENERY MANAGEMENT SYSTEM (SMS)/SCENIC INTEGRITY OBJECTIVES (SIO)

There would not be compliance with SIOs under SLT in Very High or High SIO areas. In Moderate SIO areas, compliance is likely for middleground to background activities. In Low SIO areas, exploration and production activities would be in compliance with the objectives.

- Measurement Indicator #4 CONSISTENCY WITH THE 2000 DIXIE SCENERY MANAGEMENT SYSTEM LAND AND RESOURCE MANAGEMENT PLAN AMENDMENT

In High SIO corridors, SLT without site-specific mitigation measures to maintain the SIO would not be consistent with the designation of Scenic Byways and Backways as Concern Level 1 travelways in the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment (USFS 2000a).

4.2.5 Impacts by Alternative

The degree to which the impacts of connected actions (Section 4.2.4) would differ by alternative is discussed in this section. Alternatives involve leasing options, which would restrict the locations and the nature of oil and gas impacts. Because different resource components overlap, leasing options assigned to each resource component would also overlap and the most restrictive leasing option would take precedence (refer to Section 2.3.1).

Table 4.2-3 shows the acres of each resource component under each leasing option by alternative. Table 4.2-3 incorporates the amount of overlap with more restrictive leasing options (assigned to other resources) in addition to the leasing options assigned directly to each resource component. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternative D and E. Under Alternatives D1 and E1, all acres within IRAs are NSO, whereas under D2 and E2, acres within IRAs are under a less restrictive leasing option (CSU or SLT, respectively). The following SIO designations fall within IRAs: 3,217 acres Very High SIO (4 percent of Very High SIO acres); 128,426 acres High SIO (32 percent of High SIO acres); 142,064 acres Moderate SIO (26 percent of Moderate SIO acres); 159,384 acres Low SIO (54 percent of Low SIO acres), and 132,814 acres Unassigned SIO (44 percent of Unassigned SIO acres). Low and Moderate SIO areas are mostly covered by equal or more restrictive leasing options, as a result of overlapping leasing options assigned to other resources.

In this section, impacts are generally discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts will be highlighted and discussed. Impacts in regards to *Measurement Indicator #2* would be the same for Alternatives B through E, as described above in Section 4.2.4.

4.2.5.1 Alternative A

There would be no effects to the landscape under the No Action Alternative, other than those already occurring in existing lease areas. There would be no effects to night skies under No Action (*Measurement Indicator #1*). There would be no effects to SIOs under No Action (*Measurement Indicator #3*). This alternative would be consistent with the 2000 Scenery Management System Amendment to the Land and Resource Management Plan (*Measurement Indicator #4*).

Table 4.2-3 Acreage of Visual Resource Components under each Leasing Option by Alternative

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
Very High (Wilderness and	NA	85,707	85,707	85,707	85,707	85,707	85,707	85,707
	NL	4,213	4,195	4,088				

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
RNA's)	NSO		19	126	4,213	4,213	3,217	
	CSU							
	SLT						997	4,213
High	NA	1,548	1,548	1,548	1,548	1,548	1,548	1,548
	NL	400,567	297,588	35,132				
	NSO		102,979	365,435	171,335	67,769	128,426	
	CSU				229,232	332,798		
	SLT						272,141	400, 567
Moderate	NA	2,829	2,829	2,829	2,829	2,829	2,829	2,829
	NL	536,313	369,250	10,317				
	NSO		116,844	378,330	179,484	40,447	142,064	
	CSU		50,220	147,666	350,980	490,017		
	SLT				5,849	5,849	394,249	536,313
Low	NA	130	130	130	130	130	130	130
	NL	293,050	239,900	9,562				
	NSO		43,821	239,350	173,603	23,622	159,384	
	CSU		9,284	44,093	119,403	269,383		
	SLT						133,621	293,050
Unassigned	NA	154	154	154	154	154	154	154
	NL	305,153	223,580	3,429				
	NSO		68,228	262,418	137,775	6,069	132,814	
	CSU		13,346	39,306	167,378	299,084		
	SLT						172,339	305,153
NPS Park Protective Measure	NA							
	NL	1,285	1,285					
	NSO			1,926				
	CSU				1,926	1,926		
	SLT						1,926	1,926

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternative D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.

4.2.5.2 Alternative B

Under this alternative there would be No Leasing on 4,195 acres of Very High SIO land, and leasing under NSO on 19 acres. The remaining 85,707 acres, or 95 percent of Very High SIO lands are Not Available for leasing.

In the designated High SIO areas of the Dixie National Forest, there would be No Leasing on 297,588 acres (74 percent), and the lease option would be NSO for an additional 102,979 acres, or approximately 26 percent of the High SIO areas of the Forest. The remaining High SIO lands (<0.5 percent) are Not Available for leasing.

Of the Moderate SIO lands on the Forest, there would be No Leasing on 369,250 acres, or 68 percent of the designated Moderate SIO lands. On 116,844 acres, or 22 percent of the Moderate SIO lands on the Forest, NSO would be applied. The lease option would be CSU on

50,220 acres, or 9 percent of the Moderate SIO lands on the Forest. The remaining Moderate SIO lands (1 percent) are Not Available for leasing.

There would be No Leasing on 239,900 acres, or 82 percent of the Low SIO lands on the Forest. The NSO option would be applied to 43,821 acres, or 15 percent of the Low SIO lands on the Forest. On 3 percent, or 9,284 acres of Low SIO lands, leasing would be allowed under CSU. The remaining 130 acres (Brian Head and small areas associated with limitations of the GIS data) of Low SIO lands are Not Available for leasing.

With the exception of Alternative A, this alternative provides the most protection for the scenic resources of the Forest. Alternative B would have negligible impacts to night skies (*Measurement Indicator #1*), except in the few areas of CSU (4 percent of the Forest), where developments would be possible; in these areas impacts would be minor to moderate. There would be no effect to night skies in areas surrounding Bryce Canyon National Park, which are NL. Alternative B would be in compliance with the SIOs, with considerations made for facility location and site design in Moderate SIO areas adjacent to viewing corridors (*Measurement Indicator #3*). This alternative would be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment (*Measurement Indicator #4*).

4.2.5.3 Alternative C

Alternative C has less restrictive leasing options than Alternative B and more restrictive options than Alternative D. The Very High SIO lands carry essentially the same options as under Alternative B, other than the NSO option, which increases slightly to 126 acres.

Under this alternative, there are few High SIO areas (less than 1 percent) that are available for leasing. There would be No Leasing on 35,132 acres of High SIO lands. The leasing option would be NSO for 365,435 acres, or about 91 percent of the High SIO areas of the Forest.

Of the Moderate SIO lands, NSO would be applied to 378,330 acres, or 70 percent of the Moderate SIO lands on the Forest. The lease option would be CSU on 147,666 acres, or 27 percent of the Moderate SIO lands on the Forest. The remaining Moderate SIO lands are Not Available for leasing or would have NL applied.

A NSO option would be applied to 239,350 acres, or 82 percent of the Low SIO lands on the Forest. On 15 percent, or 44,093 acres of Low SIO lands, leasing would be allowed under CSU. The remaining Low SIO lands are Not Available for leasing or would have NL applied.

This alternative still places the majority of the Forest acreage into the NSO option. Like Alternative B, Alternative C would have negligible impacts to night skies (*Measurement Indicator #1*), except in the areas of CSU (14 percent of the Forest) where impacts could be minor or moderate. All areas surrounding Bryce Canyon National Park (1,926 acres) would be NSO, which would reduce night sky impacts (*Measurement Indicator #1*) to negligible levels. NSO also provides protection for the scenic resources of the Forest, and would be in compliance with the SIOs, with considerations made for facility location and site design in Moderate SIO areas adjacent to viewing corridors (*Measurement Indicator #3*). This alternative would be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment (*Measurement Indicator #4*).

4.2.5.4 Alternative D1 (NSO in IRAs)

Alternative D has less restrictive leasing options than Alternative C and more restrictive options than Alternative E. The majority of Very High SIO lands are Not Available for leasing. There are 4,213 acres that could be leased under NSO. Of the High SIO lands, 171,335 acres, about 43 percent of the High SIO areas of the Forest, would be NSO. The CSU option applies to 229,232 acres, or 57 percent of High SIO lands. The remaining High SIO lands (less than 1 percent) are Not Available for leasing.

Under this alternative, many SIO Moderate and Low areas would be available for leasing under SLT. Of the Moderate SIO lands, NSO would be applied to 179,484 acres, or about 33 percent of the Moderate SIO lands on the Forest. The lease option would be CSU on 350,980 acres, or 65 percent of the Moderate SIO lands on the Forest. SLT would be the option on 5,849 acres, about 1 percent of Moderate SIO lands. The remaining Moderate SIO lands (1 percent) are Not Available for leasing.

The NSO option would be applied to 173,603 acres, or 59 percent of the Low SIO lands on the Forest. On 41 percent, or 119,403 acres of Low SIO lands, leasing would be allowed under CSU. The remaining 130 acres of Low SIO lands are Not Available for leasing.

This alternative provides for NSO in IRAs. In these and other NSO areas (41 percent of the Forest), impacts to night skies would be negligible (*Measurement Indicator #1*). In other areas (CSU and SLT; 53 percent of the Forest), impacts to night skies could be minor to moderate.

CSU in High SIO areas would not meet the SIO, depending upon the site and distance from viewing areas (*Measurement Indicator #3*). CSU, with considerations made for facility location and site design in Moderate SIO areas adjacent to viewing corridors, is likely to comply with the SIO. This alternative may not be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment for those High SIO corridor areas, subject to CSU (*Measurement Indicator #4*).

4.2.5.5 Alternative D2 (CSU in IRAs)

The majority of Very High SIO lands are Not Available for leasing. There are 4,213 acres that could be leased under NSO. Of the High SIO lands, the leasing option would be NSO for 67,769 acres, about 17 percent of the High SIO areas of the Forest. The CSU option applies to 332,798 acres, or 83 percent of High SIO lands. The remaining High SIO lands (less than 1 percent) are Not Available for leasing.

Of the Moderate SIO lands, NSO would be applied to 40,447 acres, or about 8 percent of the Moderate SIO lands on the Forest. The lease option would be CSU on 490,017 acres, or 91 percent of the Moderate SIO lands on the Forest. SLT would be the option on 5,849 acres, about 1 percent of Moderate SIO lands. The remaining Moderate SIO lands (less than 1 percent) are Not Available for leasing.

The NSO option would be applied to 23,622 acres, or 8 percent of the Low SIO lands on the Forest. On 92 percent, or 269,383 acres of Low SIO lands, leasing would be allowed under CSU. The remaining Low SIO lands (less than 1 percent) are Not Available for leasing.

Impacts to night skies (*Measurement Indicator #1*) would be as described under Alternative D1, except there would be fewer areas covered by NSO (9 percent of the Forest under D2).

This alternative provides for CSU in IRAs. CSU in High SIO areas may not meet objectives depending upon the site and distance from viewing areas (*Measurement Indicator #3*). CSU, with considerations made for facility location and site design in Moderate SIO areas adjacent to viewing corridors, is likely to comply with the SIO. This alternative would likely not be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment for those High SIO corridor areas subject to a TL or CSU (*Measurement Indicator #4*).

4.2.5.6 Alternative E1 (NSO in IRAs)

Alternative E would open the majority of the Dixie National Forest to leasing under the standard lease terms and conditions contained on BLM Lease Form 3100-11, with the exception of areas identified as Visual Retention/SIO Very High and IRAs under the dual analysis scenario. Visual Retention/SIO Very High areas would be NSO or not available for leasing. The majority of Very High SIO lands are Not Available for leasing. There are 3,217 acres that could be leased under NSO and 997 acres under SLT. In High SIO areas, 128,426 acres would be NSO, 67 percent of High SIO areas. SLT would apply to 272,141 acres of High SIO lands, 33 percent.

In Moderate SIO areas, NSO would apply to 142,064 acres or 27 percent, and SLT would be the option on 394,249 acres or 73 percent of Moderate SIO lands. In Low SIO areas, NSO would apply to 159,384 acres, or 54 percent, and 133,621 or 46 percent would be available under SLT.

Impacts to night skies (*Measurement Indicator #1*) would be as described under Alternative D1, except 35 percent of the Forest would be covered by NSO (negligible impacts) and the remainder available for leasing (59 percent) would be covered by SLT (minor to moderate impacts).

This alternative would likely not be consistent with the 2000 Dixie Scenery Management System Land and Resource Management Plan amendment for High SIO areas, and Moderate foreground and middleground SIO areas subject to SLT (*Measurement Indicator #4*).

4.2.5.7 Alternative E2 (SLT in IRAs)

Leasing would be allowed anywhere on the Dixie National Forest that is legally available. This alternative would be similar to Alternative E1 above, except NSO areas would decrease, and SLT would increase. The majority of Very High SIO lands are Not Available for leasing; there are 4,213 acres that could be leased under SLT. Other than Very High SIO lands noted, the remainder of the Forest, for the most part (99 percent), would be available under SLT. In High SIO areas, 400,567 acres would be SLT. In Moderate SIO areas 536,313 acres would be SLT. In Low SIO areas, 293,050 acres would be available under SLT. Under this alternative, all impacts would be as described in Section 4.2.4.7.

4.3 Inventoried Roadless Areas, Unroaded-Undeveloped Areas, and SuitableWild and Scenic Rivers

4.3.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Tables 4.3-1 and 4.3-2 provide examples of how these terms would apply to IRAs and Unroaded-Undeveloped Area, and suitable Wild and Scenic Rivers, respectively.

Table 4.3-1 Terms used to Describe Effects to IRAs and Unroaded-Undeveloped Areas

Attribute of Effect		Description relative to IRAs
Quality	Beneficial	An improvement in the roadless characteristics or wilderness attributes of an IRA or Unroaded-Undeveloped Area.
	Adverse	A degradation of the roadless characteristics or wilderness attributes of an IRA or Unroaded-Undeveloped Area, such as wildlife habitat fragmentation or a loss of acres eligible to be managed as an IRA or Unroaded-Undeveloped Area.
Magnitude (Intensity)	Negligible	A change in roadless characteristics or wilderness attributes that is too small to be effectively measured or be perceptible to a human visitor. *Example: Oil and gas activity adjacent to an IRA that is not easily seen or heard from within the IRA.*
	Minor	A measurable or perceptible change that is small enough that it does not result in a change to ecological conditions, a loss of acres eligible to be managed as an IRA or Unroaded-Undeveloped Area, or a marked decrease in a users experience within the IRA or Unroaded-Undeveloped Area. *Example: Seismic exploration that avoids off-road travel in sensitive areas.*
	Moderate	A measurable or perceptible change that is large enough that it may result in changes to ecological conditions, a loss of roadless or Unroaded-Undeveloped Area acres, or a decrease in a user's experience. Loss of roadless acres does not affect the ability of the IRA or Unroaded-Undeveloped Area to be managed as such. *Example: An exploratory well that requires a small amount of road construction, but that would not bisect the IRA in any way.*
	Major	A change that is easily measurable and visibly apparent. Changes would result in changes to ecological conditions, a loss of roadless or Unroaded-Undeveloped Area acres, or a decrease in a user's experience. Loss of roadless or Unroaded-Undeveloped Area acres may reduce the size of the IRA or Unroaded-Undeveloped Area such that it may not be able to be managed as such. *Example: A road that bisects an IRA into several smaller areas.*
Duration	Temporary	An increase in noise during construction or seismic exploration that does not occur once construction or exploration is completed.
	Short Term	A degradation of roadless characteristics or wilderness attributes that occurs during exploration activities (i.e., construction of exploratory well pads or access roads). Any disturbance (including roads) is limited only to the time needed for exploration and reclamation, 10 years or less.
	Long Term	A degradation of roadless characteristics or wilderness attributes due to the construction of production facilities (i.e., a production field and associated roads). The life of the production field and the time needed for reclamation would exceed 10 years.

Table 4.3-2 Terms used to Describe Effects to Suitable Wild and Scenic Rivers

Attribute of Effect		Description relative to Eligible Wild and Scenic Rivers
Quality	Beneficial	An improvement in the outstandingly remarkable values or protection of the free flow of a suitable Wild and Scenic River.
	Adverse	A degradation of the outstandingly remarkable values or the free flow of a suitable Wild and Scenic River.
Magnitude (Intensity)	Negligible	A change in the outstandingly remarkable values that is too small to be effectively measured or be perceptible to a human visitor. *Example: Oil and gas activity adjacent to* a suitable Wild and Scenic River *that is not easily seen or heard from within the ¼-mile river corridor.*
	Minor	A measurable or perceptible change that is small enough that it does not alter the outstandingly remarkable values, alter the free flow, result in a loss of acres of a suitable Wild and Scenic River, or result in a marked decrease in a users experience within the area. *Example: Seismic exploration that avoids off-road travel in sensitive areas.*
	Moderate	A measurable or perceptible change that is large enough that it may result in changes to the outstandingly remarkable values, a loss of acres of a suitable Wild and Scenic River, or a decrease in a user's experience. *Example: An exploratory well that requires a small amount of road construction, but that would not cross or bisect the segment.*
	Major	A change that is easily measurable and visibly apparent. Changes would result in degradation to the outstandingly remarkable values, a loss of acres of a suitable Wild and Scenic River, alteration of free flow, or a decrease in a user's experience. *Example: A road that crosses or bisects a segment.*
Duration	Temporary	A degradation of outstandingly remarkable values that occurs during construction or seismic exploration, but that does not occur once construction or exploration is completed.
	Short Term	A degradation of outstandingly remarkable values that occurs during exploration activities (i.e., construction of exploratory well pads or access roads). Any disturbance (including roads) is limited only to the time needed for exploration and reclamation, 10 years or less.
	Long Term	A degradation of outstandingly remarkable values due to the construction of production facilities (i.e., a production field and associated roads). The life of the production field and the time needed for reclamation would exceed 10 years.

4.3.2 Measurement Indicators

4.3.2.1 Inventoried Roadless Areas and Unroaded-Undeveloped Areas

- *Measurement Indicator #1* NARRATIVE DISCUSSION TO IMPACTS TO ROADLESS CHARACTERISTICS AND WILDERNESS ATTRIBUTES
- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE IN IRAS OR UNROADED-UNDEVELOPED AREAS

4.3.2.2 Suitable Wild and Scenic Rivers

- *Measurement Indicator #1* NARRATIVE DISCUSSION TO SUITABILITY AND "OUTSTANDINGLY REMARKABLE VALUES"

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE WITHIN ¼-MILE DISTANCE FROM EITHER BANK OF SUITABLE STREAM SEGMENTS

4.3.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E it is assumed that activities described under the RFDS would occur on some portion of the Dixie National Forest. However, depending on the alternative, activities described under the RFDS would be restricted in some locations. These activities include 60 to 120 acres (depending upon ranger district) of surface disturbance associated with seismic surveys, 83 to 332 acres (depending upon ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field (per ranger district). The locations of activities are not yet known. Given that the roadless and wilderness characteristics of IRAs and of Unroaded-Undeveloped Areas and the outstandingly remarkable values of suitable Wild and Scenic Rivers relate to a broad array of resources, nearly every aspect of oil and gas activity has the potential to impact these resources. In general, the impacts of seismic exploration would be negligible to minor and temporary to short term due to the small amount of disturbance expected.

Exploratory wells and access roads would have a much larger impact on each of these resources, ranging from minor to major depending upon the location of the disturbance relative to the IRA, Unroaded-Undeveloped Areas, and/or suitable Wild and Scenic River. For each of these resources, roads present the greatest potential for impacts due to the extent of ground covered and the fact that IRAs, Unroaded-Undeveloped Areas, and streams suitable to be classified as “wild” are valued for their lack of roads and development. However, temporary roads used to access exploratory wells (as well as the well pads themselves) would still have a short-term impact, as these areas would be reclaimed following exploration. Well pads, production facilities, power lines, pipelines, and access roads associated with a production field would have long-term impacts due to the direct loss of roadless or ‘wilderness potential’ acres for the life of the development and the impacts to the river segments included as suitable in the National Wild and Scenic River System. These impacts could range from minor to major depending upon the location of the facilities relative to the resource, because the final disposition of each road created for oil and gas use would be decided at the site-specific NEPA stage.

Table 4.3-3 lists the leasing options assigned to IRAs and suitable Wild and Scenic River segments under each alternative. Descriptions of leasing options (and associated impacts on these resources) are described in Section 4.3.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) whenever the applicable resource component occurs on the Dixie National Forest.

Table 4.3-3 Leasing Options assigned under each Alternative

Resource Component	Alternative[1]						
	A	B	C	D1	D2	E1	E2
Inventoried Roadless Areas	NL	NL	NSO-03	NSO-03	CSU-04	NSO-03	SLT
Suitable Wild and Scenic Rivers	NL	NL	CSU-05	CSU-05	CSU-05	SLT	SLT

[1] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternative D and E. D1 and E1 represent the acres available if NSOis applied to all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.

Leasing options and the 2001 Roadless Area Conservation Rule are discussed in Section 2.3.2. The rule does not explicitly prevent issuing new oil and gas leases (NL) nor does it strictly require a NSO leasing option be connected with mineral leases in IRAs. It does prohibit the road construction or reconstruction and timber removal that would be practically necessary for efficient oil and gas exploration through drilling, as well as the road building and timber removal necessary for building oil and gas production facilities. It is possible that certain resource mapping and exploration activities could occur on new oil and gas leases in IRAs as long as these activities were not prohibited by the re-enactment of the 2001 Roadless Area Conservation Rule or similar protection directive.

Unroaded-Undeveloped Areas do not have specific leasing options assigned. Those areas that are not within IRAs would be protected by the various other resource protections. Table 4.3-5 lists the leasing option overlaps within Unroaded-Undeveloped Areas.

4.3.4 Impacts of Connected Actions by Leasing Option

This section summarizes the leasing options described in Chapter 1 of the EIS and describes how they would apply to IRAs, Unroaded-Undeveloped Areas, and suitable Wild and Scenic Rivers under the various alternatives. Leasing options would dictate the conditions under which impacts from connected actions (as described in the RFDS) may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to IRAs, Unroaded-Undeveloped Areas, and suitable Wild and Scenic Rivers considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.3.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs), the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.3.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing and includes the Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing would occur in these areas. Death Hollow Creek, Mamie Creek, and Pine Creek are suitable Wild and Scenic River segments located within these areas, and a small portion of IRAs occur within the areas withdrawn by the Utah Wilderness Act of 1984. These would not be legally available for leasing.

4.3.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing. No direct disturbance to IRAs or suitable Wild and Scenic

Rivers would occur under NL. Under Alternative A, NL would apply to all areas on the Dixie National Forest and there would be no direct or indirect effects to IRAs, Unroaded-Undeveloped Areas, or suitable Wild and Scenic Rivers. Under Alternative B, NL would also apply specifically to IRAs and suitable Wild and Scenic Rivers and no direct impacts would occur in these areas. Adverse indirect effects to these resources could occur as a result of oil and gas activity on lands available for leasing adjacent to these areas. Indirect effects are not likely to affect the ability of these areas to be managed as IRAs or Wild and Scenic Rivers; however, they could degrade various roadless or wilderness characteristics and outstandingly remarkable values. The types of indirect effects under NL would be the same as those described in Section 4.3.4.6. For seismic exploration and exploratory wells, adverse indirect effects would generally range from negligible to minor and be temporary or short term. A production field would have moderate to major, adverse, long-term indirect effects.

4.3.4.3 No Surface Occupancy (NSO)

NSO would prohibit occupancy or use of the land for oil and gas related activities (i.e., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). Seismic exploration could occur under NSO. NSO does not apply to suitable Wild and Scenic Rivers under any alternative.

Under NSO, the only direct impacts to IRAs or Unroaded-Undeveloped Areas would occur as a result of seismic exploration and would range from negligible to moderate, and adverse as summarized below in the measurement indicators.

Indirect impacts to IRAs and Unroaded-Undeveloped Areas would be the same as described in Section 4.3.4.6 and in most cases would be adverse, ranging from negligible to minor and temporary or short term.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DISCUSSION OF IMPACTS TO ROADLESS CHARACTERISTICS AND WILDERNESS ATTRIBUTES

The impacts of seismic exploration in IRAs and Unroaded-Undeveloped Areas would generally be the same as described in Section 4.3.4.6 (under seismic exploration) and the other sections of Chapter 4 referenced in Section 4.3.4.6. The impacts will be summarized in this section and the reader is referred to Section 4.3.4.6 and the other sections of Chapter 4 for more detailed information.

<u>Roadless Characteristics (IRAs)</u>

High quality or undisturbed soil, water, and air: The transportation of seismic equipment using buggies would produce surface ruts, particularly in areas of soft soil. The creation of ruts could promote small-scale soil erosion. Other direct impacts include possible chemical/fuel spills, vehicle emissions, and the creation of fugitive dust. Adherence to BMPs and prompt reclamation of disturbed areas would limit the magnitude and duration of these impacts. These impacts would be adverse, negligible to minor and short term.

Sources of public drinking water: Seismic exploration would have only short-term negligible to minor adverse effects as discussed for water in the previous roadless characteristic.

Diversity of plant and animal communities: Adverse effects of seismic exploration would be short term and minor resulting from the temporary disturbance of mobile wildlife due to noise

and human presence, mortality to less mobile animals, and the potential to introduce noxious weeds.

Habitat for threatened, endangered, proposed, candidate, and sensitive species dependent on large undisturbed areas of land: Impacts to threatened, endangered, proposed, and candidate species would be avoided/mitigated through compliance with the Endangered Species Act. Impacts to sensitive species would be adverse, short term, and minor as described in the previous roadless characteristic.

Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized: Seismic activity would lead to minor short-term increases in noise levels that would detract from the recreation experience.

Reference landscapes: Seismic exploration would have negligible to minor, short-term adverse impacts to an IRA's potential to serve as a reference landscape, due primarily to the possibility of noxious weed introductions.

Natural appearing landscapes with high scenic quality: Seismic exploration would not result in substantial alteration of the scenic quality of the landscape and impacts would be negligible and short term.

Traditional cultural properties and sacred sites: Cultural surveys would be required prior to any seismic exploration and areas identified would be protected by Section 106 of the National Historic Preservation Act and impacts would be negligible.

Other locally identified unique characteristics: Specific, comprehensive information on unique characteristics is not available for each IRA. Any unique characteristics present would likely be adversely impacted by seismic exploration with short-term effects ranging from negligible to moderate.

Wilderness Attributes (IRAs and Unroaded-Undeveloped Areas)

Natural Integrity: Seismic exploration would have negligible, adverse, short-term effects on long-term ecological processes, primarily due to the potential for noxious weed introductions.

Apparent Naturalness: Short-term impacts from seismic exploration would include the appearance of ruts and drill holes. These impacts would be adverse and minor.

Solitude and Primitive Recreation: Seismic activity would disturb the solitude of IRAs and opportunities for primitive recreation during the exploration, due primarily to helicopter and/or buggy traffic/noise and explosions. These adverse impacts would be minor and limited to the length of the exploration.

Challenging Experience: Seismic exploration would have no effect on the ability of IRAs to provide a challenging experience.

Special Features/Special Places/Special Values: Adverse, negligible to moderate short-term impacts could occur similar to what is described for locally identified unique characteristics.

Wilderness Manageability and Boundaries: Seismic activity would have no effect on the ability of an IRA to be managed as wilderness.

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE IN IRAS

The only disturbance that could occur within IRAs under NSO would be associated with seismic exploration. If the full amount of seismic exploration predicted by the RFDS were to occur within IRAs, disturbance could affect up to 60 acres on the Pine Valley Ranger District and 120 acres on each of the Cedar City, Powell, and Escalante Ranger Districts. No new or reconstructed roads would occur in IRAs

4.3.4.4 Timing Limitation (TL)

The TL leasing options does not directly apply to IRAs or suitable Wild and Scenic Rivers under any alternative.

4.3.4.5 Controlled Surface Use (CSU)

INVENTORIED ROADLESS AREAS

CSU provides for controlled but generally allowed surface use on all or portions of a lease. Operations would be held to special constraints that may exceed the standard lease terms, Forest Service regulations, and operating standards.

A CSU leasing option was developed for IRAs for Alternative D2 with leasing allowed in IRAs. This CSU was designed to allow for exploration within IRAs while still preserving the ability of these areas to be managed for the undeveloped, unroaded charateristics of the area. The CSU would not allow mechanical road construction or reconstruction; as a result no new temporary or permanent roads would be constructed. Travel may occur along any designated roads located within IRAs (as described in Section 3.3.2, roads without evidence of mechanical construction, such as two-track roads, may exist in IRAs). In addition, this CSU would allow timber harvest. As a result, exploration, including seismic and exploratory wells, could occur within IRAs. It is unlikely that a production field would occur within an IRA under this CSU, as a production field would require permanent roads to service the wells and transport the oil to market. Seismic exploration and the construction and operation of well pads and associated facilities would have adverse effects to the roadless characteristics and wilderness attributes of IRAs. The general type of impacts would be the same as described for SLT in Section 4.3.4.6. However, the amount of disturbance and the duration of impacts would be reduced relative to SLT due to the lack of road construction and the fact that a production field would not be developed. As a result, impacts would be short term. Impacts associated with seismic activity would be adverse, negligible to minor. Impacts associated with exploratory wells would be minor to moderate.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DISCUSSION OF IMPACTS TO ROADLESS CHARACTERISTICS AND WILDERNESS ATTRIBUTES

The impacts of seismic exploration within IRAs would generally be the same as described in Section 4.3.4.6 and summarized in Section 4.3.4.3. The impacts of exploratory wells would also generally be the same as described in Section 4.3.4.6 and the other sections of Chapter 4 referenced in Section 4.3.4.6. While access roads would not be constructed under CSU, the types of impacts associated with roads in Section 4.3.4.6 would still occur under CSU due to the

fact that travel would still be allowed on designated roads (as defined in 36 CFR 121.1 Subpart A). However, under CSU there would be less disturbance of habitat as roads would not be mechanically constructed or widened to their full width.

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE IN IRAS OR UNROADED-UNDEVELOPED AREAS

There would be no construction or reconstruction of roads. Disturbance would consist of seismic exploration, the construction of well pads, and the clearing on vegetation within or along designated roads. If the full amount of seismic exploration predicted by the RFDS were to occur within IRAs, which is unlikely, disturbance could affect up to 60 acres on the Pine Valley Ranger District and 120 acres on each of the Cedar City, Powell, and Escalante Ranger Districts. Without the disturbance associated with access roads, exploratory wells would disturb up to 5.9 acres per well, for a total of up to 29.5 acres on the Pine Valley Ranger District, 88.5 acres on the Cedar City Ranger District, and 118 acres each on the Powell and Escalante Ranger Districts. The amount of vegetation that would need to be cleared in order to use designated roads is unclear, but it is assumed that it would be much less than the full disturbance estimated for access road construction (6.6 acres per well) for a total of 33 acres on the Pine Valley Ranger District, 99 acres on the Cedar City Ranger District, and 132 acres on each of the Powell and Escalante Ranger Districts.

SUITABLE WILD AND SCENIC RIVERS

A CSU leasing option is applied to Wild and Scenic Rivers under Alternatives C and D. This CSU leasing option would not allow the construction of new roads within ¼-mile of either bank of a suitable Wild and Scenic River to preserve its classification as Wild. Further, in accordance with Section 9 of the Wild and Scenic Rivers Act and USFS (2006a), pipelines and power lines would not be allowed within ¼-mile of either bank of a suitable Wild and Scenic River. Portions of other facilities, such as well pads and central tank batteries, could be located within ¼-mile of a suitable Wild and Scenic River if the location of these facilities would not degrade the outstandingly remarkable values. Seismic exploration would be permitted under the CSU leasing option. Impacts to suitable Wild and Scenic Rivers under CSU are described in the measurement indicators below.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DISCUSSION OF IMPACTS TO SUITABILITY AND "OUTSTANDINGLY REMARKABLE" VALUES

Seismic exploration using buggies could produce surface ruts, particularly in areas of soft soil near streams, which could promote small-scale soil erosion. . Chemical or fuel spills in or adjacent to streams could also negatively impact fish habitat and aquatic ecology; however, these impacts should be mostly negligible due to the BMPs in BLM and USFS (2007), Appendix C, and the ability to move operations by up to 200 meters (656 feet) under SLT. Seismic surveys also have the potential to disturb recreation due to noise from drilling, blasting, and vehicular and/or helicopter traffic. The presence of buggies, helicopters, and mobile drill rigs would temporarily degrade the scenic qualities of these areas, with scenic integrity returning to baseline levels once these activities are completed. Well pads and associated facilities (excluding pipelines and power lines) could also be located within ¼-mile of either streambank of a suitable Wild and Scenic River. Constructing these facilities in a way that would not jeopardize outstandingly remarkable values likely involves locating them at a sufficient distance

that they do not impact ecological conditions, scenic integrity, or recreational values. In all practicality, the inability to construct roads, pipelines, or power lines within ¼-mile of a suitable Wild and Scenic River segment would preclude locating more than a portion of a well pad or other similar facility within the buffer. Considering this, impacts should be negligible to minor, and long or short term.

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE WITHIN ¼-MILE OF SUITABLE WILD AND SCENIC RIVER SEGMENTS

Under CSU, no road construction or reconstruction would occur. Up to 120 acres could be disturbed by seismic exploration on the North Fork of the Virgin River (Cedar City. This disturbance estimate represents the maximum amount that may occur if all the seismic exploration predicted to occur by the RFDS were to occur within the ¼-mile buffer around suitable Wild and Scenic Rivers. Similarly, if it is assumed that an entire pad for an exploratory well could be constructed within the ¼-mile buffer, then 5.0 acres could be disturbed per well, with a total possible disturbance of 88.5 on the North Fork of the Virgin River (15 wells). However, it is extremely unlikely that more than 1 well pad would be located with ¼-mile of a suitable Wild and Scenic River due the ability of one exploration well to adequately explore the small area surrounding these streams, and the ability under SLT to move facilities by up to 200 meters (656 feet). As a result, the expected disturbance would be much less, likely no more than 1 well (5.9 acres). For a production field, the inability to construct any roads would also preclude constructing an entire production field within the buffer around a suitable Wild and Scenic River. Further, it is highly unlikely that a production field would be located in direct proximity to a suitable Wild and Scenic River. However, for purpose of this analysis, the disturbance associated with the elements of a production field that could be located within ¼-mile of a suitable Wild and Scenic River under CSU would be 137.6 acres (20 wells, topsoil storage areas, 1 water injection well, and production facilities).

4.3.4.6 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing option other than those listed on BLM Lease Form 3100-11 (SLT), the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2, and the BMPs listed in Section 4.3.4. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

<u>Inventoried Roadless Areas and Unroaded-Undeveloped Areas</u>

Assuming IRAs and Unroaded-Undeveloped Areas are open to oil and gas leasing activity under SLT and the2001 Roadless Area Conservation Rule is not in effect, disturbance could consist of seismic exploration, construction and reconstruction of roads, exploratory well pads and associated facilities, and production wells with their associated facilities. Table 4.3-4 shows the projected road construction that could occur within IRAs or Unroaded-Undeveloped Area in each ranger district (assuming the 2001 Roadless Area Conservation Rule was not in effect, in the case of IRAs). These activities/facilities would have adverse effects to the roadless characteristics of IRAs and wilderness attributes of both IRAs and Unroaded-Undeveloped Areas. In general, seismic exploration has the least potential for impacts, followed by well pads, production facilities, power lines, pipelines, and access roads. Roads would tend to have the greatest impacts due to the extent of ground covered and the fact that IRAs and Unroaded-

Undeveloped Areas are generally valued for their lack of roads. Disturbance associated with seismic activity would be adverse, negligible to minor and short term as discussed in the measurement indicators. Impacts from exploratory wells would also be primarily short term, and minor to moderate. For both these activities, once activities and reclamation were completed, the conditions should return to baseline conditions. However, given the arid nature of many areas on the Dixie National Forest, reclamation could involve longer periods of time and some evidence of these activities may be present long term (greater than 10 years). If oil or gas is discovered, and a production field developed, there would be a direct loss of roadless or Unroaded-Undeveloped Area acres for the life of the development, which is expected to be longer than 10 years. The direct loss of roadless or Unroaded-Undeveloped Area acres would be an adverse effect and could range from minor to major, depending upon the size of the IRA or Unroaded-Undeveloped Area and the roadless characteristic or wilderness attribute being impacted, as discussed in the measurement indicators.

Table 4.3-4 Projected Road Construction and Total Disturbance that could occur within IRAs or Unroaded-Undeveloped Areas, by Ranger District

Ranger District	Activity	[1]Roads (miles)		[1]Total Disturbance (Acres)
		New Roads	Reconstructed Roads	
Pine Valley	Seismic Exploration (100 miles)			60.0
	Exploratory Wells (5 wells)	3.3	19.6	83.0
	Production Wells (19 wells)	10.0		253.9
Cedar City	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (15 wells)	9.9	58.8	249.0
	Production Wells (19 wells)	10.0		253.9
Powell	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (20 wells)	13.2	78.4	332.0
	Production Wells (19 wells)	10.0		253.9
Escalante	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (20 wells)	13.2	78.4	332.0
	Production Wells (19 wells)	10.0		253.9
[2]Forest Total	Seismic Exploration			420.0
	Exploratory Wells	39.6	235.2	996.0
	Production Wells	10.0		253.9

[1] Miles and acres of roads are a part of the estimated total disturbance, which also includes well pads, production facilities, power lines, pipelines, and truck loading areas (BLM 2007a).
[2] A single production field is predicted for the entire Forest; however, it could be located on any of the ranger districts. As a result, the total disturbance for production wells is the same for each ranger district and the Forest total.

Indirectly, drill rigs, power lines, roads, seismic exploration, vehicular traffic, and other facilities and noise associated with oil and gas activity may be visible and audible from various locations within IRAs (USFS 1995a). This would also apply within Unroaded-Undeveloped Areas. These impacts would be both long and short term depending upon the nature of the development. Similar to direct impacts discussed above, indirect effects would be adverse and range from negligible to moderate depending upon the roadless characteristic or wilderness attribute. These effects are discussed in the measurement indicators.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DISCUSSION OF IMPACTS TO ROADLESS CHARACTERISTICS AND WILDERNESS ATTRIBUTES

Many of the roadless characteristics are also resource issues that are described in other sections of Chapter 4. The impacts described in those reports are summarized for each roadless characteristic and the reader is referred to the appropriate sections for further information.

Roadless Characteristics (IRAs)

High quality or undisturbed soil, water, and air: Impacts to soil, water, and air are described in Sections 4.7 (water and watershed resources), 4.8 (soils and geologic hazards), and 4.12 (air resources). Seismic exploration in IRAs would be conducted primarily using the explosion method due to the lack of roads. Seismic drill rigs would be transported using off-road buggies or helicopter. The use of buggies would produce surface ruts, particularly in areas of soft soil, which could promote small-scale soil erosion. Other direct impacts include possible coolant/oil/fuel spills from equipment, vehicle emissions, and the creation of fugitive dust. Prompt reclamation of disturbed areas would limit the duration of these impacts. The construction of exploration and production drilling well pads and access roads would present a greater risk of soil erosion due to runoff events, wind, and traffic. Sediment could be transported to wetlands, streams, lakes, and other waterbodies, which would degrade aquatic ecosystem function. Further, impacts to soils and water could result from the spill of hydrocarbons, drilling mud, or other chemicals. Impacts to air quality would occur primarily from vehicle emissions and fugitive dust from road traffic. The ability to move operations up to 200 meters (656 feet) to avoid sensitive resources, compliance with the BMPs listed in BLM and USFS (2007) and Appendix C, and prompt reclamation of disturbances following short-term exploration activities would reduce impacts. Disturbances related to development and production activities would be minimally reclaimed following construction and full reclamation of these disturbances would be delayed for the duration of the production. Direct impacts from exploration to production would be expected to be adverse, negligible to moderate, and both short term to long term. There would be no indirect impacts to soil, water, or air within IRAs.

Sources of public drinking water: The potential effects to sources of public drinking water are described in Section 4.7. Impacts to municipal watersheds would largely be avoided under SLT by moving facilities up to 200 meters (656 feet) where required to protect sensitive areas and by complying with the BMPs listed in BLM and USFS (2007) and Appendix C. If contamination did occur, adverse effects would range from negligible to major depending upon the location and amount of contamination. Effects would be primarily short term, as conditions would return to normal following the spill and proper cleanup and reclamation. Indirect impacts to portions of municipal watersheds located outside of IRAs would be the same as described in Section 4.7.

Diversity of plant and animal communities: Impacts to plant and animal communities are described in Sections 4.9 and 4.5, respectively. Impacts of seismic exploration include temporary disturbance of mobile wildlife due to noise and human presence and potential mortality to less mobile animals. Seismic exploration also has the potential to introduce noxious weeds, which could impact both plant and animal communities. Exploratory wells and access roads would remove vegetation/habitat for the life of the well and the time necessary for effective reclamation. Production wells and associated facilities would have similar impacts, but they would be more long term due to the delay in full reclamation until production ceases. Oil and gas activity could also disturb biological crusts, which would physically destabilize the soil, reduce soil fertility, decrease the ability of the soil to retain water, and increase the potential for noxious weed invasion (NSTC 2001). Recovery of biological crusts may take decades to hundreds of years. Further, oil and gas activity within the Side Hollow Ponderosa Pine Provenance Study Area could remove trees or disturb soil and vegetation communities, which

would disrupt the long-term study underway. However, given the small size of the study area (4.5 acres), impacts would be avoidable under SLT by the ability to move operations by up to 200 meters (656 feet). Impacts to other unique habitats not identified in this section would vary depending upon the habitat and the location of disturbance. Overall, exploration activities would have the least amount of impacts on the diversity of plant and animal communities due to the relatively small amount of disturbance and direct adverse impacts would most likely range from negligible to moderate and would be short term. Due to the greater amount of disturbance expected from a production field, impacts could range from minor to major and would be long term. Oil and gas activity on land adjacent to IRAs would have no impacts on the diversity of plant communities within IRAs. Activity on adjacent land could intersect wildlife migration corridors and further isolate wildlife communities. However, given the large size of IRAs and the high quality habitat present in these areas, adverse indirect effects would be negligible and short term to long term.

Habitat for threatened, endangered, proposed, candidate, and sensitive species dependent on large undisturbed areas of land: Threatened, endangered, proposed, candidate, and sensitive species are discussed in Section 4.6. SLT requires lessees to comply with all applicable laws, including the Endangered Species Act. Compliance with the Endangered Species Act would avoid and/or mitigate most impacts to habitat for threatened, endangered, proposed, and candidate species. Habitat for sensitive species, and species dependent on large areas of land, would not be protected by the Endangered Species Act and could be impacted by oil and gas activity. The type of impacts would generally be the same as described above for the diversity of plant and animal communities. The intensity of impacts would vary depending upon the amount of habitat affected and could range from negligible to moderate and short term for exploration activities. Adverse impacts of a production field would be long term and would likely range from minor to major. Indirect impacts would be the same as described for the diversity of plant and animal communities.

Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized: Impacts to recreation are discussed in Section 4.4. Exploration and development activities would lead to temporary increases in noise levels that would detract from the nearby recreation experience. In addition, the visual presence of facilities would detract from the recreation experience. These impacts would be adverse and negligible to minor in larger IRAs and moderate to major in the smaller IRAs such as Dixie, Gum Hill, Red Canyon South, Shakespeare Point, and South Rim. Impacts would primarily be short term, limited to the length of exploration and time needed for full reclamation. Production wells and facilities would have similar, but long-term effects until production ceased and the disturbances were fully reclaimed. Indirectly, the ability to see and hear oil and gas facilities and/or activities on adjacent land would degrade the recreation experience. These effects would be adverse, long term, and negligible to minor depending upon the topography and placement of the facilities relative to the IRAs.

Reference landscapes: Seismic exploration, exploratory wells, access roads, and production wells, would introduce human disturbance into IRAs and would potentially eliminate the ability to use parts of these areas as reference landscapes. The intensity of these adverse effects would be minor for seismic exploration to major for a production field, depending also upon the size of the IRA and the placement of facilities. Effects would be long term, since once a landscape is disturbed it loses its value as a reference landscape. There would be no indirect impacts to the ability of an IRA to be used as a reference landscape.

Natural appearing landscapes with high scenic quality: Scenic integrity is discussed in detail in Section 4.2. Seismic exploration would not result in substantial alteration of the scenic quality of

the landscape. Well pads, access roads, and other facilities would alter its natural appearance and degrade the scenic qualities of landscapes. These impacts would be adverse and negligible to moderate depending upon the placement of facilities and would be short term, limited to the length of exploration for exploratory wells and associated access roads. They would be long term for production facilities until production ceased and disturbances were fully reclaimed. Indirectly, oil and gas facilities on adjacent land would also reduce the natural appearance of areas visible from IRAs, but not of IRAs themselves.

Traditional cultural properties and sacred sites: Cultural properties have not been identified in the majority of IRAs. However, cultural surveys would be required prior to any lease activity and areas identified would be protected by Section 106 of the National Historic Preservation Act. There would also be no indirect effects to cultural properties within IRAs.

Other locally identified unique characteristics: All the unique characteristics that may be present within IRAs on the Dixie National Forest were not identified in Chapter 3. Any unique characteristics that may be present within IRAs on the Dixie National Forest are likely considered under the specific resource for which it is unique and therefore considered elsewhere in the document. Impacts may be direct or indirect and intensity would vary depending upon the specific characteristics and both the level and location of oil and gas activity. In general, seismic exploration would have the least amount of impacts, followed by exploratory wells and production wells. Impacts could, therefore, range from negligible to major and may be short term or long term.

Wilderness Attributes (IRAs and Unroaded-Undeveloped Areas)

Natural Integrity: Seismic exploration would have little effect on long-term ecological processes. Well pads and access roads can disrupt ecological processes by increasing soil erosion and sediment delivery to aquatic ecosystems, removing vegetation, and removing or altering wildlife habitat. These impacts are discussed in further detail in Sections 4.5 (fish and wildlife), 4.6 (special status species), 4.7 (water and watershed resources), 4.8 (soils and geologic hazards), and 4.9 (vegetation). Without knowing the location of any future disturbance relevant to specific resources, it is difficult to predict the magnitude of the impacts on long-term ecological processes. However, the protection measures included in SLT, BMPs, and other environmental laws are designed to prevent major impacts to long-term ecological processes and adverse impacts would likely range from minor to moderate. Impacts could be both long and short term. The relative intensity of impacts to any one IRA or Unroaded-Undeveloped Area would also depend upon the size of the IRA or Unroaded-Undeveloped Area affected. There would be no indirect impacts to natural integrity.

Apparent Naturalness: Impacts from this disturbance would include the appearance of roads, well pads, and power lines. These impacts would be minor to moderate for large IRAs or Unroaded-Undeveloped Areas and moderate to major for smaller IRAs or Unroaded-Undeveloped Areas. Effects would be short term for seismic exploration and exploratory wells and long term for a production field. There would be no indirect impacts to apparent naturalness.

Solitude and Primitive Recreation: Seismic exploration would disturb the solitude of IRAs and Unroaded-Undeveloped Areas and opportunities for primitive recreation, due primarily to noise from helicopters, buggies, and explosions. These impacts would be minor and temporary, with the duration limited to the length of the exploration. Exploratory wells and access roads would eliminate opportunities for solitude near the activity due to vehicular traffic, noise, and visual

disruption of the landscape. The presence of these facilities would also reduce the primitive recreation experience. These impacts would be adverse and minor for most IRAs and Unroaded-Undeveloped Areas due to their large size relative to the area disturbed and the ability for the visitor to avoid these facilities; however, impacts would be more intense in the smaller IRAs and Unroaded-Undeveloped Areas. Impacts would be short term for exploratory wells and long term for a production field. Indirect impacts to solitude would be the same as described for Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive recreation.

Challenging Experience: The opportunity for a challenging experience would primarily be impacted by the presence of roads. Roads would increase the ability of the public to access areas that otherwise would be accessible only through a challenging experience. This impact would be adverse and range from minor to moderate for most IRAs or Unroaded-Undeveloped Areas due to their large size relative to the roaded area. However, as with other resources, the impacts would be more intense for the smaller IRAs and Unroaded-Undeveloped Areas. Impacts would be both short term for exploration activities and long term for production facilities. There would be no indirect impacts to a challenging experience.

Special Features/Special Places/Special Values: As described for locally identified unique characteristics, the special features/places/values in the 38 individual IRAs or 46 Unroaded-Undeveloped Areas are not described in this section or in Chapter 3. Any unique characteristics that may be present within IRAs on the Dixie National Forest are likely considered under the specific resource for which it is unique and therefore considered elsewhere in the document. Impacts may be direct or indirect with the intensity ranging from negligible to major depending upon the resource and interaction with the oil and gas activities. In general, seismic exploration would have the least amount of impacts, followed by exploratory wells and productions wells. Duration may be short term for exploration activities and long term for production facilities.

Wilderness Manageability and Boundaries: Seismic exploration would have no effect on the ability of an IRA or Unroaded-Undeveloped Area to be managed as wilderness. Disturbance associated with well pads and access roads could change the shape of an Unroaded-Undeveloped Area or IRA's boundary or could dissect an area into fragments that would be too small to be managed as wilderness (less than 5,000 acres). For example, an access road that bisects an IRA or Unroaded-Undeveloped Areas could fragment it into two sections that, by themselves, would be too small to be managed as wilderness areas. Alternatively, an access road could be built near the boundary of an IRA or Unroaded-Undeveloped Area and although this may reduce the size of the IRA, it would not reduce it sufficiently to affect its wilderness potential. As a result, the intensity of effects would be dependent on the road placement and the amount of disturbance and could range from negligible to major. The effects would be most pronounced in some of the smaller Unroaded-Undeveloped Areas or IRAs. Impacts from exploratory wells and access roads would be short term and once disturbance is reclaimed the boundary would return to prior conditions. A production field would substantially alter boundaries in the long term. There would be no indirect effects to wilderness manageability and boundaries.

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE IN IRAS

New roads and reconstruction of National Forest System roads would disturb an area approximately 39 feet wide. There would be approximately 3.3 miles of new temporary roads that could occur within IRAs or Unroaded-Undeveloped Areas on the Pine Valley Ranger

District, 9.9 miles on the Cedar City Ranger District, and 13.2 miles on each of the Powell and Escalante Ranger Districts. In addition, approximately 19.6 miles of existing National Forest System roads on the Pine Valley Ranger District, 58.8 miles on Cedar City Ranger District, and 78.4 on both the Powell and Escalante Ranger Districts would need to be temporarily widened. A production field would require an additional 10 miles of permanent roads.

Table 4.3-4 lists the amount of projected road disturbance that could occur in an IRA or Unroaded-Undeveloped Area. For this analysis, it is assumed that the activity projected for any ranger district could occur entirely within an individual IRA or Unroaded-Undeveloped Area located on that ranger district, although this is unlikely. The total amount of disturbance that could occur in an individual IRA or Unroaded-Undeveloped Area would be 396.9 acres for IRAs or Unroaded-Undeveloped Areas on the Pine Valley Ranger District, 622.9 acres for IRAs or Unroaded-Undeveloped Areas on the Cedar City Ranger District, and 705.9 acres for IRAs or Unroaded-Undeveloped Areas on the Powell and Escalante Ranger Districts.

Suitable Wild and Scenic Rivers

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DISCUSSION OF IMPACTS TO SUITABILITY AND "OUTSTANDINGLY REMARKABLE" VALUES

Death Hollow Creek, Mamie Creek, and Pine Creek are located within the Box-Death Hollow Wilderness Area and there would be no direct impacts to these suitable stream segments from oil and gas activities. Under SLT, seismic surveys, roads, exploratory wells, and production wells and associate facilities could occur within ¼-mile of the North Fork of the Virgin River. These activities would involve some degree of surface disturbance that could include vegetation removal, soil compaction, earthwork, and natural drainage pattern alteration, resulting in increased erosion. Having roads and wells near the stream corridor increases the risk for contamination from spills of hydrocarbons, water produced by the drilling process, fuel, or chemical spills. Potential erosion and the effects of sediment on streams are discussed in Section 4.7 (water and watershed resources). Roads and well pads would also adversely affect the scenic and recreational values identified for the North Fork Virgin River. The appearance of these features would interfere with the natural look of this stream and would decrease the desire to recreate in this area.

SLT allows the Forest Service to require a lessee to move operations by up to 200 meters (656 feet) for resource management reasons. . Movement by up to 200 meters (656 feet) would not, however, eliminate impacts to the scenic and recreational values of the North Fork of the Virgin River. Adverse impacts would range from minor to major if roads are built within ¼-mile of this stream. The impacts would be short term for disturbance from seismic exploration and exploratory wells and long term for a production field.

Concerning indirect effects, oil and gas activity on land beyond the ¼-mile buffer on either side of suitable Wild and Scenic River could degrade the scenic and recreational values of the North Fork of the Virgin River. These impacts would be negligible for seismic activity and mostly minor and temporary for exploratory wells and roads. However, the development associated with a production field could lead to moderate to major impacts.

- *Measurement Indicator #2* MILES OF ROADS (RECONSTRUCTION AND NEW CONSTRUCTION) AND ACRES OF DISTURBANCE

WITHIN ¼-MILE OF SUITABLE WILD AND SCENIC RIVER SEGMENTS

No road reconstruction would occur due to the lack of roads in the stream corridor. Approximately 9.9 miles of new, temporary roads would be required for exploratory wells on the Cedar City Ranger District, and 13.2 miles on the Escalante Ranger District. However, it is unlikely that more than one exploratory well would occur within ¼-mile of an individual stream and actual road construction would likely be much less. This is particularly true for the North Fork Virgin River, which only has 0.7 miles suitable for inclusion in the National Wild and Scenic River System. A production field would require approximately 10 miles of permanent roads; however, it is unlikely that a production field would occur within ¼-mile of a suitable Wild and Scenic River.

Total disturbance associated with oil and gas activity could be up to 622.9 acres on Cedar City Ranger District, and 705.9 acres on the Escalante Ranger District. It is highly unlikely that this disturbance would occur entirely within ¼-mile of a suitable Wild and Scenic River, and in the case of the North Fork of the Virgin River, it would be impossible given that the total buffered area only comprises 279 acres. Therefore, for the purpose of this analysis, total disturbance for the North Fork of the Virgin River is estimated to be the total acres available (279 acres), although it is highly unlikely this would occur.

4.3.5 Impacts by Alternative

The degree to which the impacts of connected actions (Section 4.3.4) would differ by alternative is discussed in this section. Alternatives involve leasing options, which would restrict the locations and the nature of oil and gas impacts that are allowed.

Table 4.3-5 shows the acres and percentage of each resource component under each leasing option by alternative. It is important to note that, with regard to IRAs, the past history of the 2001 Roadless Area Conservation Rule has been full of changes in applicability due to judicial actions. Due to the uncertainty in the future status of the roadless rule, this section intends to evaluate the effects to IRAs under a broad range of protective leasing options ranging from NSO to SLT. This occurs for Alternatives C, D1, and E1, in which the impact evaluation is conducted under the NSO leasing option, to meet the intent of the 2001 Roadless Area Conservation Rule; and for Alternatives D2 and E2, in which a less restrictive leasing option would allow new disturbances for oil and gas exploration and development. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.

Table 4.3-5 Acreage of Resource Components under each Leasing Option by Alternative

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
Inventoried Roadless Areas	NA	4,637	4,637	4,637	4,637	4,637	4,637	4,637
	NL	565,922	565,922	22,040				
	NSO			543,883	565,922	41,616	565,922	
	CSU					524,306		
	SLT							565,922
Unroaded-Undeveloped Areas	NA	88,327	88,327	88,327	88,327	88,327	88,327	88,327
	NL	815,102	686,025	23,364				
	NSO		109,479	740,442	542,192	55,319	526,802	

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
Suitable Wild and Scenic Rivers	CSU		19,598	51,297	272,466	759,339		
	SLT				444	444	288,300	815,102
	NA	5,733	5,733	5,733	5,733	5,733	5,733	5,733
	NL	279	279	7				
	NSO			273	7	7		
	CSU				273	273		
	SLT						279	279

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.

In this section, impacts are discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts is highlighted and discussed.

4.3.5.1 Alternative A

No new oil and gas leases would be authorized under Alternative A and there would be no direct or indirect impacts to IRAs, Unroaded-Undeveloped Areas, or suitable Wild and Scenic Rivers as a result of oil and gas leasing activity. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time.

4.3.5.2 Alternative B

Alternative B would apply a NL leasing option to 100 percent of IRAs and Wild and Scenic River segments and their associated buffers that are in areas available for leasing. As a result, there would be no direct impacts to IRAs or Wild and Scenic Rivers. Indirect impacts to both IRAs and Wild and Scenic Rivers would be the same as described for SLT (Section 4.3.4.6).

The majority (84 percent) of Unroaded-Undeveloped Areas would be stipulated as No Lease, and in these areas, no impacts to Unroaded-Undeveloped Areas would occur. In the 13 percent of Unroaded-Undeveloped Areas covered by NSO, only seismic activities would be allowed and wilderness attributes (Measurement Indicator #1) would be impacted temporarily (described in Section 4.3.4.3). There would be no impacts from roads (Measurement Indicator #2) as only seismic activities are allowed under NSO.

4.3.5.3 Alternative C

INVENTORIED ROADLESS AND UNROADED-UNDEVELOPED AREAS

Under Alternative C, NSO would apply to all IRAs not within areas unavailable for leasing (4,637 acres are unavailable for leasing, less than 1 percent) and disturbance would be limited to exploration, which does not require road building or timber cutting. Exploratory drilling and oil and gas production activities would practically be eliminated by the prohibition on road construction or timber cutting. Direct impacts from seismic exploration would result in short-

term adverse effects that would range from negligible to moderate, as described for seismic exploration under NSO (Section 4.3.4.3). Indirect effects would be the same as described for SLT in Section 4.3.4.6.

Ninety-one percent of Unroaded-Undeveloped Areas that are available for lease are covered by NSO (for other resources, including IRAs) under Alternative C. Only seismic activities would be allowed in these areas and wilderness attributes (*Measurement Indicator #1*) would be impacted temporarily (described in Section 4.3.4.3). More adverse impacts to wilderness attributes or from roads (*Measurement Indicator #2*) could occur within "CSU" areas (overall, 9 percent of Unroaded-Undeveloped Areas), under which impacts would be equivalent to SLT because the CSU is for other resources. Some Unroaded-Undeveloped Areas would be disproportionately affected by having more area open under CSU for other resources (thus, effectively SLT for Unroaded-Undeveloped Areas) to oil and gas activities under Alternative C. These areas include Antimony (32 percent or 6,744 acres CSU; Escalante Ranger District), Dry Lake (20 percent or 1,911 acres CSU; Escalante Ranger District), Little Creek Peak (25 percent or 4,780 acres CSU; Cedar City Ranger District), Pacer Lake (34 percent or 5,561 acres CSU; Escalante Ranger District), and Wagon Box (18 percent or 1,047 acres CSU; Cedar City Ranger District). Impacts within these areas would be as described in Section 4.3.4.6. Impacts from oil and gas activities discussed in Section 4.3.4.6 within Dry Lake and Wagon Box would be more adverse (moderate or major) due to their small size (<10,000 acres).

SUITABLE WILD AND SCENIC RIVERS

Under Alternative C only 5 percent (273 acres) of the suitable Wild and Scenic River segments and their buffers are located outside wilderness. These areas would have an NSO stipulation. The impacts of seismic exploration on Wild and Scenic River suitability and outstandingly remarkable values (*Measurement Indicator #1*) are described under NSO (Section 4.3.4.3).

No road construction or reconstruction would occur under Alternative C. Disturbance (*Measurement Indicator #2*) from seismic activity could be up to 120 acres on the North Fork of the Virgin River (Cedar City Ranger District).

4.3.5.4 Alternative D1 (NSO in IRAs)

INVENTORIED ROADLESS AND UNROADED-UNDEVELOPED AREAS

Under Alternative D1 (NSO in IRAs), the vast majority of IRAs would be under NSO (over 99 percent) with 4,637 acres (1 percent) within areas not legally available for leasing (NA). Given that most of the available acres are under NSO, the impacts to IRAs would generally be the same as described for Alternative C.

Sixty-seven percent of Unroaded-Undeveloped Areas (that are available for lease) is covered by NSO under Alternative D1 (i.e., most of the Unroaded-Undeveloped Areas that are within IRAs). Only seismic activities would be allowed in these areas and wilderness attributes (*Measurement Indicator #1*) would be impacted temporarily (described in Section 4.3.4.3). Thirty-three percent of Unroaded-Undeveloped Areas (that is available for lease) is covered by CSU (for other resources) under Alternative D1, and 32 out of 46 Unroaded-Undeveloped Areas are covered by at least 15 percent CSU. Impacts in these areas would be as described under SLT (Section 4.3.4.6) because the CSU is for other resources and would not protect the Unroaded-Undeveloped Area specifically. Impacts would be more adverse (moderate or major) in the smaller Unroaded-Undeveloped Areas. These smaller Unroaded-Undeveloped Areas (<10,000 acres) include Cave Canyon, Cottonwood, Kane Mountain, and Lost Peak (Pine Valley Ranger

District); Wagon Box (Cedar City Ranger District); Big Hollow, Blind Springs, and Red Canyon South (Powell Ranger District); and Birch Creek, Canaan Mountain, Dry Lake, Heaps Canyon, and Hog Ranch (Escalante Ranger District).

SUITABLE WILD AND SCENIC RIVERS

The only suitable Wild and Scenic River segment outside wilderness (is the North Fork of the Virgin River , which 7 acres would be under NSO with the exception of approximately 5 percent (273 acres on the North Fork of the Virgin River) that would be under CSU.

The impacts of seismic exploration on suitability and outstandingly remarkable values (*Measurement Indicator #1*) are described under NSO (Section 4.3.4.3). Up to 60 acres could be disturbed (*Measurement Indicator #2*) by seismic exploration on the North Fork of the Virgin River. This disturbance estimate represents the maximum amount that may occur if all the seismic exploration predicted to occur by the RFDS were to occur within the ¼-mile buffer around streams, which is unlikely.

The impacts under CSU are described in Section 4.3.4.5. Under CSU, the outstandingly remarkable values would not be degraded. Under this alternative, only a small portion of the North Fork of the Virgin River (273 acres) would be under CSU. The impacts under CSU would be adverse and minor. As a result, the overall impacts to suitable Wild and Scenic Rivers would be negligible to minor.

4.3.5.5 Alternative D2 (CSU in IRAs)

INVENTORIED ROADLESS AND UNROADED-UNDEVELOPED AREAS

Under this alternative, 1 percent (4,637 acres) of IRAs would be within areas not available to leasing. Approximately 7 percent (41,616 acres) would be under NSO and 92 percent (524,306) under CSU. Only seismic exploration could occur on the 7 percent of IRAs under NSO. However, the majority of IRAs would be available under CSU. The impacts under CSU are described in Section 4.3.4.5 and would include seismic exploration, exploratory wells, and the clearing of vegetation. Impacts as a result of these activities would range from negligible to moderate.

The majority of Unroaded-Undeveloped Areas (93 percent) would be CSU under Alternative D2. Impacts to Unroaded-Undeveloped Areas would be as described under SLT (Section 4.3.4.6) because the CSU is designed to protect other resources (i.e., not the Unroaded-Undeveloped Areas).

SUITABLE WILD AND SCENIC RIVERS

NSO would apply to less than 1 percent (7 acres) of suitable Wild and Scenic River segments, CSU to 5 percent (273 acres), and the remaining 95 percent (5,733 acres) are within wilderness and not available for leasing. The impacts of oil and gas activity to suitable Wild and Scenic Rivers under CSU are discussed in Section 4.3.4.5 and would be negligible to minor and short to long term.

4.3.5.6 Alternative E1 (NSO in IRAs)

INVENTORIED ROADLESS AND UNROADED-UNDEVELOPED AREAS

The acres of IRAs available for leasing under NSO would be the same as for Alternative C. Impacts would also be the same.

Impacts to Unroaded-Undeveloped Areas that overlap with IRAs would be as described under Alternative C for IRAs. Impacts for the remainder of Unroaded-Undeveloped Areas (about 40 percent; under SLT) would be very similar to those described for Alternative D1 because CSU impacts are equivalent to SLT for Unroaded-Undeveloped Areas. , There would be more acres under SLT than under CSU for Alternative E1 as compared to Alternative D1; however, impacts would be the same as described for D1.

SUITABLEWILD AND SCENIC RIVERS

Of areas not within wilderness, approximately 82 percent (2,086 acres) would be under NSO and the remaining 18 percent (460 acres) would be available under SLT. This would include 273 acres on the North Fork of the Virgin River. Impacts are described for the measurement indicators below.

The impacts of seismic exploration on suitability and outstandingly remarkable values (*Measurement Indicator #1*) are described under NSO (Section 4.3.4.3). The impacts that could occur under SLT are described in Section 4.3.4.6 and include the degradation of outstandingly remarkable values due to the construction of roads. Under this alternative, only a small portion of each stream would be subject to these impacts and a large change to the outstandingly remarkable values is unlikely.

Disturbance from seismic activity (*Measurement Indicator #2*) could be up to 120 acres on the North Fork of the Virgin River (Cedar City Ranger District). Also, up to 273 acres on the North Fork of the Virgin River could be disturbed by the activities predicted to occur by the RFDS, including roads, power lines, and pipelines.

4.3.5.7 Alternative E2 (SLT in IRAs)

INVENTORIED ROADLESS AND UNROADED-UNDEVELOPED AREAS

All acres of IRAs and Unroaded-Undeveloped Areas would be available under SLT and impacts would be as described for SLT in Section 4.3.4.6.

SUITABLE WILD AND SCENIC RIVERS

The total acreage (278 acres) of suitable Wild and Scenic River segments located outside wilderness would be available under SLT and would be impacted as described for SLT in Section 4.3.4.6.

4.4 Recreation Resources

4.4.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.4-1 provides an example how these terms would apply to Recreation Resources.

Table 4.4-1 Terms used to Describe Effects to Recreation Resources

Attribute of Effect		Description relative to Recreation Resources
Quality	Beneficial	A change to ROS setting characteristics that would enhance the quality of the setting for recreational activities.
	Adverse	A change to ROS setting characteristics that would degrade the quality of the setting for recreational activities.
Magnitude (Intensity)	Negligible	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management that is so small it would not have a measurable effect on the existing inventoried ROS setting.
	Minor	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management that would result in recreational setting characteristics that are still fully compatible or normal for the existing inventoried ROS setting.
	Moderate	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management that would result in recreational setting characteristics that are inconsistent with the existing inventoried ROS setting.
	Major	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management that would result in recreational setting characteristics that are inconsistent with and unacceptable to the existing inventoried ROS setting.
Duration	Temporary	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management during construction of a facility (i.e., road, well pad) that would not occur once construction is completed.
	Short-term	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management due to exploration activities (i.e., construction of exploratory well pads or access roads). The change to the ROS setting would be limited only to the time needed for exploration and reclamation, 10 years or less.
	Long-term	A change to access, remoteness, naturalness, social encounters, visitor impacts, facilities and site development, and visitor management due to ongoing exploration and operation of production facilities (i.e., a production field and associated roads). The change to the ROS setting would be similar to the life of the production field and would exceed 10 years.

4.4.2 Measurement Indicators

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS
- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

4.4.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E, it is assumed that activities described under the Reasonable Foreseeable Development Scenario (RFDS) would occur. Activities described under the RFDS include 60 to 120 acres (depending on ranger district) of overland travel associated with seismic surveys, 80 to 330 acres (depending on ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field. The locations of these activities are not yet known. In general, impacts to recreation resources are described in terms of human (“user”) reactions.

In some cases (i.e., for ROS classes and dispersed areas), impacts are described in terms of the character of the resource area itself. The following sections contain descriptions of biotic and abiotic features that comprise the physical setting for recreation activities, including: visual resources (Sections 3.2 and 4.2), fish and wildlife (Sections 3.5, 3.6, 4.5, and 4.6), water (Sections 3.7 and 4.7), soils (Sections 3.8 and 4.8), vegetation (Sections 3.9 and 4.9), and air quality (Sections 3.12 and 4.12).

Various phases of oil and gas development would impact recreation resources differently, depending on their duration and on the amount and type of disturbance involved. The following phases are discussed in terms of possible impacts to all recreation resources under an SLT leasing option: seismic activity, exploratory drilling, production, and road construction.

Seismic Activity: Seismic exploration involves covering moderate distances by all-terrain buggy or helicopter and detonating small explosives in selected locations, creating temporary noise and human disturbances in those locations as well as temporary disturbances along the route as it is traversed by the equipment. Noise would be produced mainly by the explosives used to generate vibrations. Moving the equipment along the route using buggies would involve less noise disturbance relative to using helicopters, although helicopters may accomplish the seismic survey in less time. Seismic activities would have temporary impacts on recreation with intensity depending on the presence and nature of recreation resources in the area. In general, individuals utilizing recreation resources are not likely to be displaced as a result of seismic activities.

Exploratory Drilling: Exploratory drilling involves the construction of drill pads and access roads, which removes areas used for recreation. Disturbances to recreation resources caused by construction and intermittent human presence on an exploration well would be short term, lasting for the duration of operations, and would extend as far as the operations were visible and audible to humans. Impacts to visual resources are discussed in detail in Section 4.2. Recreational users who seek to observe wildlife may be displaced further in some cases, due to reduced wildlife densities surrounding oil and gas disturbances (refer to Sections 4.5 and 4.6). Noise disturbances from the actual drilling would be temporary. Visual disturbances and human presence associated with the well would last for the duration of operations, which would be short term unless a production field was developed. These disturbances would cause some individuals utilizing recreation resources in the vicinity to be displaced and seek alternative recreation opportunities; individuals may or may not return to these areas after reclamation.

Production: A production field would involve the largest amount of disturbance and the most adverse impacts to recreation resources. The actual disturbed area, in addition to the visual and acoustic reach around the production field, could be incompatible with many recreation resources due to human presence, visual disturbances, and levels of noise. Impacts to displaced recreational users due to disturbance from the well pads and roads would be long term because production activities would last longer than 10 years. During initial field development, well drilling and field construction activities would produce the most potential for incompatibility with recreation locally. After production wells are drilled and the field constructed, human presence, traffic and noise would continue at a moderate level.

Road Construction: Road construction and reconstruction would accompany drilling in most cases. New roads could increase access levels to certain areas, which would increase the number of users and adversely modify some recreation resources. Road construction may also prevent access to recreation resources temporarily (during construction) or for the duration of operations: short term for exploration wells or long term for a production field. Changes in

access would adversely impact some recreation resources in that values such as solitude would be compromised.

Potential changes to ROS recreation setting indicators and in the use and quality of the recreation experience (*Measurement Indicators #1* and *#2*, respectively) will be discussed by recreation resource component (Table 4.4-2) as appropriate below.

Table 4.4-2 lists the leasing options assigned to each recreation resource component under each alternative. Descriptions of leasing options (and associated impacts on recreation resources) are described in Section 4.4.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) wherever the applicable resource component occurs on the Dixie National Forest.

Table 4.4-2 Leasing Options by Alternative for Recreation Resources

Recreation Resource Component	Alternative				
	A	B	C	D	E
ROS: Primitive	NL	NL	NSO-07	NSO-07	SLT
ROS: Semi-Primitive Non-Motorized Setting	NL	NSO-08	NSO-08	CSU--07	SLT
ROS: Semi-Primitive Motorized Setting	NL	CSU-08	CSU-08	CSU-08	SLT
ROS: Roaded Natural Setting	NL	CSU-08	CSU-08	SLT	SLT
Designated Dispersed Areas	NL	NSO-04	CSU-06	SLT	SLT
Developed Sites (with appropriate buffer): Recreation Sites, Campgrounds, Guard Stations, etc.	NL	NSO-05	NSO-05	CSU-06	SLT
Administrative Sites	NL	NSO-05	NSO-05	CSU-06	SLT
Recreation Residences (with 0.25-mile buffer)	NL	NSO-06	NSO-06	NSO-06	SLT

Although the resource components listed in the table above specifically address dispersed recreation, dispersed recreation is not discussed as a separate resource in this section. Rather, dispersed recreation is indirectly assessed through the ROS class inventory and the inherent setting indicators of access, remoteness, naturalness, social encounters, visitor impacts, and visitor management. The ROS class settings are the backdrop against which a variety of dispersed recreation activities occur. Designated Dispersed Areas remain in the GIS model to provide a complete picture of the location of mapped resources on the Dixie National Forest.

4.4.4 Impacts of Connected Actions by Leasing Option

Leasing options would dictate the conditions under which impacts from connected actions (described under the RFDS) may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to recreation considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.4.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the BLM and USFS *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.4.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing would occur in these areas and no disturbance to recreation resources in these areas would occur. NA does not apply to any of the recreation resource components under any alternative.

4.4.4.2 No Lease (NL)

Under the no lease option, no new leases would be issued and as existing leases expire or terminate, those lands would no longer be administratively available for oil and gas exploration or development. No disturbance, and therefore no impacts, to recreational resources would occur under NL. Under Alternative A, NL would apply to all recreation resource components listed in Table 4.4-2.

4.4.4.3 No Surface Occupancy (NSO)

With the exception of seismic activities, NSO would prohibit occupancy or use of the land for oil and gas related activities (i.e., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures).

Under this leasing option, oil and gas leases within applicable recreation sites would be issued with the leasing option that no surface occupancy is allowed. Excluding impacts related to seismic activities, there would be no direct or indirect impacts to recreation resources under NSO.

Measurement Indicators

DEVELOPED SITES, ADMINISTRATIVE SITES, RECREATION RESIDENCES, AND DISPERSED RECREATION

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

Though the impacts from seismic activities would be minor and temporary, recreationists in these areas may feel that their recreation experience was compromised because of the noise and possible sight of Off Highway Vehicles (OHVs), helicopters, and blasting noise.

ROS: PRIMITIVE SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under NSO, the presence and use of motorized vehicles for seismic activities and blasting itself would be inconsistent or unacceptable with the ROS Primitive setting indicators for access, remoteness, and naturalness. These indicators state that motorized trails and use are unacceptable in Primitive settings. The distant sight and/or sound of human activity and visual intrusion in high scenic areas are both inconsistent with Primitive settings and would change the character of these inventoried areas. These effects would be minor to moderate and temporary in nature.

ROS: SEMI-PRIMITIVE NON-MOTORIZED SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under NSO, the presence and use of motorized vehicles for seismic activities, and blasting itself, would be inconsistent with the ROS Semi-Primitive Non-Motorized setting indicator for access and possibly remoteness. These indicators state that Semi-Primitive Non-Motorized settings are inconsistent with motorized trails and the distant sight and/or sound of human activity. These effects would be negligible to minor and temporary in nature.

4.4.4.4 Timing Limitation (TL)

A TL leasing option would not apply to any recreation resource components directly.

4.4.4.5 Controlled Surface Use (CSU)

CSU provides for controlled surface use on all or portions of a lease. Operations would be held to special operational constraints that may otherwise exceed the mitigation provided by SLT, regulations, and operating orders. Under this leasing option, oil and gas leases would be issued with leasing options that allow surface occupancy of the leasehold, but with specific controls on oil and gas activities (see Appendix D). Proposed oil and gas activities could be located so they would not be obvious to recreation users and minimize intrusive sights and sounds from facilities and roads. Vehicular access would be limited to established roadways and well pads. Proposed well sites would be individually sited on a case-by-case basis (within 200 meters (656 feet) of the original site) to take advantage of vegetative or topographic screening. A CSU leasing option would apply to the recreation resource components as shown in Table 4.4-2.

Measurement Indicators

ALL RECREATION RESOURCE COMPONENTS

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

Long-term effects from oil and gas activities on recreation resources would be minor. CSU leasing options in these areas would minimize intrusive interactions with recreationists. Some users may feel that their recreation experience was compromised because of the noise and possible sight of vehicles and personnel.

ROS: SEMI-PRIMITIVE NON-MOTORIZED SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under CSU, the presence and use of motorized vehicles for ongoing operations would be inconsistent with the ROS Semi-Primitive Non-Motorized setting indicator for access and possibly remoteness. These indicators state that Semi-Primitive Non-Motorized settings are inconsistent with motorized trails and primitive roads and the distant sight and/or sound of human activity. These effects would be minor to moderate and short term or long term.

ROS: SEMI-PRIMITIVE MOTORIZED SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under CSU, the presence and use of motorized vehicles for ongoing operations would be compatible with the ROS Semi-Primitive Motorized setting indicator for access and remoteness. These effects would likely be negligible to minor and short term or long term.

ROS: ROADED NATURAL SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under CSU, the presence and use of motorized vehicles for ongoing operations would be fully compatible with the ROS Roaded Natural setting indicator for access and remoteness. These effects would likely be negligible to minor and short term or long term.

4.4.4.6 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing option other than those listed on BLM Lease Form 3100-11 (SLT), the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2, and the BMPs listed in Section 4.4.4. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

Under Alternative D, SLT would apply to ROS Roaded Natural, including within IRAs if the 2001 Roadless Area Conservation Rule was not in effect. Under Alternative E, SLT would apply to all the recreation resource components, including within IRAs if the 2001 Roadless Area Conservation Rule was not in effect.

The main conflict between oil and gas activities and recreation resources is a potential change in adjacent land use. Oil and gas activities may conflict with adjacent developed recreation sites or areas that are inventoried as suitable settings for certain recreational activities and experiences (ROS Classes). The potential conflict would be proportional to the total area available for that recreation resource, and for the purposes of this analysis, within each ranger district. The maximum amount of recreation acreage losses within ranger districts, assuming exploration and production developments occurred in each area, is presented in Table 4.4-3. Percentages in the table were calculated using the maximum number of disturbed acres predicted within each ranger district divided by the total number of acres of the resource within that ranger district.

Table 4.4-3 Maximum Percentage of Possible Recreation Area Disturbance on the Dixie National Forest

Resource	Pine Valley[1]	Cedar City[1]	Powell[1]	Escalante[1]
ROS: Primitive Setting[2]	<1%	100%	100%	21%
ROS: Semi-Primitive Non-Motorized Setting	<1%	1%	<1%	<1%
ROS: Semi-Primitive Motorized Setting	<1%	<1%	1%	<1%
ROS: Roaded Natural Setting	1%	1%	1%	1%
Developed Sites	17%	42%	64%	80%
Administrative Sites	100%	--	100%	100%
Recreation Residences	100%	100%	--	--

[1] Assumes the greatest amount of disturbance predicted in a ranger district occurred within each area
[2] Acres in wilderness (not available for lease) are not counted in percentages of ROS: Primitive that could be disturbed.

At developed recreation sites, short-term impacts from exploratory activities would not cause users to modify their behavior or be dissatisfied with their experience because developed sites carry an inherent expectation of some noise, built structures, and other human-caused disturbance. However, for most developed recreation sites (including mapped developed areas and administrative sites), impacts from disturbance-related conflicts would likely occur as a result of a production field. Development of a production field on ground set aside for developed recreation sites, or in direct proximity to developed recreation sites, would likely require these sites to be relocated in order to reduce user conflicts and preserve user experience. On the Powell and Escalante Ranger Districts, where a production field is more likely to occur, these impacts would be moderate to major and long term in nature. Impacts would be slightly less intense within developed sites on the Pine Valley and Cedar City Ranger Districts (as a production field is less likely to occur on these ranger districts); these impacts would be minor and moderate, respectively, and relocation may not be necessary. Recreation residences could be avoided under SLT by the ability to move activities by up to 200 meters (656 feet). However, a production field on land adjacent to recreation residences would disturb users as described for developed recreation sites.

Regarding dispersed recreation activities (including camping, hiking, equestrian use, mountain biking, OHV use, and hunting and fishing), either exploration or production activities would cause short (exploration) or long term (production) impacts to users engaging in dispersed recreation activities. Seekers of dispersed recreation usually carry an expectation of solitude, quiet, and naturalness that would be disrupted by noise and human presence from oil and gas activities. Impacts would depend on the specific ROS class of the area, discussed below, as user expectations and thus the assessment of the quality of the recreational experience would differ in each area.

Measurement Indicators

ROS: PRIMITIVE SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under SLT, several indicator characteristics of a Primitive setting could be compromised by oil and gas activities, including access, remoteness, and naturalness. All aspects of oil and gas activity, including exploration, production field development, and road construction would fundamentally conflict with the setting indicators for Primitive areas. These activities would compromise the natural-appearing setting and apparent remoteness of Primitive areas to some degree by introducing artificial elements and noises into the landscape. Activities under SLT could have moderate to major, long-term impacts in terms of compatibility with inventoried Primitive areas and the recreation activities that are generally associated with them. Impacts would be short to long term depending on whether or not wells were developed for production.

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

The potential for oil and gas activities to decrease dispersed recreation use in Primitive areas and overall recreation experience is moderate to major. The Cedar City and Powell Ranger Districts have the least amount of Primitive lands available, so oil and gas development in these districts would have a disproportionate potential to affect primitive recreation in these areas (Table 4.4-3). Exploration and construction activities in new locations would likely be followed by a decrease in recreation use as some users may feel that their recreation experience would

be compromised because of intrusive sights and sounds not compatible with the setting. Use levels may or may not rebound after exploration is completed or production wells are in place. There is a strong possibility in Primitive areas that displaced users would not return to these areas after being affected by disturbances.

ROS: SEMI-PRIMITIVE NON-MOTORIZED SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under SLT, several indicator characteristics of a Semi-Primitive Non-Motorized area could be compromised by oil and gas activities. These characteristics primarily include setting access, remoteness, and naturalness. Road construction would cause the most intense adverse impacts to the Semi-Primitive Non-Motorized setting by violating the basic character of a non-motorized area. Production field development would also require a high level of site disturbance. Any oil and gas activity would compromise the natural-appearing setting and apparent remoteness of a Semi-Primitive Non-Motorized area to some degree by introducing artificial elements and noises into the landscape. Activities under SLT could have moderate to major, long-term impacts in terms of compatibility with inventoried Semi-Primitive Non-Motorized areas and the recreation activities that are generally associated with them. Impacts would be short to long term, depending on whether or not wells were developed for production.

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

The potential for oil and gas activities to decrease dispersed recreation use in Semi-Primitive Non-Motorized areas and overall recreation experience is moderate to major. Exploration and construction activities in new locations would likely be followed by a decrease in recreation use as some users may feel that their recreation experience would be compromised because of intrusive sights and sounds not compatible with the setting. Use levels may or may not rebound after exploration drilling is completed and reclaimed or once wells are in place. It is possible that users displaced from Semi-Primitive Non-Motorized areas due to oil and gas activities would not return to these areas after being affected by disturbances.

ROS: SEMI-PRIMITIVE MOTORIZED SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under SLT, affected setting indicator characteristics of Semi-Primitive Motorized areas would include access, remoteness, and naturalness. Effects would be similar to those in Semi-Primitive Non-Motorized areas with the exception of road construction. Road construction from oil and gas activities, in some cases, would be compatible with the setting in Semi-Primitive Motorized areas. Primitive roads are permissible in these areas, but would not be adequate to support oil and gas traffic, which requires a graded road with two lanes and imported fill (i.e., gravel). Because highly modified roads should be located 0.5 miles from a Semi-Primitive Motorized area, ROS compatibility would need to be evaluated on a case-by-case basis.

Any oil and gas activities under SLT could have minor to moderate, long-term impacts in terms of compatibility with inventoried Semi-Primitive Motorized areas and the recreation activities that are generally associated with them. Impacts would be short to long term, depending on whether or not wells were developed for production.

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

The potential for oil and gas activities to decrease dispersed recreation use in Semi-Primitive Motorized areas and overall recreation experience is minor to moderate. Exploration and construction activities in new locations would likely be followed by a decrease in recreation use as some users may feel that their recreation experience would be compromised because of intrusive sights and sounds not compatible with the setting. Use levels may rebound after exploration drilling is completed and reclaimed or once wells are in place.

ROS: ROADED NATURAL SETTING

- *Measurement Indicator #1* CHANGES TO ROS RECREATION SETTING INDICATOR CHARACTERISTICS

Under SLT, production field development is most likely to compromise the naturalness setting characteristic of Roaded Natural areas. This means that the proposed development would be comprised of moderate to dominant visual elements in the landscape compared to the existing landscape character. Oil and gas development activities would need to be evaluated on a case-by-case basis to determine if they are compatible with Roaded Natural setting characteristics. In most cases, impacts would likely be minor and short to long term, depending on whether or not wells were developed for production.

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

Users in Roaded Natural areas would expect noticeable modification and intrusive sights and sounds characteristic of an exploration well or production field development. However, due to the expectation that resource modification and utilization "harmonize with the natural environment," impacts of an oil and gas exploration well or production field in a Roaded Natural area may adversely impact the use and quality of the recreation experience. It is possible that there would be a decrease in dispersed recreational use or changes in use patterns for Roaded Natural areas if an oil and gas development were built, and the impacts of this decrease would be minor and short-term to long-term depending on the nature of the development.

DEVELOPED SITES

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

Oil and gas activities under SLT may lead to decreases in the usage and quality of certain developed recreation sites because most users would not expect the visual contrast, noise, or activities associated with oil and gas development. Developed sites usually serve as destinations or hubs for recreation activities in the immediate area. Viewing oil and gas developments within the natural setting of a developed recreation site may cause users to be dissatisfied with their recreation experience. Oil and gas activities that occur in close proximity to developed sites would likely impact these areas greatly. Another factor is the type of activities that are pursued at a given developed site. For example, areas used as base camps for OHV use may not be as affected as family picnic areas or group campsites. Under SLT, the impacts on developed recreation sites from noise and increased traffic due to oil and gas activities would be minor to moderate, depending on individual perception. Since traffic levels and noise are relatively high in the vicinity of these areas (many users present at one time and adjacent to major roads) the increase in noise and traffic levels would be perceptible and may cause users to abandon the site or be dissatisfied with their experience, depending on individual

perceptions. Impacts to developed sites would be short to long term depending on whether or not wells were developed for production.

RECREATION RESIDENCES

- *Measurement Indicator #2* POTENTIAL DECREASE IN USE AND QUALITY OF THE RECREATION EXPERIENCE

Oil and gas activities under SLT would have a similar impact on recreation residences as on developed sites. Visual impacts from oil and gas developments would be minor because these visual interruptions are not likely to lead to discontinued use of the residence. In most cases, recreation residence users stay for less than a week per visit and would tolerate visual interruptions in the area, although some may be dissatisfied with their experience and complain. Impacts would be minor to moderate and short to long term, depending on proximity to residences and whether or not wells were developed for production.

Recreation residences occur in three tracts and are adjacent to paved or well-maintained unpaved roads. An increase in traffic due to oil and gas activities could be perceptible to many users of recreation residences, particularly in the case of semi trucks transporting drills or oil tankers transporting oil from producing wells. Impacts from major traffic in the vicinity of recreation residences would be minor and intermittent over the long term. Noise from oil and gas activities would not be expected by users of recreation residences, but would not likely lead to discontinued use of the residence. Some users may be dissatisfied with their recreational experience due to noise from oil and gas activities, particularly if a production field or primary access route to the field were developed in the vicinity of a residence. In other locations, noise impacts would be negligible to moderate. Impacts from noise would be short term in the case of exploration wells, while production field development would involve intermittent noise disturbances over the long term.

4.4.5 Impacts by Alternative

The degree to which the connected action impacts (Section 4.4.4) would differ by alternative is discussed in this section. Each alternative involves a unique set of leasing options for each resource component, which would restrict the locations and the nature of oil and gas activities that are allowed wherever these resources occur.

Table 4.4-4 shows the acres of each resource component for recreation under each leasing option, by alternative. When different leasing options for the same area overlap (due to more than one resource being present), the more restrictive leasing option takes precedence. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option. A more detailed table that separates the acreage by resource component and ranger district is available in Appendix B.

In this section, impacts are discussed mainly at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences among ranger districts are highlighted. Impacts by measurement indicators are summarized in Table 4.4-5, and differences between alternatives regarding recreation resource components are outlined in the text.

Table 4.4-4 Acreage of Resource Components under each Leasing Option by Alternative

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
ROS: Primitive	NA	84,607	84, 607	84, 607	84, 607	84, 607	84, 607	84, 607
	NL	19,317	19,317	4,246				
	NSO			15,071	19, 317	19, 317	16,443	
	CSU							
	SLT						2,874	19,317
ROS: Semi-Primitive Non-Motorized	NA	4,138	4,138	4,138	4,138	4,138	4,138	4,138
	NL	696,851	566,851	12,955				
	NSO		130,000	683,896	449,877	25,622	441,281	
	CSU				246,974	671,229		
	SLT						255,570	696,851
ROS: Semi-Primitive Motorized	NA	907	907	907	907	907	907	907
	NL	559,144	366,337	22,805				
	NSO		136,533	357,708	138,114	47,974	96,994	
	CSU		56,274	178,630	421,030	511,170		
	SLT						462,151	559,144
ROS: Roaded Natural	NA	703	703	703	703	703	703	703
	NL	263,731	181,880	22,519				
	NSO		65,297	188,883	58,914	49,020	11,185	
	CSU		16,554	52,328	198,958	208,851		
	SLT				5,859	5,859	252,546	263,731
Developed Sites (with appropriate buffer)	NA	1	1	1	1	1	1	1
	NL	4,923	3,988	506				
	NSO		935	4,417	1,023	978	52	
	CSU				3,900	3,945		
	SLT						4,871	4,923
Administrative sites	NA							
	NL	848	772	14				
	NSO		76	834	455	454	2	
	CSU				392	393		
	SLT						846	848
Recreation Residences (with ¼ mile buffer)	NA	42	42	42	42	42	42	42
	NL	777	766	567				
	NSO		11	210	777	777		
	CSU							
	SLT						777	777

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.

4.4.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing

decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will either be developed or expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. Under Alternative A, there would be no adverse impacts to recreation resources on the Dixie National Forest.

4.4.5.2 Alternative B

There would be no effects to ROS: Primitive areas under Alternative B because these areas would be covered by NL. Impacts to other recreation resources under Alternative B would be negligible for the most part because the most lands on the Dixie National Forest would be NSO or NL, including Semi-Primitive Non-Motorized (19 percent NSO, 81 percent NL or NA) ROS settings. Developed and administrative sites and recreation residences would be covered predominantly by NL or NA leasing options and seismic activities allowed under NSO are unlikely to cause impacts to these areas. Thus, impacts would be negligible. Seismic activities would be allowed on 133,000 acres of Semi-Primitive Non-Motorized settings, 137,000 acres of Semi-Primitive Motorized settings, and 65,000 acres of Roaded Natural settings covered by NSO under Alternative B; impacts in terms of ROS class and user experience could be minor and would be short term within Semi-Primitive Non-Motorized and Semi-Primitive Motorized. Within Roaded Natural settings, seismic activities would not have a measurable impact on ROS class. Very small portions of Semi-Primitive Motorized and Roaded Natural settings would be available for all oil and gas activities subject to CSU constraints under Alternative B. Within these areas covered by CSU, oil and gas activities would be possible and may cause minor impacts with regard to user experience (*Measurement Indicator #2*), but not likely to ROS class (*Measurement Indicator #1*) within Roaded Natural. Impacts in terms of user experience would be short to long term depending on whether exploration (short term) or production activities (long term) occurred.

4.4.5.3 Alternative C

Alternative C with NSO in IRAs would have similar impacts for recreation resources as described for Alternative B. For developed and administrative sites and recreation residences, impacts between Alternative B and Alternative C are similar because these areas have the same leasing options under the two alternatives and both areas would be open to disturbance from seismic activities (under NSO) that would most likely have negligible impacts. A larger proportion of Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, and Roaded Natural settings are NSO under this alternative; however, impacts from seismic activities would be the same as under Alternative B: potentially minor and short term. A proportion of Semi-Primitive Motorized and Roaded Natural areas would be available for all oil and gas activities (subject to CSU constraints) under this alternative. Impacts under Alternative C would still be largely negligible and minor and short to long term, depending on the activity (i.e., production activities would have long-term impacts).

4.4.5.4 Alternative D1 (NSO in IRAs)

Alternative D has less restrictive leasing options than Alternative C and more restrictive options than Alternative E. Impacts under Alternative D1 (NSO in IRAs) would likely not be measurably different than under Alternative D2 (CSU in IRAs) (below) in intensity or duration for any recreation resources, with the exception of Semi-Primitive Non-Motorized areas. Due to the substantial overlap with IRAs, the intensity of impacts within these areas would be reduced

relative to Alternative D2 because fewer acres would be available for road building and other oil and gas developments that could compromise the Semi-Primitive Non-Motorized setting.

4.4.5.5 Alternative D2 (CSU in IRAs)

Impacts under this alternative would be only slightly more adverse than under Alternative C, with the possible exception of Semi-Primitive Non-motorized areas, which could have moderate impacts. Recreation residences would be NA or NSO under this alternative, as under Alternative C, thus impacts in terms of potential decrease in use and quality of the recreation experience (*Measurement Indicator #2*) would be the same as under Alternative C (negligible) because seismic activities are temporary and unlikely to diminish users' recreation experience. Primitive areas would be 19 percent NSO (rather than NL as under Alternative C); impacts from seismic activities could be short term and minor in terms of affecting ROS class and users' recreation experience. Developed and administrative sites and ROS Semi-Primitive Motorized and Non-motorized areas would have CSU leasing options under this alternative that would cover most of these areas because only a small portion of the Forest is NSO under this alternative. CSU leasing options are designed for each resource component (see Appendix D) to minimize adverse impacts that may result from oil and gas activities, thus impacts to most resources from oil and gas activities covered by CSU would be minor. Roaded Natural settings would have similar impacts to SLT because these areas do not carry special leasing options under Alternative D, and unrestricted oil and gas activities are less likely to have adverse affects on these resource components.

4.4.5.6 Alternative E1 (NSO in IRAs)

Alternative E has the least restrictive leasing options of Alternatives A through E. The intensity and duration of impacts to recreation resources would be similar to impacts described in Section 4.4.4.6 because most resources do not overlap with IRAs substantially. Impacts within Semi-Primitive Non-motorized settings would be moderate as opposed to moderate to major under SLT (Alternative E2 with SLT in IRAs; Section 4.4.4.6) because fewer acres would be available for road building and other oil and gas developments that could compromise the Semi-Primitive Non-Motorized character.

4.4.5.7 Alternative E2 (SLT in IRAs)

Impacts to recreation resources would be as described in Section 4.4.4.6 Standard Lease Terms.

Table 4.4-5 Impacts to Recreation Resources with respect to Measurement Indicators #1 and #2

Resource	*Measurement Indicators*	ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
ROS: Primitive	*MI #1*	No effect	No effect	neg-minor ST	neg-minor ST	neg-minor ST	moderate ST-LT	mod-major ST-LT
	MI #2	No effect	No effect	neg-minor ST	neg-minor ST	neg-minor ST	moderate ST-LT	mod-major ST-LT
ROS: SPNM	*MI #1*	No effect	neg-minor ST	neg-minor ST	minor ST-LT	minor-mod ST-LT	moderate ST-LT	mod-major ST-LT
	MI #2	No effect	neg-minor ST	neg-minor ST	minor ST-LT	minor-mod ST-LT	moderate ST-LT	mod-major ST-LT
ROS: SPM	*MI #1*	No effect	neg-minor ST	neg-minor ST-LT	minor ST-LT	minor ST-LT	moderate ST-LT	moderate ST-LT
	MI #2	No effect	neg-minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	moderate ST-LT	moderate ST-LT
ROS: RN	*MI #1*	No effect	negligible ST-LT	negligible ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
	MI #2	No effect	neg-minor ST-LT	neg-minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
Developed sites	*MI #2*	No effect	negligible ST	negligible ST	minor ST	minor ST	mod-major ST	mod-major ST
Recreation residences	*MI #2*	No effect	negligible ST	negligible ST	negligible ST	negligible ST	mod-major ST	mod-major ST

LT = long term; ST = short term; neg = negligible; mod = moderate

4.5 Fish and Wildlife

4.5.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.5-1 provides an example how these terms would apply to fish and wildlife resources.

Table 4.5-1 Terms used to Describe Effects to Fish and Wildlife

Attribute of Effect		Description relative to Fish and Wildlife Resources
Quality	Beneficial	An increase in the amount or quality of suitable habitat for a species.
	Adverse	A decrease in the amount or quality of suitable habitat for a species.
Magnitude (Intensity)	Negligible	A modification in habitat amount or quality that is too small to be perceptible by a species. *Example: Loss of 1% of available habitat.*
	Minor	A modification in habitat amount or quality that would only affect some individuals of a species and would not affect the reproductive rate of the population. *Example: Loss of 10% of available habitat. Example: Increase in invasive plants within suitable habitat.*
	Moderate	A modification in habitat amount or quality that would affect enough individuals of a species that the reproductive rate of the population could be affected. Population decline or a loss of viability would be possible. *Example: Extended noise disturbance that affects many reproducing individuals.*
	Major	A modification in habitat amount or quality that would affect the reproductive rate of a population of a species and is likely to lead to a population decline or loss of viability. *Example: An irretrievable loss of critical habitat that would affect a population. Example: A hazardous materials spill that renders several miles of aquatic habitat unsuitable.*
Duration	Temporary	A habitat modification that only occurs during construction of a facility (i.e., road, well pad). Original habitat condition is immediately restored once construction is completed. *Example: Noise disturbance from seismic blasts.*
	Short Term	A habitat modification that occurs during exploration activities (i.e., construction of exploratory well pads or access roads) or that may last for one or a few reproductive seasons. The habitat modification lasts 10 years or less. Original habitat condition would likely be restored within this time frame. *Example: Noise disturbance from exploration activities.*
	Long Term	A habitat modification that occurs during extended exploration activities or during production activities. The habitat modification lasts more than 10 years and original condition may or may not be restored. *Example: Noise disturbance from a production well.*

4.5.2 Measurement Indicators

- *Measurement Indicator #1* ACRES OF DIRECT DISTURBANCE OF HABITAT AND INDIRECT HABITAT LOSS AS COMPARED TO AVAILABLE HABITAT
- *Measurement Indicator #2* NUMBER OF VISITS AND NOISE LEVELS
- *Measurement Indicator #3* ESTIMATES OF INCREASED SEDIMENT PRODUCTION AND AMOUNT THAT COULD REACH AQUATIC HABITATS
- *Measurement Indicator #4* NUMBER AND TYPE OF STREAM, RIPARIAN AREA, AND WETLAND CROSSINGS
- *Measurement Indicator #5* POTENTIAL CHANGES TO AQUATIC HABITAT CONDITION (AQUATIC CONDITION INDICATORS)
- *Measurement Indicator #6* INCREASES IN INVASIVE PLANTS

4.5.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E it is assumed that activities described under the RFDS would occur. These activities include 60 to120 acres (per ranger district) of overland travel associated with seismic surveys, 80 –to 330 acres (per ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field. The locations of activities are not yet known.

The main impacts to fish and wildlife that are possible from land clearing include mortality, injury, and habitat modification, fragmentation, and loss. For wildlife, the destruction of occupied burrows or nests, displacement, and the direct disturbance of habitat during land clearing would result in direct impacts. The loss of forested habitats, and in some cases sagebrush, would generally be long term, while the loss of grassland or forbs could be short term if areas revegetate with native species. For fish, land clearing in the vicinity of an occupied stream can increase the potential for delivery of sediment, salts, organics, and nutrients (Trombulak and Frissel 2000) in surface water runoff because vegetation is no longer present to block or dilute such introductions. Roads are often located closer to streams than well pads and are more likely to cause erosion or provide a channel for delivery of spilled hazardous substances (fuel, coolant, lubricants, drilling and well construction materials). These occurrences can degrade habitat and ecosystem functioning, which may affect fish habitat (e.g., water temperature, stream bank vegetation, macroinvertebrates, large woody debris). Blue Ribbon Fisheries criteria would affected if a waterbody were to lose, among other characteristics, 1) its ability to sustain a viable fishery (by reduced water quantity or quality) or 2) its accessibility to the public (see UDWR 2006b for list of criteria). Operating procedures (Appendix C) are designed to avoid these impacts.

Wildlife tends to avoid areas with noise and human presence if possible, so the area of affected wildlife habitat could be larger than the area directly occupied by oil and gas activities. Avoidance and stress responses by wildlife extend the influence of each well pad, road, and facility up to a quarter mile for some terrestrial species and more for others. Wildlife could be displaced from an area of this size or larger. This creates a larger population within a smaller area of undisturbed habitat that is likely to be less suitable than what was disturbed. Under

these conditions, wildlife are likely to become further stressed by increased competition in the new area due to the increased density of individuals vying for limited resources. Increased mortality from large predators that feed in the congregation areas could also occur. Depending on the ecological importance of the habitat and the timing of disturbance, individuals may experience lower reproductive success or mortality. Small, isolated disturbances within non-limiting habitats may be of minor consequence within most ecosystems. However, larger-scale developments within habitats that are of a more direct importance to the productivity of wildlife have the potential to be substantial because the undisturbed habitat surrounding the disturbance is less likely to be as suitable (WFGD 2004).

Fragmentation of wildlife habitats is a concern with oil and gas disturbances due to the linear extent of many activities, including roads connecting to well pads. (Seismic activity would not fragment habitat). For larger mammals, fragmentation may hinder metapopulation dynamics such as migration and dispersal. At a smaller scale, wildlife such as small mammals and reptiles are affected by single roads that may block short-range movements or split a population and prevent migration in and out. Road crossings in streams can create barriers to fish movement (Trombulak and Frissel 2000), which can isolate fish populations. Fragmentation of fish and wildlife populations leads to reduced genetic diversity and increased susceptibility to population decline. This is particularly true for migratory species that habitually move long distances.

Impacts to wildlife and fisheries resources from the different phases of oil and gas development depend on the duration, amount, and type of disturbance involved. The following phases are discussed in terms of possible impacts to all wildlife species under SLT: seismic activity, exploratory drilling and road construction, and production.

Seismic Activity: Seismic exploration involving both buggies and helicopters would temporarily disturb wildlife, due to noise and human presence, in the vicinity of operations. Noise would be produced mainly by the explosives used to generate vibrations. Mobile wildlife are likely to move away from the disturbance, and most would be expected to return to the area when humans were no longer present. Long-term impacts to wildlife species from seismic activities could occur if habitat becomes less suitable due to noxious weed invasion (via drill-mounted buggies; see Section 4.9) or habitat changes to key vegetation components. Seismic activities would have a negligible impact on fisheries because surface disturbance is minimal and vibrations would be temporary. In terms of habitat impacts, seismic activities would involve temporary impacts because vegetation crushed by overland travel would likely recover or resprout soon after. For wildlife, areas with crushed vegetation would not be suitable as cover in the short term.

Exploratory Drilling and Road Construction: Exploratory drilling involves the construction of dill pads and access roads, which removes wildlife habitat (land clearing), may impact stream channels, and may increase the potential for the introduction of sediment and hazardous materials to the aquatic system. Disturbance to wildlife caused by intermittent human presence on an exploration well would be short term, lasting for the duration of operations. Direct mortality may occur to smaller species, such as rodents, reptiles, and (nesting) birds, during construction of the pad and roads. Noise disturbances from the actual drilling would be temporary. Human presence and noise could cause mobile individuals in the vicinity to be displaced; individuals may or may not return to the area after reclamation. Fish could be affected by construction across streams (culverts), and by the potential for habitat degradation, caused by increases in sediment yield, short-term pulses of turbidity, and chemical contamination that are the result of construction and use of roads or well pads near streams.

Adverse effects within Blue Ribbon fishery streams would affect Blue Ribbon criteria if the stream were to no longer able to sustain a viable fishery. Prolonged noise disturbances could also apply to fish if drilling occurred close to a stream.

Production: A production field would involve the largest amount of disturbance and the most adverse impacts to wildlife. The disturbed area and some surrounding habitat around each production well would be unsuitable for many wildlife species due to human presence and noise during production well drilling activity, which would last for several months. Direct mortality could occur during construction to any small, less mobile wildlife individuals within disturbance footprints. Impacts to larger, more mobile individuals that are displaced due to drilling and construction noise would be temporary. Fish could be impacted during this time by noise and any additional road building in proximity to or across occupied streams (see habitat degradation, above). Impacts to displaced individuals due to habitat disturbance from the well pads and roads could be long term. After production wells are constructed, human presence and noise would continue at a moderate level.

Table 4.5-2 lists the leasing options assigned to active raptor nests and migratory birds under each alternative. Aquatic species would be covered by leasing options for streams, lakes, and riparian and wetland areas (see Section 4.7); leasing options for these areas are not discussed in this section. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) wherever the applicable resource component occurs on the Dixie National Forest.

Table 4.5-2 Leasing Options Assigned under each Alternative for Wildlife Resources

Resource	Alternative				
	A	B	C	D	E
Active raptor nests	NL	CSU-11	CSU-11	CSU-11	SLT
Migratory birds (nests)	NL	CSU-16	CSU-16	LN	SLT
Streams, lakes, riparian, etc. (see Section 4.7)	NL	NL 500 ft buffer NSO-19 300 ft buffer	NSO-20 300 ft buffer	CSU-22 300 ft buffer	SLT

Locations of raptor/migratory bird nests, native fishes, and other aquatic species discussed in this section are either unknown, only partially mapped, or not mapped. Leasing options would apply to currently unmapped areas wherever they are found.

4.5.4 Impacts of Connected Actions by Lease Option

Leasing options would dictate the conditions under which connected actions (described under the RFDS) would be allowed, and under which, impacts may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to fish and wildlife resources considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.5.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the BLM and USFS *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.5.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing is being considered in these areas and no disturbance to wildlife or fisheries resources in these areas would occur. This leasing option does not apply directly to any of the fish and wildlife resource components under any alternative.

4.5.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing. No disturbances associated with oil and gas leasing would occur on lands with an NL leasing option.

Under Alternative A, NL would apply to migratory bird and raptor nests. Because no new leases would be authorized under the NL option, there would be no surface disturbance related to oil and gas activities within these areas and thus no direct or indirect impacts to these resources.

4.5.4.3 No Surface Occupancy (NSO)

With the exception of seismic activities, NSO would prohibit occupancy or use of the land for oil and gas related activities (e.g., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). Under Alternative C, linear features (e.g., roads, pipelines) would be allowed as perpendicular stream crossing under NSO (except in sensitive fish habitat; see Section 4.6). A NSO leasing option would not apply to fish and wildlife resources directly under any alternative.

4.5.4.4 Timing Limitation (TL)

TL prohibits surface activities during specified time periods, usually to avoid direct and indirect impacts to fish or wildlife species during sensitive periods. This leasing option does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation, and that less stringent, project-specific mitigation measures would be insufficient. A TL would not apply to fish and wildlife resources directly under any alternative.

4.5.4.5 Controlled Surface Use (CSU)

CSU provides for controlled but generally allowed surface use on all or portions of a lease. Operations would be held to special operational constraints that may otherwise exceed the mitigation provided by SLT, regulations, and operating orders. With regard to wildlife and fisheries, CSU leasing options would ultimately allow agencies (e.g., a Dixie National Forest biologist) to control where and when oil and gas activities occurred within a lease.

Under Alternatives B, C, and D, a CSU would apply to active raptor nests and occupied territories. CSU would apply to migratory bird nests under Alternatives B and C. CSU would also apply to aquatic habitats and would thus affect aquatic species under Alternative D. Impacts to these species under CSU with regard to applicable measurement indicators are described below. Refer to Appendix D for descriptions of each CSU.

MIGRATORY BIRDS

Measurement Indicators

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Mitigations (determined by a Dixie National Forest biologist) may be required if migratory bird nests are found in the area during pre-construction surveys; these may include a timing restriction (see Appendix D). Under the CSU, habitat disturbance for migratory birds could occur outside of specified timing restrictions and these impacts would be as described under SLT (Section 4.5.4.6).

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

If migratory bird nests are detected during surveys and avoided during the specified nesting period and distance (for raptors), noise and human presence impacts would be negligible because activities would be restricted while birds were nesting under CSU. The Dixie National Forest would be in compliance with the Migratory Bird Treaty Act under CSU if unintentional take was minimized.

AQUATIC SPECIES

Measurement Indicators

- *Measurement Indicator #3* ESTIMATES OF INCREASED SEDIMENT PRODUCTION AND AMOUNT THAT COULD REACH AQUATIC HABITATS

Impacts to aquatic species from increases in sediment production under CSU would be lower than under SLT, due to soil protection measures that are part of this particular stipulation. Oil and gas facilities within 300 feet of aquatic habitats (streams, lakes, riparian areas, etc.) would be placed on wooden platforms to reduce soil disturbance, thus vehicles and other operations would not make contact with the soil and potentially introduce sediments into adjacent aquatic habitats. Impacts to aquatic species with regard to increased sediment production under CSU would be short (exploration activities) to long term (production activities) and negligible to minor. Impacts could be minor because a small amount of sediment, that may affect some individuals of various aquatic species, may still be introduced into aquatic habitats during installation and removal of the platforms.

- *Measurement Indicator #4* NUMBER AND TYPE OF STREAM, RIPARIAN AREA, AND WETLAND CROSSINGS

Impacts from stream, riparian, or wetland crossings under CSU would be the same as SLT because stream crossings are not restricted under this leasing option and would be installed following standard specifications (e.g., BLM and USFS 2007), as under SLT. Impacts would be short (exploration) to long (production) term and minor because it is likely that only some individuals (of any aquatic species) would be affected by a stream, riparian, or wetland crossing at any one location. There would be no impacts to populations of aquatic species from crossings.

- *Measurement Indicator #5* POTENTIAL CHANGES TO AQUATIC HABITAT CONDITION (AQUATIC CONDITION INDICATORS)

Impacts to aquatic habitat condition would be the same under this CSU as under SLT, because operations could be in a similar proximity to aquatic habitats. Impacts to aquatic habitat conditions under SLT have the potential to be major because populations would almost certainly be affected by an unanticipated event such as a spill, although this type of event is unlikely. Adverse impacts to aquatic species populations would be certain to lower the reproductive rate

of the population and could put the persistence of the species on the Dixie National Forest in an uncertain position. Blue Ribbon Fishery criteria would also be adversely affected such that the affected stream would no longer meet the criteria for natural reproduction capacity. Impacts under SLT would be short to long term and moderate to major, depending on the location of disturbance, present condition of the aquatic habitat, and the severity of the impact.

4.5.4.6 Lease Notice (LN)

A lease notice provides more detailed information concerning existing limitations, regulations, or orders, or addresses special considerations. A LN does not impose new restrictions on oil and gas activities and would be attached to leases regardless of other leasing options.

A lease notice would be attached to any lease that occurred within 0.5 miles of a known golden eagle or bald eagle nest from 1 January to 31 August. This would be the case for any lease within Dixie National Forest lands regardless of leasing options. The purpose of the LN in this case is to ensure compliance with the Bald and Golden Eagle Protection Act, which prohibits take (including disturbance) of bald and golden eagles. The LN would list avoidance or minimization measures specific to bald and golden eagle nests that may occur in the vicinity. In order to comply with the Bald and Golden Eagle Protection Act, surveys for bald and golden eagles would be conducted in any area leased for oil and gas exploration that occurs within or near suitable habitat. The Bald and Golden Eagle Protection Act prohibits take, possession, and commerce of bald and golden eagles; so, to comply with the Act, oil and gas activities would not be allowed in the vicinity of active nests.

A lease notice would be attached to any lease within the nesting season for migratory birds. This is the case for any lease within Dixie National Forest lands regardless of leasing options. The purpose of the LN in this case is to ensure compliance with the Migratory Bird Treaty Act, which prohibits take of migratory birds. Direction from the US Fish and Wildlife Service (USFWS) regarding migratory birds on USFS lands, however, states that activities occurring within migratory bird habitats should “minimize direct take of individual migratory birds when feasible.” Since conservation of populations is emphasized, a low level of incidental take is assumed. The LN would list avoidance or minimization measures specific to migratory bird nests that may occur in the vicinity. Mitigations would ultimately be determined by a Dixie National Forest biologist on a case-by-case basis if migratory bird nests are encountered.

4.5.4.7 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT), the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2, and the BMPs listed in Section 4.5.4. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

All leaseholders would be required to comply with the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act under SLT (see Section 4.5.4.6). Under Alternative E, SLT would apply to all raptor nests (including bald and golden eagle) and migratory birds as the default leasing option.

In general, disturbance to fish and wildlife habitats would be “minimized” under SLT, avoiding “unreasonable or unnecessary disturbances during construction of pads, access, and other facilities, and during operations.” Disturbed terrestrial habitat would be reshaped and re-

vegetated after use. Roads and drainage structures would be located to minimize impacts on water quality, such as on benches upslope from streams, lakes, ponds, riparian areas, and floodplains (BLM and USFS 2007). A Spill Prevention Control and Countermeasures (SPCC) Plan would be approved before operations are authorized, and sediment control structures would be used at the base of fill slopes. Regarding potential noise disturbances to wildlife, operators would be required by the standards listed in Appendix C to "centralize production facilities, use telemetry to monitor wells, and delay non-essential maintenance activities in important wildlife habitat during critical seasons of use to reduce the number of vehicle trips to the sites and activity that could disturb or stress wildlife." In addition, all vehicles and other gasoline or diesel-powered equipment must be equipped with properly functioning mufflers (Appendix C). Regarding potential disturbances to fish and aquatic species, facilities are to be located on benches upslope from streams, lakes, ponds, riparian areas, and floodplains to the extent feasible. A SPCC Plan, which addresses the potential for spills to occur, must be filed with the Forest Service and approved by the authorized officer before construction or operations begin. Stream crossings designed to allow fish passage would be "planned and constructed to minimize disturbance of the riparian and aquatic habitats by locating crossings at the most advantageous location and by crossing as close to a right angle as possible (Appendix C).

Measurement indicators are discussed below for all fish and wildlife resources, as SLT is the default leasing option and would cover all areas of the Dixie National Forest.

Measurement Indicators

ALL WILDLIFE

Measurement Indicator #1 ACRES OF DIRECT AND INDIRECT HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

The primary adverse impact to wildlife from oil and gas activities is a loss of habitat and habitat effectiveness. Disturbances created by excavations, roads, facilities, equipment, human activity, and noise physically eliminate some habitat as well as impair the effectiveness of a larger (otherwise suitable) habitat area. Because oil and gas developments are typically configured as point and linear disturbances scattered throughout broader areas, the direct disturbance is relatively small compared to the amount of impaired, surrounding habitat. The number and timing of wells projected on each ranger district is presented in Section 2.2.1. The disturbance expected from post-leasing activities is presented as Tables 2.2-1 and 2.2-2. In summary, the RFDS predicts between 396 and 706 acres of disturbance on each ranger district over the next 15 years. The Pine Valley Ranger District would have the least disturbance and the Powell and Escalante Ranger Districts would have the most. It is likely that the area of unsuitable habitat surrounding the actual disturbance would be much greater. For terrestrial species, the impacts of habitat disturbance in the event that development and production occurs on a well field (production field disturbance in the RFDS = 254 acres) could be long term and moderate at that location. Moderate impacts could occur to some terrestrial wildlife species because a substantial number of individuals would be affected and these impacts may carry over to the population level. Exploration activities that do not result in development would be short term (less than 10 years) and could be moderate, depending on the species, if enough individuals are affected. Minor impacts would result if population-level impacts, such as a decline in the reproductive rate, did not occur and only some or a few individuals were affected.

Impacts to aquatic species from a loss of suitable stream habitat would be minor to moderate, depending on the number of individuals affected. If a high-quality area of aquatic habitat used by many individuals of a species were lost, impacts would be moderate because a population

could be affected by the loss of habitat. Impacts within Blue Ribbon Fisheries would be moderate. Aquatic habitat losses could also be permanent because aquatic habitats are not easily restored after a disturbance (see *Measurement Indicator #5*, Aquatic species and habitat).

MIGRATORY BIRDS

Migratory birds are most sensitive to human disturbance during the nesting and fledging periods. Oil and gas activities could cause direct impacts (disturbance) to nests, or cause adult birds to abandon nests containing eggs and young. Pre-construction surveys would be conducted before exploration on a site to determine the presence of raptor nests, and if found, agencies would have the authority to relocate oil and gas activities up to 200 meters (656 feet) from a requested location or delay operations for up to 60 days in order to avoid impacts to individual nesting birds. For non-raptors (e.g., passerines or songbirds), compliance with the Migratory Bird Treaty Act is required, which may involve pre-construction surveys for species of concern. Although take of individual birds is to be minimized, some unintentional or "incidental take" of migratory birds (i.e., passerines) would be expected within suitable habitat even when surveys are conducted. Incidental take, by definition, occurs as an unintended consequence of lawful activities. Any migratory birds that nest in open country and on the ground, such as burrowing owls, ferruginous hawks, and many passerine birds, may be more vulnerable to incidental take because oil and gas activities tend to occur in these habitats. USFS 2007g describes specific direction from the USFWS for compliance with the Migratory Bird Treaty Act on the Dixie National Forest and states that conservation of populations and habitats are to be prioritized over conservation of individuals.

- *Measurement Indicator #1* ACRES OF DIRECT AND INDIRECT HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Direct and indirect adverse impacts to migratory birds would occur if suitable habitats were disturbed and habitat effectiveness was impacted. For raptors, suitable nesting habitat would be disturbed if snags or large trees were removed. Cliff habitat is less likely to be disturbed because drilling is less feasible in these areas. Foraging habitat for most raptors, nesting habitat for ground-nesting species such as burrowing owls, and nesting habitat for migratory passerines would be removed wherever open areas (grassland, shrublands) were disturbed by oil and gas activities. Impacts would be minor because migratory bird habitats are generally common vegetation types and only a small percentage of these habitats would be removed by oil and gas activities, thus a substantial amount of undisturbed suitable habitat would likely be available outside the disturbance area. Disturbance of migratory bird habitats would be short to long term depending on the type of vegetation (i.e., impacts grasses and some shrub habitats would be short term; impacts to forest would be long term) and the activity (i.e., exploration activities would be short term; production activities would be long term). Compliance with the Migratory Bird Treaty Act requires the Dixie National Forest to conserve habitats and populations of migratory birds. Habitat impacts, if they occurred, may affect individuals and these impacts would be minor. Moderate impacts, in which populations may be affected, are not likely to occur under compliance with the Act.

- *Measurement Indicator #2* – NUMBER OF VISITS AND NOISE LEVELS

For some raptors, avoidance and stress responses extend the influence of each well pad, road, and facility up to several hundred meters during egg laying and early incubation (USFS 1995a). Species of migratory birds differ in their sensitivity to noise (distances for raptors listed in Romin and Muck 2002). For ferruginous hawk, northern harrier, Cooper's hawk, red-tailed hawk,

sharp-shinned hawk, Swainson's hawk, merlin, and Turkey vulture, a half-mile buffer is recommended during nesting; for burrowing owl and prairie falcon, a quarter-mile buffer is recommended (Romin and Muck 2002). Oil and gas activities within a few hundred meters are likely to disturb bird nests in the vicinity. Daily traffic and intermittent drilling for less than one year would be expected during the exploratory phase. Under SLT, Agencies could move operations up to 200 meters (656 feet) from an active nest or delay operations up to 60 days.

For raptors, noise impacts from drilling and traffic during exploration would most likely be temporary and minor, unless these activities led to impacts on nesting success, or if only a few raptors were impacted while nesting or foraging. If noise disturbances from either exploration or production activities affected enough individual raptors to affect a population, noise could cause moderate impacts. Under SLT, a large number of individual birds could be affected because 200-meter (656-foot) and 60-day allowances may not be sufficient to prevent noise disturbances that would be possible within a larger radius (i.e., one quarter or one half mile) and for a longer period. Noise levels during production are high during production drilling and well field construction; this level of noise would be most likely to cause raptors nesting within a quarter mile to be impacted. Impacts from production activities within this radius are likely to be moderate. Subsequent noise levels on a production field would be lower after construction and drilling and may be tolerable to nesting raptors. In the years following well field construction, impacts to nesting raptors from daily visits by field workers and tanker vehicles would be negligible to minor as individual raptors may or may not modify their behavior as a result of a low-level noise disturbance.

For migratory passerines, oil and gas activities in the vicinity of nesting birds may cause adverse noise impacts that could lead to impacts on nesting success. Oil and gas activities would not be in proximity to enough passerine nests that populations would be affected; however, oil and gas activities within a 100 to 200 foot radius of a nest could result in take due to stress on birds or the masking of predator arrival or associated alarm calls (Slabbekoorn and Ripmeester 2008). Because populations of migratory passerines are unlikely to be affected under compliance with the Migratory Bird Treaty Act, impacts from incidental take due to noise would be minor and short term.

AQUATIC SPECIES AND HABITAT

- *Measurement Indicator #3* – ESTIMATED INCREASES IN SEDIMENT PRODUCTION

Predicting the amount of increase in sediment delivery from oil and gas activities is difficult due to the number of variables involved. Both the quantity of the source (the eroded material) and the quantity that arrives at a stream are highly dependent upon site-specific factors such as soil characteristics, ground slope, distance between the disturbance and stream, and vegetation characteristics between the disturbance and stream. Once sediment has reached a stream, the distance and timing of its downstream progression is highly dependent upon factors such as flow patterns, velocity, substrate, and channel morphology. In addition, locally increased runoff due to drainage pattern alterations (i.e., along roads) can increase in-stream erosion and sediment transport. For these reasons, it is not possible to estimate specific sediment quantities for disturbances whose locations are not known; these estimates would be assessed during the NEPA process for specific proposals. More information on water quality is available in Section 4.7 (Water and Watershed Resources).

Sediment increases in streams degrade habitat for macroinvertebrates, the primary food source for most fish species. Increases in sediment may shift the macroinvertebrate community to a more sediment-tolerant community that includes less desirable species. For salmonids,

increased sedimentation could substantially degrade spawning habitat, which would reduce spawning success and recruitment by reducing trout embryo survival rates, as well as decrease rearing and overwintering habitat (see Section 4.6). Impacts from sedimentation under SLT would be short to long term and minor to moderate depending on the level of sedimentation. Moderate impacts would result if enough individuals were affected to lower the reproductive rate of a population of an aquatic species.

- *Measurement Indicator #4* – NUMBER OF CROSSINGS

Direct impacts to fish, amphibians, or mollusks could occur from mortality during construction of stream crossings (Section 4.7). Stream crossings could be allowed in more locations under SLT and would have the greatest potential for direct adverse impacts to aquatic habitat outside of an unanticipated accident or spill (see *Measurement Indicator #5*). The number and location of stream crossings that would be associated with oil and gas activities is not known. Stream crossings would be planned and constructed to minimize disturbance to riparian and aquatic habitats, including stream substrate, by locating crossings at the most advantageous location and by crossing at or near perpendicular to the stream channel (Appendix C). Culverts and structures would be designed to allow fish passage and to maintain habitat. When no longer needed for operations, crossings would be removed and the stream and banks restored to pre-disturbance conditions and stream hydraulics. Timing restrictions during installation and removal may be needed to protect fisheries, in coordination with UDWR and Utah Division of Water Rights (Stream Alteration Program). Recommended specifications for culverts across streams, wetlands, and low water crossings associated with oil and gas activities are contained in BLM and USFS (2007). Impacts from road crossings under SLT would be short (exploration) to long (production) term and minor because it is likely that only some individuals would be affected by a stream crossing at any one location. Impacts to sensitive fish species from improperly installed culverts could be moderate (see Section 4.6).

- *Measurement Indicator #5* – CHANGES TO AQUATIC HABITAT CONDITION

In general, impacts to aquatic species from adverse changes to aquatic habitat have the potential to be long term or permanent because aquatic habitats are not easily restored to the original functioning condition after a disturbance.

Channel disturbance, the clearing of vegetation, and construction and use of roads and pads in the vicinity of aquatic habitats could adversely impact aquatic habitat conditions. Impacts could occur due to sedimentation (see *Measurement Indicator #3*), the introduction of spilled hazardous substances, loss of streamside vegetation (decreased bank stabilization and increased water temperature), and removal of large woody debris. These impacts, if they occurred, would be short to long term and minor to moderate depending on the quantity of sedimentation or hazardous materials introduced, the amount of vegetation removed, the type of aquatic habitat (river, stream, pond), and the current condition of the aquatic habitat. Fish, amphibians, and mollusks would be adversely affected by a negative change in aquatic habitat condition. Impacts to mollusks could occur via changes in water quality or impacts to springs (see Section 4.7). Impacts to aquatic species would be minor if only some individuals were affected; impacts would be moderate if a substantial enough number of individuals were affected so as to reduce the reproductive rate of an aquatic species population.

Although unlikely, the greatest potential for an adverse change in the aquatic habitat condition would be in the event of an oil spill resulting from a haul truck overturning or a pipeline failing and the released oil discharging to a drainage. The consequences of such unanticipated events have the potential to be greater under SLT because oil and gas activities are more likely to be

closer to streams. However, under SLT resource protection measures and Clean Water Act compliance would reduce the chance of these impacts occurring. Introduction of a substantial quantity of oil to a stream would have major adverse impacts to fisheries and aquatic species for some distance downstream. The deposition of oil on channel banks and substrate could inhibit algal growth and could result in ongoing contamination of the water. While short-term effects could be severe, long-term damage would be minimal if clean-up efforts are implemented at the time of the accident (USFS 1995a). Blue Ribbon Fishery criteria would be adversely affected because the stream would no longer meet the criteria for natural reproduction capacity. Operating procedures regarding site placement, design, and proper road crossings are designed to minimize such occurrences (Appendix C) although these types of events are more likely under SLT because more miles of road may be closer to streams. Oil spill impacts would be long term and could be major, depending on the amount of spilled oil that enters the aquatic system and the effectiveness of clean-up efforts, because populations of aquatic species would almost certainly be affected by a large-scale spill that was not effectively mitigated.

Although the Dixie National Forest could require an operator to move a well as far away from a stream as allowed (200 meters, 656 feet), this is the maximum possible buffer that would be enforced if an operator wished to drill in close vicinity to a stream. Stream crossings could also be moved up to 200 meters (656 feet) in order to minimize impacts to relatively high-quality reaches. Allowances under SLT may or may not be sufficient in preventing adverse impacts to aquatic habitats.

In summary, due to the greater potential for adverse impacts resulting from accidents or unanticipated events, including those that take place in more sensitive aquatic areas (see Section 4.7), impacts to aquatic habitat conditions under SLT have the potential to be major. Major impacts would result if populations were certain to be affected by an event. Adverse impacts to aquatic species populations would be certain to lower the reproductive rate of the population and could put the persistence of the species on the Dixie National Forest in an uncertain position. In areas where the aquatic habitat is already degraded from fire effects, further degradation could have long-term impacts that would further impede recovery of these habitats (see Cumulative Effects, Section 5.5). Impacts under SLT would be short to long term and moderate to major, depending on the location of disturbance, present condition of the aquatic habitat, and the severity of the impact.

- *Measurement Indicator #6* INCREASES IN INVASIVE PLANTS

In some riparian areas, tamarisk (*Tamarix ramoissima*), whitetop (*Cardaria draba)*, and Russian olive (*Elaeagnus angustifolia*) are replacing native riparian vegetation such as willows (*Salix* spp.) and cottonwoods (*Populus* spp.). Invasive grasses and species such as rabbitbrush also replace native vegetation and create fewer shaded areas and less stable banks. As a result, higher water temperatures and higher rates of sedimentation characterize the habitat, both of which degrade aquatic habitats from an optimally functioning condition. Impacts from the spread of invasive plants would be long term and minor, because it is unlikely that populations of aquatic species would be affected.

4.5.5 Impacts by Alternative

The degree to which the connected action impacts (Section 4.5.4) would differ by alternative is discussed in this section. Alternatives involve leasing options, which would restrict the locations and the nature of oil and gas impacts that are allowed. In general, impacts are discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the

comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts is highlighted and discussed.

Impacts to migratory birds, aquatic species, and habitat impacts to other wildlife (with no leasing options) are described below. Aquatic species would generally be protected by lease options applied to water and riparian areas (Section 4.7). Sensitive fish habitat carries special leasing options and is discussed in Section 4.6 (Special Status Species). All uses of measurement indicators in the following alternatives comparison follow Section 4.5.4.6: *Measurement Indicator #2* applies to migratory birds, and *Measurement Indicators #3*, *#4*, and *#5* apply only to aquatic species. *Measurement Indicator #1* is discussed for all terrestrial wildlife. *Measurement Indicator #6* applies to native fishes and aquatic species.

4.5.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. Under Alternative A, there would be no adverse impacts to fish and wildlife species or habitats.

4.5.5.2 Alternative B

Chapter 2 of the EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative B (Table 2.5-2) and where those acres are located (Figure 2.5-2a-d). Approximately 75 percent of the Dixie National Forest would not be available for lease (NA) or would have a NL option applied under Alternative B. Of the leasable lands, 20 percent would be NSO and 4 percent would be CSU. As under all alternatives, six percent of the Forest is legally unavailable for leasing (NA).

Noise impacts (*Measurement Indicator #2*) to migratory birds would be negligible because CSU leasing options would be in place that would prevent disturbance to nesting raptors, and other migratory birds of interest (see Appendix D). Habitat disturbance impacts (*Measurement Indicator #1*) to migratory birds would be short to long term and minor because: 1) 1,670 acres of maximum disturbance, over a 15-year period, is relatively small (0.1%) when compared to the amount of habitat available on the Dixie National Forest, and 2), the Migratory Bird Treaty Act requires that the Dixie National Forest conserve populations of migratory birds; thus impacts would likely be minor to moderate (moderate impacts would occur if populations may be affected). Impacts from unintentional take of migratory passerines would be minor. Impacts to other wildlife species (not protected by leasing options or laws) from potential habitat losses (*Measurement Indicator #1*) under Alternative B would be as described under SLT (Section 4.5.4.6): potentially long term and moderate. Long term and moderate impacts would occur to a wildlife species if a production field was developed in suitable habitat and the habitat loss had the potential to affect the species at the population level.

Impacts to fish and aquatic species would be unlikely under Alternative B due to a NL condition on a 300-foot buffer around streams, lakes, reservoirs, and springs and a NSO leasing option to 500-feet around these resources (Section 4.7). NSO buffer zones would not allow use or

occupancy, including road building. Impacts to fish and aquatic species with regard to *Measurement Indicators #3*, *#4*, *#5*, and *#6* under Alternative B would be negligible.

4.5.5.3 Alternative C

Alternative C has less restrictive leasing options than Alternative B and more restrictive options than Alternative D. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative C (Table 2.5-3) and where those acres are located (Figure 2.5-3 (a-d)). Under Alternative C, 76 percent of the Dixie National Forest would be NSO, 11 percent would be CSU, and three percent would be TL from 15 May to 5 July. Six percent would be NA. In addition, linear features (e.g., roads, pipelines) would be allowed as perpendicular stream crossings under NSO.

Impacts to migratory birds would be as described under Alternative B due to CSU leasing options. Impacts to other wildlife species from potential habitat losses (*Measurement Indicator #1*) would also be as described under Alternative B (and as described under SLT; Section 4.5.4.6).

Most potential impacts to fish and aquatic species would be unlikely under Alternative C due to NSO buffer zones that would not allow use or occupancy within 500 feet of streams (see Section 4.7; road crossings would be allowed but not in sensitive fish habitat; see Section 4.6). Impacts to fish and aquatic species with regard to *Measurement Indicators #3,* and *#5* under Alternative C would be negligible. With the exception of sensitive fish habitat under Alternative C, the NSO leasing option would allow for perpendicular stream crossings (*Measurement Indicator #4*; see Section 4.6 for sensitive fish habitat); thus, stream crossing impacts to native, non-sensitive fishes would be as described under SLT (Section 4.5.4.6): long term and minor. Indirect impacts to these fishes with regard to the spread of invasive plants (*Measurement Indicator #6*) would be long term and minor because it is likely that only individuals, and not *populations* of native fishes or other aquatic species, would be affected by the potential spread of invasive plants via seismic activities that may indirectly degrade aquatic habitats.

4.5.5.4 Alternative D1 (NSO in IRAs)

Alternative D has less restrictive leasing options than Alternative C and more restrictive options than Alternative E. Chapter 2 describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative D with NSO/CSU in IRAs (Table 2.5-4) and where those acres are located (Figures 2.5-4 (a-d)). Under Alternative D with NSO in IRAs, 41 percent of the Dixie National Forest would be NSO. Six percent would be NA.

Impacts to raptors in terms of habitat disturbance (*Measurement Indicator #1*) and noise (*Measurement Indicator #2*) would be as described under Alternative B, due to CSU leasing options. The Migratory Bird Treaty Act would be in effect under all alternatives. Therefore, noise impacts to migratory birds would be minor, as populations would not be affected due to compliance with the Act. Habitat impacts for migratory birds would be the same as under Alternative B, potentially long term and minor, because populations would not be affected if key habitats are conserved. Impacts to other wildlife from potential habitat losses (*Measurement Indicator #1*) could be as described under Alternative B: potentially long term and moderate.

Impacts to aquatic species would be more likely under Alternative D1 than Alternatives A to C, because operations under CSU would allow operations to be at a similar proximity to streams as SLT. There would thus be less potential for increase in sedimentation (*Measurement Indicator #3*) under Alternative D, relative to Alternative E. However, the potential for adverse changes to

the aquatic habitat condition (*Measurement Indicator #5*; see Section 4.5.4.6) would be similar. Direct and indirect impacts to aquatic species from stream crossings (*Measurement Indicator #4*) and increases in invasive plants (*Measurement Indicator #6*) would be as described under Alternative C. Overall, impacts to aquatic species under Alternative D would the same as under SLT, potentially major, due to the similar potential for a catastrophic event with operations in close proximity to aquatic habitats.

4.5.5.5 Alternative D2 (CSU in IRAs)

Under Alternative D2, 9 percent of the Dixie National Forest would be NSO. Impacts to fish and wildlife species would be the same as described for Alternative D1 because no areas with assigned leasing options are within IRAs.

4.5.5.6 Alternative E1 (NSO in IRAs)

Alternative E has the least restrictive leasing options. Chapter 2 of this EIS describes how many acres of the Forest would fall under each leasing option under Alternative E1 (Table 2.5-5) and where those acres are located (Figures 2.5-5 (a-d)). Thirty five percent of the Dixie National Forest is within IRAs and would be NSO. Six percent of the Dixie National Forest would be NA.

Impacts to fish and wildlife would be the same as under Alternative E2 with SLT in IRAs because no areas with assigned leasing options are within IRAs. Any fish or wildlife habitat without leasing options that happens to overlap IRAs could only be affected by seismic activities. General impacts to fish and wildlife from seismic activities are described in Section 4.5.3.

Impacts to migratory birds would also be as described under SLT: short to long term, depending on whether exploration (short term) or production activities (long term) took place in suitable habitat, and potentially moderate because a higher number of individual nests could be disturbed and as a result, a relatively higher level of unintentional take could occur. Some impacts to aquatic species (*Measurement Indicators #3* and *#5*) would be as described under SLT (Section 4.5.4.6): long term and moderate to major. Direct and indirect impacts to aquatic species from stream crossings (*Measurement Indicator #4*) and increases in invasive plants (*Measurement Indicator #6*) would be as described under Alternative C.

4.5.5.7 Alternative E2 (SLT in IRAs)

Impacts to fish and wildlife species would be the same as described in Section 4.5.4.6. Under Alternative E2, leasing would be allowed on 94 percent of the Dixie National Forest.

Table 4.5-3 Impacts with respect to Measurement Indicators #1 - #5

Resource		ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
All wildlife (no leasing options or legal protection)	*MI #1*	No effect	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT
Migratory birds	*MI #1*	No effect	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
	MI #2	No effect	negligible ST	negligible ST	negligible ST	negligible ST	minor-mod ST	minor-mod ST
Aquatic species	*MI #3*	No effect	negligible ST-LT	negligible ST-LT	neg-minor ST-LT	neg-minor ST-LT	minor-mod ST-LT	minor-mod ST-LT
	MI #4	No effect	negligible ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
	MI #5	No effect	negligible ST-LT	negligible ST-LT	mod-major ST-LT	mod-major ST-LT	mod-major ST-LT	mod-major ST-LT
	MI #6	No effect	negligible LT	minor LT	minor LT	minor LT	minor LT	minor LT

LT = long term; ST = short term; neg = negligible; mod = moderate

4.6 Special Status Species

4.6.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.6-1 provides an example how these terms would apply to special status wildlife and plant species.

Table 4.6-1 Terms used to Describe Effects to Special Status Species

Attribute of Effect		Description relative to Special Status Species
Quality	Beneficial	An increase in the amount or quality of suitable habitat for a species.
	Adverse	A decrease in the amount or quality of suitable habitat for a species.
Magnitude (Intensity)	Negligible	A modification in habitat amount or quality that is too small to be perceptible by a species. *Example: Loss of 1% or less of available habitat.*
	Minor	A modification in habitat amount or quality that would only affect some individuals of a species and would not affect the reproductive rate of the population. *Example: Loss of 1-10% of available habitat. Example: Increase in invasive plants within suitable habitat.*
	Moderate	A modification in habitat amount or quality that would affect enough individuals of a species that the reproductive rate of the population could be affected. Based on habitat loss (%) as well as other factors. Population decline or a loss of viability would be possible. *Example: Extended noise disturbance that affects many reproducing individuals. Example: Disturbance of breeding/nesting habitat that affects the reproduction of many individuals.*
	Major	A modification in habitat amount or quality that would affect the reproductive rate of a population of a species and is likely to lead to a population decline or loss of viability. *Example: An irretrievable loss of suitable habitat that would affect a population. Example: A hazardous materials spill that renders suitable aquatic habitat unsuitable. Example: Complete loss of important breeding area that supports the population.*
Duration	Temporary	A habitat modification that only occurs during construction of a facility (i.e., road, well pad). Original habitat condition is immediately restored once construction is completed. *Example: Noise disturbance from seismic blasts.*
	Short Term	A habitat modification that occurs during exploration activities (i.e., construction of exploratory well pads or access roads) or that may last for one or a few reproductive seasons. The habitat modification lasts 5 years or less. Original habitat condition would likely be restored within this time frame. *Example: Noise disturbance from exploration activities.*
	Long Term	A habitat modification that occurs during extended exploration activities or during production activities. The habitat modification lasts more than 5 years and original condition may or may not be restored. *Example: Noise disturbance from a production well.*

4.6.2 Measurement Indicators

- *Measurement Indicator #1* ACRES OF DIRECT DISTURBANCE OF HABITAT AND INDIRECT HABITAT LOSS AS COMPARED TO AVAILABLE HABITAT
- *Measurement Indicator #2* NARRATIVE DISCUSSION ON POTENTIAL EFFECTS RELATED TO FRAGMENTATION OF EXISTING HABITATS AND POPULATIONS.
- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS
- *Measurement Indicator #4* ROAD DENSITY BY SUBWATERSHED (6TH LEVEL HUC)
- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS
- *Measurement Indicator #6* IMPACTS DETERMINATIONS (BA AND CHANGES IN VIABILITY FOR SENSITIVE SPECIES)
- *Measurement Indicator #7* COMPLIANCE WITH UDWR POPULATION OBJECTIVES
- *Measurement Indicator #8* COMPLIANCE WITH FISHERIES CLASSIFICATION SYSTEM (UTAH) FOR STREAMS
- *Measurement Indicator #9* COMPLIANCE WITH LAND AND RESOURCE MANAGEMENT PLAN STANDARDS AND GUIDELINES FOR MIS

4.6.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E, it is assumed that activities described under the RFDS would occur. Activities described under the RFDS include 60 to 120 acres (depending on ranger district) of overland travel associated with seismic surveys, 80 to 330 acres (depending on ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field. The locations of these activities are not yet known. Section 4.5 contains a discussion of general impacts to wildlife and fisheries related to oil and gas activities (i.e., seismic, exploration, road building, and production).

Like other wildlife species, impacts to Forest-sensitive species associated with oil and gas generally include a direct loss of habitat in addition to behavioral avoidance of a larger area around the direct disturbance, due to human presence and noise. The amount of habitat lost to human presence and noise depends on the species' tolerance of such disturbances. Nesting spotted owls and other raptors, for example, are relatively sensitive to noise. Continuous noise disturbances, such as from the initial drilling of a well, would create a larger avoidance zone than would noise created by seismic surveys, which involve short blasts. Invasive species proliferations may also result from oil and gas disturbances, which could remove large areas of suitable habitat for sensitive species (mainly sagebrush). It is important to note, however, that leasing options assigned to sensitive species and habitats are intended to prevent these and the other adverse impacts described above.

Impacts to TEC species associated with oil and gas include 1) direct habitat loss and degradation from surface disturbance; 2) indirect habitat loss, such as infestations of invasive species that degrade habitat after the disturbance has occurred and erosion on steeper slopes: and 3) direct disturbance to species from oil and gas related activities The direct disturbance (killing) of TEC species from oil and gas-related activities would be highly unlikely and would be avoided with pre-construction surveys and avoidance measures at the site-specific development

stage. Lease notices described in Appendix D would be issued wherever leases are proposed within a threatened or endangered species' suitable habitat. A Biological Assessment (BA) was completed for oil and gas leasing (this EIS) and, in addition, additional BAs would be completed under a separate process at the time future activities are proposed. Each BA would disclose all potential impacts to TEC species and ensure compliance with the Endangered Species Act.

The USFWS determined in their Biological Opinion that connected actions May Affect, and are Likely to Adversely Affect (MA-LAA) California condor (in the Pine Valley Ranger District), Utah prairie dog, and Mexican spotted owl. These determinations are due to the unknown extent, timing, and location of connected actions. On suitable habitat for California condor outside of the Pine Valley Ranger District, connected actions would not jeopardize the experimental and non-essential population. Virgin River chub, woundfin, and Mojave desert tortoise were not analyzed in the BA or Biological Opinion because consultation with the USFWS determined there is no suitable habitat for these species on the Dixie National Forest.

This section of the EIS also discloses all potential impacts to Forest Service Sensitive species from connected actions to leasing. Compliance with the Land and Resource Management Plan (USFS 1986) in terms of potential impacts to MIS (and with regard to *Measurement Indicator #8*) is discussed at the end of Section 4.6.4.7.

Table 4.6-2 lists the leasing options by special status species, for each alternative. Leasing options are described in Section 4.6.5.

Table 4.6-2 Leasing options by Alternative for Special Status Species

Resource	Alternative				
	A	B	C	D	E
TEC					
Threatened, endangered, and candidate species and suitable habitat	NL	LN	LN	LN	SLT
California condor (Experimental/Nonessential) rim habitat	NL	CSU-19	CSU-19	TL-04 Feb 1 – Aug 31	SLT
California condor (Endangered) rim habitat and nest/roost sites	NL	LN	LN	LN	SLT
Utah prairie dog colonies	NL	NSO-13	NSO-13	NSO-13	SLT
Designated Critical Mexican spotted owl habitat	NL	NL	LN	LN	SLT
Potential Mexican spotted owl habitat	NL	CSU-15	CSU-15	CSU-15	SLT
Mexican spotted owl PAC	NL	NSO-12	NSO-12	CSU-14	SLT
Sage grouse leks (with 2-mile buffer)	NL	NL	NSO-09	NSO-10 (1-mile buffer)	SLT
Sage grouse brood-rearing habitat	NL	NL	CSU-09	TL-01 May 1 – July 15	SLT
USFS-Sensitive and MIS					
USFS-Sensitive species and suitable habitat	NL	NSO-16	CSU-20	CSU-20	SLT
Fisheries habitat (USFS-Sensitive species; Occupied and Suitable)	NL	NL 500 ft	NSO-17 500 ft	CSU-21 300 ft	SLT
Pygmy rabbit habitat	NL	NSO-16	CSU-20B	CSU-20B	SLT

Resource	Alternative				
	A	B	C	D	E
(60,752 acres)					
USFS-Sensitive bat habitat	NL	NSO-16	CSU-20A	CSU-20A	SLT
Boreal toad habitat	NL	NSO-16	CSU-20D	CSU-20D	SLT
Goshawk nest areas	NL	NSO-11 0.5-mile radius	NSO-11 0.5-mile radius	CSU-12 0.3-mile radius	SLT
Goshawk PFA	NL	CSU-13	CSU-13	CSU-13	SLT
Peregrine falcon nests(1-mile radius)	NL	NSO-15	NSO-15	CSU-18	SLT
Peregrine falcon rim habitat	NL	CSU-19	CSU-19	TL-04 Feb 1 – Aug 31	SLT
Bald eagle winter concentration areas	NL	NSO-14	NSO-14	CSU-17	SLT
Bald eagle nests (0.5-mile radius)	NL	LN	LN	LN	SLT
Flammulated owl habitat	NL	NSO-16	CSU-20C	CSU-20C	SLT
USFS-Sensitive plant species and suitable plant habitat	NL	NSO-27	CSU-27	LN	SLT
Crucial and substantial elk and mule deer winter range	NL	NL	CSU-10	TL-02 Dec 1 – April 1	SLT
Crucial elk and mule deer summer range	NL	NL	TL-03 May 15 – July 5	TL-03 May 15 – July 5	SLT

4.6.4 Impacts of Connected Actions by Leasing Option

Leasing options would dictate the conditions under which impacts from connected actions (described under the RFDS) may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to special status species considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.6.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the BLM and USFS *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.6.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing is being considered in these areas and no disturbance to special status species in these areas would occur. This leasing option does not apply directly to any special status species resource component.

4.6.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing. No disturbance to special status species would occur under NL. Under Alternative A, NL would apply to all special status species with assigned

leasing options (listed in Table 4.6-2), and would also apply to Designated Critical Mexican Spotted Owl Habitat, Fisheries Habitat, Sage-Grouse Leks, Sage-Grouse Brooding Habitat, and Big Game Summer and Winter Range under Alternative B. Because no leases would be authorized under NL, there would be no disturbance related to oil and gas activities and thus no direct or indirect impacts to any special status species covered by this leasing option.

4.6.4.3 No Surface Occupancy (NSO)

With the exception of seismic activities, NSO would prohibit occupancy of the land for oil and gas related activities (e.g., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). Excluding those related to seismic activities, no disturbance to special status species from other exploratory or production activities would occur under NSO. Furthermore, it is unlikely that the Dixie National Forest would authorize seismic activities in a TEC/Sensitive species habitat during a critical period if the species was known to be present. Pre-construction surveys would determine the presence or absence of TEC/Sensitive species with reasonably certainty. The following impact analysis speaks to the small but inevitable fraction of individuals not detected by the Agency prior to authorizing seismic surveys.

Under Alternatives B, C, or D, NSO would apply to Utah Prairie Dog Colonies, Mexican Spotted Owl Protected Activity Centers (PACs), Fisheries Habitat; Sensitive Bat Habitat, Boreal Toad Habitat, Bighorn Sheep Habitat, Goshawk Nest Areas, Sage-Grouse Leks, Peregrine Falcon Nests, Bald Eagle Winter Concentration Areas, and TESP Plant Habitat (see Table 4.6-2).

Under Alternative C, perpendicular stream crossings allowed in Streams, Wetlands, Floodplains, and Riparian Areas (see Section 4.7 – “NSO with Road Crossings”) would not be allowed within Fisheries Habitat, which is defined as all occupied and suitable habitat for sensitive fish species. Sensitive fish species on the Dixie National Forest include Bonneville and Colorado cutthroat trout, and southern leatherside. A 500-foot NSO buffer around Fisheries Habitat streams under Alternative C is intended to provide a buffer large enough to avoid the increased possibility of spills or other accidents under SLT that could adversely affect streams. The only disturbance that could occur within the 500-foot buffer under NSO would be seismic exploration. The impacts of seismic exploration to streams, wetlands, floodplains, and riparian areas include a small potential for increased erosion and pollutant spills. Spills in this situation could only come from equipment used for the seismic surveys and would be limited to small quantities of fuel, coolant, or lubricants. The impacts of both these disturbances are described in detail in Section 4.7.4.6.

Impacts under NSO with regard to applicable measurement indicators are described below. *Measurement Indicator #1* (habitat loss) is discussed for all species; *Measurement Indicator #2* (Fragmentation of Habitat) is not discussed under NSO (except for boreal toad outside Fisheries Habitat, due to stream crossings) because seismic activities do not result in complete vegetation removal and only result in narrow disturbance footprints; fragmentation of habitat is thus unlikely to occur as a direct result of seismic activities allowed under NSO. An exception may be if seismic surveys increase the incidence of invasive plants within identified habitats, the area may be at increased risk of wildfire, which could fragment habitat (see Cumulative Impacts, Section 5.6). *Measurement Indicator #3* (Number of Visits and Noise Levels) is discussed for all TEC species except endangered fishes, as well as Pygmy Rabbit Habitat, Sage-Grouse Leks, and Active Raptor Nests. *Measurement Indicator #6* (USFWS effects determinations) is presented at the end of Section 4.6.5. *Measurement Indicator #5* (invasive plants) is discussed for all species.

Table 4.6-3 Impacts under NSO with regard to Measurement Indicators #1, #3, and #5

Resource Component	*MI #1 Habitat loss*	*MI #3 Noise*	*MI #5 Invasive plants*
TEC			
Utah prairie dog colonies	If seismic activities occurred, activities could impact 120 acres of colony area within the buffer (<1% of available). Impacts short term and minor because small area of disturbance would probably only affect individuals and take from seismic activities is unlikely.	If seismic activities occurred, seismic activities would temporarily interrupt communications and individuals may be more susceptible to predator attacks. Impacts temporary and minor to moderate depending on how many individuals are affected.	If seismic activities occurred, activities may introduce invasive plants that, in some cases would reduce the value of forage for Utah prairie dogs. Impacts could be long term because natives are unlikely to reestablish, and minor because only individuals in some areas would be affected.
Mexican spotted owl PAC	If seismic activities occurred, activities could impact 120 acres of habitat (16% of available). Impacts short term and minor because disturbed vegetation would regenerate within one year.	If seismic activities occurred, seismic activities would cause impacts between March 1 and August 31 if spotted owls were nesting within a 0.5-mile radius. If impacts to nesting owls occurred, which is unlikely considering surveys would be conducted before activities were authorized, impacts would be short term and moderate because reproduction would be affected for one season. Seismic activities may cause displacement of roosting owls; these impacts would be negligible to minor and short term because roosting owls would return following the temporary disturbance.	If seismic activities occurred, buggy surveys could introduce invasive plants that may adversely impact prey habitat on mesa tops where Mexican spotted owls forage. Invasive plants do not provide the same forage quality for prey species as natives and adverse changes in vegetation composition may lead to a decrease in the prey base for Mexican spotted owl. Indirect impacts would be long term and minor because owl reproduction would not be affected.
Sage grouse leks	If seismic activities occurred, seismic activities could impact 60-120 acres of habitat (0-4% of available). Impacts short term and minor because habitat removal would occur outside the lekking period and seismic disturbance would not be severe enough to affect subsequent lekking activities.	Seismic blasts would not be allowed during the lekking period, so there would be no noise impacts. Impacts negligible.	If seismic activities occurred, invasive plants may spread; impacts could be long term (see TL). Impacts would be minor because only individuals would be affected (see TL).

Resource Component	*MI #1 Habitat loss*	*MI #3 Noise*	*MI #5 Invasive plants*
USFS-Sensitive			
Fisheries habitat	If seismic activities occurred, activities would not impact stream habitat (stream crossings not allowed) and a riparian buffer would be in place. Impacts negligible.	Not applicable	If seismic activities occurred, activities may introduce invasive plants that would degrade the aquatic habitat (see CSU). Indirect impacts would be long-term and moderate because populations could be affected, as described for CSU (below).
Pygmy rabbit habitat	If seismic activities occurred, activities could impact 60-120 acres of habitat (0-1% of available). Impacts short term and negligible to minor due to the small area of disturbance relative to available habitat.	If seismic activities occurred, seismic blast impacts would be temporary and minor because pygmy rabbits would be unlikely to abandon their burrows. Reproductive rates would not be affected.	If seismic activities occurred, invasive plants may spread; impacts could be long term (see CSU). Impacts would be moderate because pygmy rabbit populations are so limited on the Forest.
Sensitive bat habitat	If seismic activities occurred, activities could impact 60-120 acres of habitat (9-40% of available). Impacts minor and short term because impacts would most likely be to foraging habitat and would affect only some individuals.	If seismic activities occurred, seismic blast impacts may disturb many individual bats but not populations and would not affect reproduction because noises would be temporary. Impacts to bats would be minor.	If seismic activities occurred, buggy surveys could introduce invasive plants that may adversely impact prey habitat where bats forage. Adverse changes in vegetation composition within prey habitat may lead to a decrease in the prey base. Indirect impacts would be long term and minor because reproduction would not be affected.
Boreal toad habitat	If seismic activities occurred, activities could impact 60-120 acres of terrestrial and aquatic habitat (2% of available). The riparian buffer would prevent impacts to aquatic boreal toad habitat under NSO. Impacts minor and short term due to seismic disturbance of a relatively small proportion of the available terrestrial habitat for boreal toad.	Not applicable.	As described for fisheries habitat, if seismic activities occurred, activities may introduce invasive plants that would degrade the aquatic habitat (see CSU for sensitive fishes). Indirect impacts would be long term and moderate.

Resource Component	*MI #1 Habitat loss*	*MI #3 Noise*	*MI #5 Invasive plants*
Goshawk nest areas	If seismic activities occurred, activities could impact 60-120 acres of habitat (0-4% of available). Impacts negligible to minor due to the small area of disturbance relative to available habitat.	Seismic blasts may cause temporary impacts to roosting raptors that would return to the roost following the blast. Impacts to roosting raptors would be negligible because individuals would only be temporarily affected.	If seismic activities occurred, buggy surveys could introduce invasive plants that may adversely impact prey habitat where raptors forage. Invasive plants do not provide the same forage quality for prey species as natives and changes in vegetation composition may lead to a decrease in the prey base for raptors. Indirect impacts would be long term and minor because raptor reproduction would not be affected.
Peregrine falcon nests	If seismic activities occurred, activities could impact 60-120 acres of habitat (1% of available). Impacts negligible to minor due to the small area of disturbance relative to available habitat.		
Bald eagle wintering habitat	If seismic activities occurred, activities could impact 60-120 acres of habitat (2-7% of available). Impacts negligible to minor due to the small area of disturbance relative to available habitat.		
Sensitive plant habitat and locations	If seismic activities occurred, activities could impact 60-120 acres of habitat (0-1% of available). Impacts negligible to minor due to the small area of disturbance relative to available habitat and the likelihood that sensitive plant populations could be avoided.	Not applicable	Seismic activities could introduce invasive plants that would directly compete with sensitive plants and reduce the area and resources available for sensitive species. Invasive species are likely to replace native plants if both are present. These impacts would be long term and minor to moderate, depending on the sensitive plant species and amount of suitable habitat.

FISHERIES HABITAT

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Stream crossings are not allowed under NSO in sensitive Fisheries Habitat, thus impacts from fragmentation of aquatic habitat would be negligible.

BOREAL TOAD HABITAT

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Fragmentation would occur outside Fisheries Habitat, where road crossings are allowed. Fragmentation impacts outside Fisheries Habitat would be as described in Section 4.6.4.7.

4.6.4.4 Timing Limitation (TL)

A TL leasing option prohibits surface activities during specified time periods, and so would avoid direct and indirect impacts to special status species during sensitive periods, such as on a seasonal habitat for a particular species during the season of use. This leasing option does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation, and that less stringent, project-specific mitigation measures would be insufficient.

Timing Limitations (see Table 4.6-2) would apply directly to California condor rim habitat under Alternative D. Regarding USFS-Sensitive species, Timing Limitations would apply directly to sage grouse brooding habitat, peregrine falcon rim habitat, and big game winter and summer range. Impacts to these species under TL with regard to applicable measurement indicators are described in Table 4.6-4 and below. *Measurement Indicator #1* (habitat loss), *Measurement Indicator #2* (fragmentation of habitat), and *Measurement Indicator #3* (noise) are discussed for all species. *Measurement Indicators #4* and *#7* (Road Density and Compliance with UDWR population objectives) are discussed below with regard to big game. Refer to Appendix D for descriptions of each TL.

Table 4.6-4 Impacts under TL regarding Measurement Indicators #1-#3

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
TEC			
California condor rim habitat (Experimental/ Nonessential)	Oil and gas activities could still occur outside the TL (September 1 – January 31), thus habitat disturbance impacts would be as described under SLT.	If oil and gas activities occurred in rim habitat outside the TL, rim habitat could be disturbed for the long term and reduce the larger area of undisturbed habitat that is available for California condors. Condor habitat areas would be less continuous, with smaller undisturbed tracts, during and after oil and gas disturbances. Fragmentation impacts would be long term and minor.	If oil and gas activities occurred in rim habitat, TL would decrease the likelihood that nesting condors would be disturbed by noise. Condors may nest on the Dixie National Forest in the future, although none have been observed to date. Noise impacts to nesting condors under the TL would be negligible. Roosting condors may still be affected by noise outside of the TL period within a one-mile radius and may be displaced from cliffs by noise disturbances; these impacts would be short term and minor.
Sage grouse brood rearing habitat	Oil and gas activities outside the TL could disturb up to 21% of available habitat. Impacts short to long term, depending on the activity, and moderate because reproduction could be affected by a reduced amount of suitable habitat.	If oil and gas activities occurred in sage grouse brood rearing habitat, roads or linear disturbances constructed outside the TL period could fragment sage grouse brooding habitat by narrowing or blocking migration corridors; these impacts would likely be short to long term, depending on the activity, and minor because.	If oil and gas activities occurred in sage grouse brood rearing habitat, noise disturbances from oil and gas activities outside the TL would not disturb sage grouse. Impacts negligible to minor.
USFS-Sensitive			
Peregrine falcon rim habitat	Oil and gas activities outside the TL could disturb up to 1% of available habitat. Impacts short to long term, depending on the activity, and negligible to minor due to the relatively small amount of disturbance relative to the available habitat.	If oil and gas activities occurred within one mile of rim habitat, foraging areas for peregrine falcon would be reduced and territories may become less suitable. Individuals may be forced into less	If oil and gas activities occurred in rim habitat, noise disturbances from oil and gas activities outside the TL would not disturb nesting birds. Impacts negligible to minor.

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
		suitable territories that contain fewer prey species or a different community of other raptors that may be more competitive for prey items or that may prey directly on peregrine falcons. Fragmentation impacts would be long term and minor.	
Crucial and Substantial big game winter range	Oil and gas activities outside the TL could disturb up to 2% of the winter range in any one ranger district. Impacts short to long term, depending on the activity, and minor due to the relatively small amount of disturbance relative to the available habitat.	Fragmentation impacts would be as described under SLT.	If oil and gas activities occurred in winter range habitat, noise disturbances from oil and gas activities outside the TL would not cause adverse effects. Impacts negligible.
Crucial big game summer range	Oil and gas activities outside the TL could disturb up to 4% of the summer range in any one ranger district. Impacts short to long term, depending on the activity, and minor due to the relatively small amount of disturbance relative to the available habitat.	Fragmentation impacts would be as described under SLT.	If oil and gas activities occurred in summer range habitat, noise disturbances from oil and gas activities outside the TL would not cause adverse effects. Impacts negligible.

Measurement Indicators

SAGE GROUSE BROOD REARING HABITAT

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Seismic activities would be the most likely to spread invasive plants due to their linear nature and the relatively long distances covered during these activities. The spread of invasive plants would reduce the amount of functional habitat for sage grouse brood rearing as they could replace native sagebrush plants that provide effective food, shelter, and temporary cover for sage grouse. Impacts from the spread of invasive plants could be long term because the replacement of sagebrush within sage grouse habitat would diminish the functionality of this habitat for the long term. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. If weeds were to spread in sage-grouse habitat, impacts would be minor because the reproductive rate of the population would not be affected.

BIG GAME WINTER AND SUMMER RANGE

- *Measurement Indicator #4* ROAD DENSITY INCREASES

An increase in temporary oil and gas roads outside the TL period would have the same impacts as described under SLT. If road density increased within a subwatershed with currently high Open Motorized Road Density (OMRD), impacts could occur because habitat would be measurably less effective in providing a safe and isolated area for big game to move within. Impacts to big game from oil and gas roads could be moderate because if a road crossed a seasonal migration corridor and reduced the effectiveness of the habitat, a large number of individuals would be affected. The reproductive rate of the population could also be affected by a road density increase if the security of the population was compromised by the road and became less suitable as a fawning or calving area (see SLT).

- *Measurement Indicator #7* COMPLIANCE WITH UDWR POPULATION OBJECTIVES

Compliance with UDWR population objectives would be the same as described under SLT. Impacts would be negligible because big game populations are currently above objectives and not at risk.

4.6.4.5 Controlled Surface Use (CSU)

CSU provides for controlled but generally allowed surface use, including exploration and development, on all or portions of a lease. Operations would be held to special operational constraints that may otherwise exceed the mitigation provided by SLT, regulations, and operating orders. With regard to special status species, CSU leasing options would ultimately allow Agencies (e.g., a Dixie National Forest biologist) to control where and when oil and gas activities occurred within a desired area/lease.

Under Alternatives B, C, and D, a CSU would apply to potential Mexican spotted owl habitat. Under Alternative D a CSU would apply to Mexican spotted owl PACs, and under Alternatives C and D, a CSU would apply to California condor rim habitat. Regarding Sensitive species, CSU leasing options would apply to fisheries habitat, pygmy rabbit habitat, sensitive bat habitat, goshawk nest areas, goshawk PFAs, sage grouse brooding habitat, peregrine falcon rim habitat, bald eagle winter concentration areas, flammulated owl habitat, TESP plant habitat, and big game winter range under at least one alternative (see Table 4.6-2).

Impacts to these species under CSU with regard to applicable measurement indicators are described below. Refer to Appendix D for descriptions of each CSU.

Table 4.6-5 Impacts under CSU with regard to Measurement Indicators #1-#3

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
TEC			
Potential Mexican spotted owl habitat	If oil and gas activities occurred in potential habitat, habitat losses would occur and impacts would be as described under SLT. Due to the large amount of potentially suitable habitat	If oil and gas activities occurred within potential habitat, fragmentation impacts would be as described under SLT.	If oil and gas activities occurred in potential habitat and if Mexican spotted owls are not detected (and are present), noise impacts would occur. The most likely use of “potential” habitat by spotted owls is

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
	available on the Dixie, impacts from a loss of up to 706 acres of potential, unverified habitat would be short term and minor.		for foraging or roosting, and impacts to foraging or roosting habitat from noise would be negligible to minor and short term. Impacts would be minor because temporary displacement in foraging or roosting habitat would not affect the reproductive rates of owls and would only affect a few individuals if the impact occurred. Impacts would be moderate if nesting owls in potential habitat were disturbed. Impacts to nesting owls, however, would be short term because only one reproductive season would be affected.
California condor rim habitat (Experimental/ Nonessential)	If oil and gas activities occurred in rim habitat under the CSU, activities would disturb up to 706 acres, depending on the ranger district, which could affect <1% percent of suitable rim habitat for California condor. Impacts would be negligible.	Fragmentation impacts to California condor would be long term and minor as described under TL.	If oil and gas activities were proposed in rim habitat under the CSU, surveys would be conducted in rim habitat. If nesting condors are present but not located, impacts would be moderate and short-term because impacts would last for one season. Outside the restriction period, undetected roosting condors within a one-mile radius may be displaced from cliffs by noise disturbances; these impacts could be short term and minor.

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
Sage grouse brood rearing habitat	If oil and gas activities occurred in sage grouse brooding habitat under the CSU, less than 1% of available habitat could be disturbed outside of the TL. Impacts short to long term depending on the activity and moderate because despite the relatively small amount of disturbance relative to the available habitat, sage-grouse brood rearing habitat is limited on the Dixie and even small disturbances could potentially impact reproduction of many individuals.	If oil and gas activities occurred in sage grouse brooding habitat under the CSU, because less habitat could be disturbed, fragmentation impacts would be of lower intensity than under SLT. Impacts minor and short to long term depending on the activity.	If oil and gas activities occurred in sage grouse brooding habitat under the CSU, oil and gas activities would be restricted during the brooding period. Noise disturbances from oil and gas activities outside this TL (see Appendix D) would not disturb sage grouse during the brooding period. Impacts negligible.
USFS-Sensitive			
Fisheries habitat	Impacts as under SLT	Impacts as under SLT	Not applicable
Sensitive bat habitat	If oil and gas activities occurred in sensitive bat habitat, activities could disturb up to 100% of available habitat in some ranger districts. No disturbance would occur near cave entrances or winter hibernacula due to CSU; impacts short to long term depending on the activity and minor because only foraging habitat is likely to be lost, which would not affect the reproductive rate of populations.	If oil and gas activities occurred within sensitive bat habitat, foraging areas for bats would be reduced. Individuals may be forced into less suitable areas that contain fewer prey species or more bats, or a greater number of predators. The CSU would allow the Dixie National Forest to restrict activities such that major disturbances did not occur during the hibernation period. Fragmentation impacts would be long term and minor because reproduction would not be affected.	If oil and gas activities occurred in sensitive bat habitat, noise disturbances to sensitive bats would not occur under CSU because activities in the vicinity of caves or hibernacula would be restricted. Impacts limited to those from seismic activities, would be temporary and minor.
Pygmy rabbit habitat	If oil and gas activities occurred in pygmy rabbit habitat under the CSU, colonies	If oil and gas activities occurred in pygmy rabbit habitat, up to 8% of suitable habitat could be	If oil and gas activities occurred in pygmy rabbit habitat some noise disturbances to pygmy

Resource Component		MI #1 Habitat loss	MI #2 Fragmentation	MI #3 Noise
		would be protected but up to 8% of available suitable habitat could be disturbed. Impacts short to long term depending on the activity and minor due to the relatively small amount of disturbance relative to the available habitat.	disturbed and these disturbances could reduce larger areas of suitable habitat such that the remaining portions may be unsuitable for pygmy rabbit. Impacts would be as described under SLT.	rabbits could occur because activities would be allowed; however, activities around colonies would be restricted under CSU and noise disturbances that do occur would be unlikely to cause pygmy rabbits to leave their burrows. Only some individuals may be affected by noise; therefore, impacts would be minor, and short to long term depending on the activity.
Boreal toad habitat		Impacts as under SLT	Impacts as under SLT	Not applicable
Raptor habitat	Goshawk nest areas	Impacts in terms of habitat loss would be as described under SLT.	If oil and gas activities occurred within a 0.5-1 mile radius of nesting habitat for raptors, foraging areas would be reduced and previously suitable home ranges may become less suitable. Raptors may be forced into areas that contain fewer prey species or a different community of other raptors that may be more competitive for prey items or that may prey directly on sensitive raptors species. Fragmentation impacts would be long term and minor because the CSU would allow the Dixie National Forest to restrict activities that would directly affect reproduction and nesting success	If oil and gas activities occurred in raptor habitat noise disturbances outside the TL that is part of CSU for these resource components would not disturb nesting birds. Disturbance to nesting birds would be negligible.
	Goshawk PFA			
	Peregrine falcon “rim”			
	Bald eagle (winter)			
	Flammulated owl			
Sensitive plant habitat and locations		If oil and gas activities occurred in sensitive plant habitat under the CSU, plant populations that are essential to the persistence of the species would likely	Fragmentation impacts would be as described under SLT.	Not applicable

Resource Component	*MI #1 Habitat loss*	*MI #2 Fragmentation*	*MI #3 Noise*
	be avoided. Impacts would be minor to moderate and long term because plants may still be disturbed by oil and gas activities and small populations could be affected.		
Crucial and substantial big game winter range	If oil and gas activities occurred in big game winter range habitat under the CSU, less than 2,500 acres could be disturbed by oil and gas activities (which include a 0.25-mile radius around actual disturbance) outside of the TL. Impacts short to long term depending on the activity and negligible to minor due to the relatively small amount of disturbance relative to the available habitat.	Fragmentation impacts would be as described under SLT, although of lesser intensity because less habitat could be disturbed. The Forest would have some leverage as to where roads were allowed so as to prevent impacts to big game populations. Fragmentation impacts would be long term and moderate under the CSU.	If oil and gas activities occurred in winter range habitat, noise disturbances outside the TL that is part of CSU for this resource component would not disturb big game during winter. Impacts negligible.

MEXICAN SPOTTED OWL PAC

A CSU leasing option in PACs would require a monitoring review prior to oil and gas activities, and NSO within the PAC, thus impacts to this species regarding *Measurement Indicator #1* (Acres of Habitat Disturbance), and *Measurement Indicator #3* (Number of Visits and Noise Levels) would be as described under NSO.

POTENTIAL MEXICAN SPOTTED OWL HABITAT

A CSU leasing option in "potential, unverified" habitat would require a site validation visit to assess habitat suitability, followed by owl surveys if the habitat is suitable. If owls are found during surveys, impacts to this species would be as described under NSO (for PACs, described above) as only seismic activities would be allowed.

CALIFORNIA CONDOR RIM HABITAT

A CSU leasing option in California condor rim habitat would require surveys on suitable habitat during the nesting season: February 1 to August 31. If active or occupied territories are found, an NSO or CSU leasing option (following leasing options for peregrine nests) would apply, depending on the alternative (see Table 4.6-2). ESA guidance would be followed for condors in the Pine Valley Ranger District.

FISHERIES AND BOREAL TOAD HABITAT

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

In some riparian areas, tamarisk (*Tamarix ramoissima*), whitetop (*Cardaria draba)*, and Russian olive (*Elaeagnus angustifolia*) are replacing native riparian vegetation such as willows (*Salix* spp.) and cottonwoods (*Populus* spp.). Invasive grasses and species such as rabbitbrush also replace native vegetation and create fewer shaded areas and less stable banks. As a result, higher water temperatures and higher rates of sedimentation characterize the invaded habitat, both of which make habitat less suitable for sensitive fish species and boreal toads that require healthy riparian vegetation, intact streambanks, and cold, clear water to spawn in the case of fish. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Indirect impacts from the spread of invasive species into aquatic habitats, if they occurred, would be long term and moderate, because populations of sensitive fishes and boreal toads may be affected if streambank vegetation is degraded. Impacts under CSU would be of this magnitude because seismic activities are allowed (as under NSO) and have the greatest potential to spread invasive species (see Section 4.9). Adverse impacts from the spread of invasive plants in aquatic habitat could be long term because the functionality of this habitat would be diminished for an indefinite period.

SAGE GROUSE BROOD REARING HABITAT

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under CSU, oil and gas activities could spread noxious weeds outside of the sensitive period for controlled surface use. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. As under TL for sage grouse, the spread of invasive plants would reduce the amount of functional sagebrush habitat used by this species. Impacts from the spread of invasive plants within sage grouse habitat would be minor and long term for reasons described under TL (for sage grouse).

PYGMY RABBIT HABITAT

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under CSU, oil and gas activities could spread noxious weeds outside of the sensitive period for controlled surface use. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. The spread of invasive plants would reduce the amount of functional sagebrush habitat for pygmy rabbit because brome grasses are not as nutritious a forage plant and cannot provide shelter or cover for pygmy rabbits, and increase in the threat of catastrophic wildfire. Impacts from the spread of invasive plants within pygmy rabbit habitat would be moderate and long-term because the functionality of this habitat would be diminished for the long term. Impacts would be moderate because there is only one known population of pygmy rabbits on the Dixie and reduced functionality of the habitat where they occur could lead to adverse reproductive effects to this local population.

BIG GAME WINTER RANGE

- *Measurement Indicator #4* ROAD DENSITY INCREASES

The addition of oil and gas roads could occur under CSU as under SLT (below) and TL (above): However, the CSU would give the Forest leverage as to where these roads are placed such that major impacts to big game populations would be avoided. Impacts from road density increases under the CSU would be moderate and long term.

- *Measurement Indicator #7* COMPLIANCE WITH UDWR POPULATION OBJECTIVES

Compliance with UDWR population objectives would be the same as described under SLT (below) and for TL (above): negligible.

4.6.4.6 Lease Notice (LN)

A lease notice provides more detailed information concerning existing limitations, regulations, or orders, or addresses special considerations. A LN does not impose new restrictions on oil and gas activities and would be attached to leases regardless of other leasing options.

A LN would be attached to any lease in the vicinity of a Threatened or Endangered species or its habitat, bald or golden eagle, or migratory bird habitat. This is the case for any lease within Dixie National Forest lands regardless of leasing options. The LN would list avoidance or minimization measures specific to each Threatened or Endangered species, bald or golden eagle, or migratory bird that may occur in the vicinity.

Endangered/Threatened/Candidate Species – In order to comply with the Endangered Species Act, surveys for Threatened or Endangered species would be conducted in any area leased for oil and gas exploration that occurs within or near suitable habitat. The Endangered Species Act prohibits destruction or "take" of a Listed species and significant modifications to its habitat. Surveys would be conducted and at the time operations are proposed in a specific location, a BA specific to that lease would be submitted to the USFWS disclosing the impacts to Threatened or Endangered species that may occur as a result of oil and gas activities. Also at this time, consultation would occur between the Dixie National Forest and the USFWS, and a Biological Opinion rendered regarding mitigations necessary to offset incidental take that may occur as a result of lawful operations by the lease holder.

Bald eagle winter concentration areas and bald eagle nests – A lease notice (LN) would be attached to any lease that occurred in the vicinity of winter concentration areas for bald eagle or known bald eagle nests. This is the case for any lease within Dixie National Forest lands regardless of leasing options. The purpose of the LN in this case is to ensure compliance and to notify the operator of the Bald and Golden Eagle Protection Act, which prohibits take (including disturbance) of bald eagles, and the Migratory Bird Treaty Act, which prohibits take of migratory birds, including raptors. The LN would list avoidance or minimization measures specific to bald eagle nests that may occur in the vicinity. Specifically, a 0.5-mile buffer would be applied around any active bald eagle nest, within which surface-disturbing activities would be prohibited. In order to comply with the Bald and Golden Eagle Protection Act, surveys for bald eagles would be conducted in any area leased for oil and gas exploration that occurs within or near suitable bald eagle habitat. The Bald and Golden Eagle Protection Act prohibits take, possession, and commerce of bald and golden eagles; so to comply with the Act, oil and gas activities would not be allowed in the vicinity of active nests or concentration areas.

Migratory Birds – A lease notice would be attached to any lease within the nesting season for migratory birds. This is the case for any lease within Dixie National Forest lands regardless of leasing options. The purpose of the LN in this case is to ensure compliance with the Migratory Bird Treaty Act and Executive Order 13186. The lease notice would notify the operator of the Migratory Bird Treaty Act, which prohibits take (including disturbance) of migratory birds. Direction from the USFWS regarding migratory birds on USFS lands, however, states that activities occurring within migratory bird habitats should "minimize direct take of individual migratory birds when feasible." Since conservation of populations is emphasized, a low level of incidental take is assumed. The LN would list avoidance or minimization measures specific to migratory bird nests that may occur in the vicinity. Mitigations would ultimately be determined

by the Dixie National Forest biologist on a case-by-case basis if migratory bird nests are encountered.

4.6.4.7 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT), the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2, and the BMPs listed in Section 4.6.4. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

All leaseholders would be required to comply with the Endangered Species Act under SLT (see Lease Notice). Under Alternative E, SLT would apply directly to all special status species resource components as the default leasing option. All leaseholders would be required to comply with the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act under SLT (see Lease Notice).

In general, disturbance to all fish and wildlife habitats, including special status species, would be "minimized" under SLT, avoiding "unreasonable or unnecessary disturbances during construction of pads, access, and other facilities, and during operations." Disturbed terrestrial habitat would be reshaped and re-vegetated after use. Roads and drainage structures would be located to "minimize impacts on water quality," such as "on benches upslope from streams, lakes, ponds, riparian areas and floodplains" (Appendix C). A SPCC Plan would be approved before operations are authorized, and sediment control structures would be used at the base of fill slopes. Regarding potential noise disturbances to wildlife, operators would be required to "centralize production facilities, use telemetry to monitor wells, and delay non-essential maintenance activities in important wildlife habitat during critical seasons of use to reduce the number of vehicle trips to the sites and activity that could disturb or stress wildlife." In addition, all vehicles and other gasoline or diesel-powered equipment must be equipped with properly functioning mufflers (Appendix C).

Acres of habitat disturbance, fragmentation effects, number of visits and noise levels, road density changes, increases in invasive plants, impacts determinations, compliance with UDWR population objectives, compliance with fisheries classification system, and compliance with MIS Guidelines (*Measurement Indicators #1, #2, #3, #4, #5, #6, #7, #8,* and *#9* respectively) will be discussed by species, as appropriate. Impacts from acres of habitat disturbance (*Measurement Indicator #1*) are discussed with regard to all species. The amounts of habitat disturbance relative to available habitat of special status species (*Measurement Indicator #1*) are summarized in Table 4.6-6. Impacts determinations (*Measurement Indicator #6*) are listed with regard to all TEC species in Table 4.6-11 and Sensitive species in Table 4.6-12. Fragmentation effects (*Measurement Indicator #2*) are discussed for all species. Road density changes (*Measurement Indicator #4)* and compliance with UDWR population objectives (*Measurement Indicator #7)* are discussed under big game. Invasive plant increases (*Measurement Indicator #5)* apply to Utah prairie dogs, pygmy rabbit, sage grouse, Sensitive fishes and MIS trout. Number of visits and noise levels (*Measurement Indicator #3)* are discussed for all TEC species and big game, raptors, pygmy rabbit, bats, and sage grouse. Compliance with State of Utah fisheries classification system (*Measurement Indicator #8)* applies only to sensitive fish and compliance with MIS Guidelines (*Measurement Indicator #9)* applies only to MIS.

Measurement Indicators

ENDANGERED FISH

Direct impacts to woundfin and Virgin River chub are not expected because these species do not occur on the Dixie National Forest, and are not expected to occur in the future due to dewatered conditions (both natural and human-caused). Designated Critical Habitat for both species occurs 14 miles downstream from the Dixie National Forest (southeast of the Pine Valley Ranger District), however, and it could be indirectly affected by actions on the Forest that degrade water quality or reduce flows to the Virgin River via Ash Creek. Under SLT, the potential for water quality impacts exists because relatively few restrictions on the location and operation of oil and gas facilities are in place. Basic restrictions that protect water quality are part of SLT, but these restrictions are not site-specific or designed with special considerations for endangered fish downstream of the Dixie National Forest. There is the potential for long-term and minor to moderate impacts to woundfin and Virgin River chub under SLT as a result of water quality impacts caused by accidents associated with oil and gas activities, such as an oil spill. The potential for water-related impacts are described in more detail in Sections 4.5 (fish and wildlife) and 4.7 (water and watershed resources).

Table 4.6-6 Maximum Percentage of Possible Habitat Disturbance for Special Status Species

Resource	Pine Valley[1]	Cedar City[1]	Powell[1]	Escalante[1]
TEC				
California condor (Experimental/Nonessential) rim habitat	--	1%	1%	<1%
California condor (Endangered) rim habitat	1%	--	--	--
Utah prairie dog colonies	--	10%	2%	6%
Designated Critical Mexican spotted owl habitat	--	--	--	4%
Potential Mexican spotted owl habitat	2%	7%	9%	8%
Mexican spotted owl PAC	--	--	--	96%
Sage grouse leks (1-mile buffer)	--	4%	3%	25%
Sage grouse brood rearing habitat	--	18%	2%	7%
USFS-Sensitive				
Fisheries habitat	8%	15%	9%	11%
Pygmy rabbit habitat	3%	6%	3%	8%
Sensitive bat habitat	63%	100%	100%	82%
Boreal toad habitat	--	--	1%	--
Crucial & Substantial elk & mule deer winter range	2%	2%	1%	1%
Crucial elk and mule deer summer range	<1%	1%	<1%	4%
Goshawk nest areas (0.5-mile buffer)	27%	2%	4%	4%
Goshawk PFA	18%	2%	3%	3%
Peregrine falcon nests (0.5-mile buffer)	--	6%	9%	--
Peregrine falcon rim habitat	1%	1%	1%	<1%
Bald eagle winter concentration areas	11%	9%	40%	41%
Flammulated owl habitat	1%	<1%	1%	<1%
Sensitive plant species and suitable habitat	4%	3%	2%	1%

[1] Assumes that the greatest amount of disturbance predicted in a ranger district occurred within each habitat area

CALIFORNIA CONDOR

Direct impacts to nesting California condors are not expected because condors are not known or expected to nest on the Dixie National Forest; however, roosting condors may be affected (see noise, below).

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Potential habitat for condors may be affected by oil and gas activities. Habitat losses would be negligible to minor and short term because there is a large amount of habitat on the Forest (Table 4.6-6) that could be utilized the following year if condors were displaced by any oil and gas disturbances. Because oil and gas activities are unlikely to occur on or near cliffs, rim habitat losses are unlikely. In the event that rim habitat was disturbed under SLT and an abundance of equally suitable habitat was not in the vicinity, impacts would be short term and minor as individual condors would be displaced to another area that may be less preferable for roosting.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Fragmentation impacts to California condor would be as described under TL and CSU: long term and minor due to the reduced size of potential territories within rim habitat.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Noise from oil and gas activities under SLT would adversely impact California condors if activities occurred within one mile of cliffs where condors were roosting. Disturbance of nests is unlikely because condors are not known or expected to nest on the Dixie National Forest. However, if nesting condors were present and disturbed by noise from oil and gas activities (i.e., drilling or traffic; see Section 4.11), displacement impacts would be short term and moderate if a nest were affected because a wild condor population could be affected by the disruption of one or a few individual nests. Roosting condors within one mile of oil and gas disturbances on the Dixie National Forest may also be displaced. Noise from seismic activities (blasting), drilling, and production setup and drilling are the most likely adverse impacts. If roosting condors were located in the vicinity of such noises and were displaced, impacts from displacement would be short term and minor.

UTAH PRAIRIE DOG

Direct impacts to Utah prairie dogs from mortality due to construction of roads and other oil and gas facilities could be long term and moderate to major. These impacts are possible under SLT because although surveys would be conducted in suitable habitat, operators are not required to modify or move operations beyond 200 meters (656 feet). Colonies could still be impacted under the 200 meter allowance because most colonies are large and would extend beyond this distance. Direct impacts to Utah prairie dogs may occur under SLT because there are a large number of colonies on the Dixie National Forest.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Less than 10 percent of the colony areas on the Dixie National Forest could be disturbed by a production development (Table 4.6-6); however, a loss of a colony area in this case would constitute serious impacts unlike habitat losses that can be weighed against available habitat.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

If oil and gas activities occurred within prairie dog colony areas, the remaining areas of continuous suitable habitat for prairie dogs would be smaller. Utah prairie dog families generally occupy territories about one acre in size (Rodriguez 2008), thus oil and gas disturbances such

as well pads and roads would reduce the size of potential territories if prairie dogs avoided the facilities and limit the distribution or number of prairie dogs that could occupy a habitat area, or that could disperse into a new area. Fragmentation impacts within colony areas would be long term and moderate.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Extended noise disturbances would adversely affect Utah prairie dogs by interrupting communications. Utah prairie dogs are highly social animals and noise from oil and gas activities in the vicinity may mask the sounds of approaching predators or other communications necessary for social interaction or survival. The reproduction of individuals would be affected by noise, and the reproductive rate of the population may also be adversely affected, thus impacts from visits and noise would be moderate to major, and could be long term if production wells were constructed.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Impacts to Utah prairie dog from invasive species would be similar to those described for seismic activities because these activities are the most likely to lead to a weed invasion (described under NSO; Section 4.6.4.3). It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Under SLT, the spread of invasive plants would also be possible in conjunction with any ground disturbance or overland travel associated with oil and gas development or production.

MEXICAN SPOTTED OWL

A loss of canyon habitats would have more severe impacts than a loss of forest, relative to the habitat preferences of Mexican spotted owls in Utah.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, oil and gas activities would have a short term and minor impact on Mexican spotted owls if they occurred within potential, unverified habitat that was not a PAC or Designated Critical Habitat because these areas may be used for foraging or roosting and possibly nesting. Less than 10 percent of the “potential, unverified” habitat area (regardless of ranger district) would be disturbed if all activities occurred in this habitat.

Impacts within PACs on the Escalante Ranger District could be relatively more adverse because PACs are limited on the Dixie National Forest. Impacts within Designated Critical Habitat could be relatively more adverse because in general, Designated Critical Habitat has been deemed essential for a species’ survival. Approximately 96 percent of PACs and 4 percent of Designated Critical Habitat on the Dixie National Forest would be disturbed if all activities occurred in one of these areas. Disturbances within PACs or Designated Critical Habitat could be long term and moderate to major.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

If oil and gas activities occurred in suitable habitats for Mexican spotted owls, foraging areas for Mexican spotted owls would be reduced and territories may become less suitable. Individuals may be forced into less suitable territories that contain fewer prey species, more raptors competing for prey items, or a greater number of predatory raptors. Fragmentation impacts would be long term and moderate because reproduction and nesting success would be affected.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Adverse impacts to Mexican spotted owls could occur if noise disturbances were within 0.5 miles of a Mexican spotted owl from March 1 to August 31 (following Romin and Muck 2002). Owls have been detected during summer and winter months on the Dixie National Forest. Noise impacts from seismic activities (blasting), exploratory drilling, and production setup and drilling are the activities most likely to be adverse and cause displacement (see Section 4.10 for predicted number of visits per activity). These impacts would be minor to moderate and short term in "potential habitat" because the site would be suitable again (with regard to noise) within 10 years for foraging, roosting, and possibly nesting. The large amount of potential habitat on the Dixie National Forest means that owls are also likely to find equally suitable habitat nearby. Within PACs or Critical Habitat, it is more likely that owls would be nesting, and less likely that owls would find equivalent suitable habitat available on the Dixie National Forest; thus, displacement from noise impacts in PACs or Critical Habitat could be long term and moderate to major. Impacts could be major because a spotted owl population could be affected by one or a few nest failures.

WESTERN YELLOW-BILLED CUCKOO

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, marginally suitable habitat for yellow-billed cuckoos on the Dixie National Forest would be lost if activities occurred in forested riparian habitat. These impacts could be minor and long term, because riparian habitats are not likely to recover from disturbances (see Section 4.7). Direct impacts to yellow-billed cuckoos are not expected because habitat is marginal and the species is not known to occur on the Dixie National Forest.

SENSITIVE FISHES

General impacts to fisheries resources are discussed in Section 4.5. Specific impacts to sensitive fish species are discussed below.

Under SLT, the ability to move operations by up to 200 meters (656 feet) should prevent most direct impacts to sensitive fishes. Habitat loss (*Measurement Indicator #1*) may occur by the construction of road crossings, by sedimentation inputs, or by other actions that cause adverse changes to water quality or habitat such that the aquatic habitat is no longer suitable for sensitive fishes. It is likely under SLT that roads crossings will have to be built on several streams, including streams with sensitive fish. Impacts from road crossings are described in Section 4.5. The impacts of road crossings would be negligible to minor for short-term turbidity increases and moderate to major for any hazardous substance spills (see Section 4.5 and general water and watershed impacts in Section 4.7).

Regarding sedimentation, pool depth can be reduced by increases in sediment delivery to streams or decreases in stream flow. In a study of cutthroat trout in Colorado and New Mexico, Harrig and Fausch (2002) found that the presence of large deep pools was one of the most important habitat features. Colorado River cutthroat trout in Wyoming are most associated with deep pools, particularly those formed by large woody debris (Young 1996). Sediment and reduced flows can also decrease the suitability of spawning gravels by limiting oxygen supply to developing eggs and increasing temperature. Overall, roads have the greatest potential to increase sediment levels in streams, with seismic exploration having the least potential. Although adherence to Best Management Practices (BMPs) should limit most impacts, impacts

could still range from negligible to minor for small disturbances such as seismic activity and minor to major for road development. Impacts to aquatic species from sedimentation in streams are analyzed as part of Section 4.5. Impacts to watershed from sedimentation in streams are analyzed as part of Section 4.7.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Culverts and bridges can serve as migration barriers to upstream movement by sensitive fishes. Fragmentation of watersheds reduces opportunities for mixing of genetic diversity, colonization of new habitat, access to areas that provide refuge for fish species in case of disturbances such as fire, and natural recolonization of populations following disturbance. While most culverts and bridges would be expected to be constructed to allow for fish passage, failure to do so could result in the decreased persistence of sensitive fish populations. These impacts would be long term and could be major because the reproductive rate of populations would be affected if a substantial number of individuals were blocked from moving up- or downstream to spawn or seek out more suitable habitat.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under SLT, the spread of invasive plants would be possible (particularly for seismic activities) in conjunction with any ground disturbance or overland travel associated with oil and gas development or production. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Invasive plants would diminish the value of fisheries habitat due to raised water temperatures and increased sedimentation, as described under CSU (Section 4.6.4.5). Indirect impacts to sensitive fishes would be long term and could be moderate.

- *Measurement Indicator #8* STATE OF UTAH FISHERIES CLASSIFICATION SYSTEM

Oil and gas activities would not be expected to result in the reclassification of any streams containing Colorado River cutthroat trout, Bonneville cutthroat trout, or southern leatherside.

PYGMY RABBIT

Direct impacts to pygmy rabbit are possible if occupied habitat (i.e., burrows and rabbits) were disturbed by oil and gas activities. Direct mortality impacts would be short to long term and minor to major depending on the number of individuals impacted.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, a loss of unoccupied suitable habitat would occur if areas within mapped habitat for pygmy rabbit (50,000 acres) were disturbed. Direct impacts to pygmy rabbit from a loss of suitable habitat under SLT would be short term and minor, due to the amount of habitat remaining (greater than 90%; Table 4.6-6), unless a production field was constructed in which case impacts would be long term and moderate to major.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Impacts to pygmy rabbits from fragmentation would be long term and moderate because pygmy rabbit populations are generally vulnerable to isolation and local extinction due to their short dispersal distances and slow pace of re-colonization in new habitats, thus populations could be

affected. Increased competition or predation in the remaining habitat may also lead to reproductive effects.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Under SLT, site visits and noise from connected actions in the vicinity of burrows could interfere with rabbits' ability to detect predators and communicate. Noise from oil and gas activities would have population-level impacts if activities took place in a high-density area and many pygmy rabbits were exposed to predators or were forced into adjacent, less-suitable habitat. Population-level impacts under SLT would be moderate to major, and short to long term, depending on whether exploration (short term) or production activities (long term) occurred in suitable habitat.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under SLT, the spread of invasive plants would be possible (particularly for seismic activities) in conjunction with any ground disturbance or overland travel associated with oil and gas exploration or production. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Invasive plants would decrease the amount of functional sagebrush habitat for pygmy rabbit because brome grasses are not as nutritious a forage plant and cannot provide shelter or cover for pygmy rabbits and increase in the threat of catastrophic wildfire. Adverse impacts from the spread of invasive plants in pygmy rabbit habitat could be long term because the functionality of this habitat would be diminished for the long term. Impacts would be moderate because there is only one known population of pygmy rabbits on the Dixie and reduced functionality of the habitat where they occur could lead to adverse reproductive effects to this local population.

SENSITIVE BATS

Direct impacts to sensitive bats would occur if activities took place in close proximity to occupied cliffs or caves, such as in the Cedar City Ranger District. Disturbance to hibernacula inside caves would cause adverse impacts to bat populations (Rodriguez 2008). See Section 4.8 (Soils and Geologic Hazards) for a more detailed discussion regarding impacts to cave resources. Destruction of hibernacula in the Cedar City Ranger District would be long term and moderate to major because the reproductive rate of the population could be affected if bats were forced to abandon the site when energy levels are low.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, a loss of suitable habitat would occur if areas within mapped habitat for sensitive bats (1,400 acres) were disturbed. Over 1,000 acres of additional mapped habitat occurs within wilderness areas (Pine Valley and Death Hollow) and would not be disturbed. Impacts to sensitive bat habitat from exploratory well pad and road construction would be short term and moderate to major within the Cedar City or Powell Ranger Districts, because a smaller amount of habitat is available (Table 4.6-6). Impacts to sensitive bat habitat in the Pine Valley or Escalante Ranger Districts would be minor because more habitat is available in these areas, thus more suitable habitat would be available to displaced individuals. Impacts would be long term if a production field were constructed in sensitive bat habitat.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

If oil and gas activities occurred within sensitive bat habitat, foraging areas for bats would be reduced. Individuals may be forced into less suitable areas that contain fewer prey species or more bats, or a greater number of predators. Fragmentation impacts would be long term and moderate because reproduction could be affected by a reduced quality of forage.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Under SLT, noise disturbances from oil and gas activities could adversely affect sensitive bats if activities took place in the vicinity of active roosts or hibernacula. Noise disturbances could be moderate because a large number of individuals typically utilize a single roost or hibernacula site, and noise could cause a large number of individuals to abandon the area. Abandonment of a suitable roost could have population-level impacts on the reproductive rate if a number of individuals do not find alternate suitable habitat and do not successfully reproduce. Population-level impacts resulting from noise would be moderate to major and short term from exploratory well pad and road construction; impacts would be moderate to major and long term if a production field were constructed in sensitive bat habitat.

- *Measurement Indicator #4* INCREASES IN INVASIVE PLANTS

Oil and gas activities, but mainly seismic surveys, could introduce invasive plants that may adversely impact prey habitat where bats forage. Adverse changes in vegetation composition within prey habitat may lead to a decrease in the prey base. Indirect impacts would be long-term and minor because reproduction would not be affected.

BIGHORN SHEEP

There is no mapped habitat for bighorn sheep on the Dixie National Forest (to date). Therefore, connected actions would not disturb, fragment, or otherwise adversely affect habitat for bighorn sheep unless habitat is mapped prior to leasing. Although there have been no confirmed sightings by Forest biologists, bighorn sheep may still occur on the Dixie National Forest, and thus may be present when and where oil and gas activities are proposed. Bighorn sheep would be included in the site-specific analyses for any proposed oil and gas disturbance, and impacts to any individual sheep present in the specified project area would be analyzed at that time. Bighorn sheep will not be analyzed further in this EIS.

BOREAL TOAD

General impacts to fisheries resources are discussed in Section 4.5 and apply to boreal toad breeding habitat. Specific impacts to boreal toad are discussed below.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, the ability to move operations by up to 200 meters (656 feet) should prevent most direct impacts to breeding (aquatic) habitat. As for sensitive fishes, habitat loss may occur by the construction of road crossings, by sedimentation inputs, or by other actions that cause adverse changes to water quality or habitat. Impacts from road crossings are described in Section 4.5. Oil and gas activities would remove about one percent of the available suitable habitat in the Powell Ranger District (that includes aquatic and terrestrial habitat) if all predicted activities in the RFDS were to occur within mapped habitat for boreal toad. Impacts from exploratory well and road construction would be short-term; impacts from a production field in boreal toad habitat would be long term. Impacts would be minor due to the relatively small amount of available habitat (one percent) that would be disturbed.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Oil and gas disturbances that occurred within mapped watersheds for boreal toad on the Powell Ranger District would fragment boreal toad habitat. These disturbances would adversely impact the ability of boreal toads to freely move between aquatic and terrestrial habitats or to disperse among these habitats. This would adversely impact the reproductive success of boreal toads (if individuals could not return to preferred aquatic habitats to breed) or limit gene flow among and between more distant populations (if individuals could not disperse to an adjacent aquatic habitat). Impacts from fragmentation would be short- to long term (depending on the activity) and moderate because the reproductive rate of boreal toad populations could be affected.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under SLT, the spread of invasive plants would be possible in conjunction with any ground disturbance or overland travel associated with oil and gas development or production. Invasive plants would diminish the value of aquatic habitats due to raised water temperatures and increased sedimentation, as described under CSU for sensitive fishes (Section 4.6.4.5). Invasive plants would also diminish the value of terrestrial habitats by reducing the quality of vegetative cover and diversity of the plant community. Indirect impacts to boreal toads from the spread of invasive species would be long term and could be moderate.

BIG GAME (MIS)

Under SLT, impacts to mule deer and elk from oil and gas activities would occur as a result of habitat loss (*Management Indicator #1*), fragmentation (*Measurement Indicator #2*), number of visits and noise levels (*Measurement Indicator #3*), and road density increases (*Measurement Indicator #5*). Impacts would be more adverse if activities occurred within crucial/substantial value winter or summer ranges during the season of use.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Oil and gas activities that occurred within big game seasonal ranges during the season of use would force animals into smaller areas of habitat that may be less suitable than what was disturbed and have a higher density of predators. Impacts on winter range during winter would have the most adverse impacts on big game because animals are most likely to be stressed during this period. When effective winter range sizes are reduced, increases in population density cause increased competition for forage and may reduce the likelihood of calf/fawn survival and general over-winter carrying capacity of the remaining winter range (WFGD 2004). Elk have been found to move up to two miles from disturbance on open winter range and avoid geophysical activities by moving to areas with more cover and also to return to disturbed areas after activities were completed (USFS 1995b). Deer may react similarly as elk and avoid areas where activities are occurring.

In general, impacts from the loss of crucial and substantial winter and summer ranges would be site specific with a number of variables influencing the outcome. Thus, disturbance from seismic and exploration drilling and other exploratory activities would be relatively small (Table 4.6-6) and impacts in terms of habitat loss would be minor. Because these activities would last less than ten years and habitats would be restored after use, impacts would be short term. Oil and gas development and production has a greater potential for habitat disturbance impacts because these activities would last for longer than ten years (i.e., long term) and would disturb more acres.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Oil and gas disturbances such as well pads and roads in big game habitats diminish the effectiveness of the remaining range that is available. Fragmentation diminishes the value of the range complex and leads to decreased productivity on the range and ultimately a loss of carrying capacity for the elk or mule deer herds. If migration routes are altered, big game animals would be forced to expend large amounts of energy to seek out new movement patterns and functional corridors and would not be able to rely on migration memory to utilize the range effectively. Fragmentation impacts from oil and gas disturbances in crucial and substantial big game habitats would be long term and major because populations would be affected by changes in range effectiveness.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Avoidance and stress responses by wildlife extend the influence of each well pad, road, and facility up to a quarter mile radius for mule deer to more than a half mile for elk on open winter ranges (USFS 1995b). This increases the amount of habitat disturbed substantially beyond the actual footprints of oil and gas activities. When disturbed, elk will usually move to areas of dense cover away from roads and people (UDWR 2005a). Displacement during blasting (seismic activities) would be temporary because big game would return to the area after completion of the activity. Displacement during exploration activities would be short term and would be most severe during drilling; these impacts would be minor because only individuals would likely be affected, returning to the site following the disturbance. Displacement during the initial construction and drilling stages of production would cause the most severe noise-related impacts. If such production activities occurred on crucial winter ranges during winter and a substantial number of individuals became stressed, impacts would be moderate because many individuals would be displaced from the largest possible area (of any oil and gas activity) and if most experience adverse reproductive effects, such noise disturbances could impact the population.

Elk with new calves and deer with new fawns are particularly sensitive to noise. Direct loss of calves and fawns could occur if substantial noise disturbance occurred during birthing periods (in the vicinity of mothers and calves or fawns) because displacement of mothers and calves/fawns into less favorable habitat could increase the likelihood of calf/fawn mortality from predation, accidents, or disease (USFS 1995b). Because the majority of the Dixie National Forest contains fawning habitat (total = 1,401,429 acres), displacement impacts to mule deer due to noise would be isolated and likely minor. Impacts to elk in the Escalante Ranger District would be relatively more severe because there is less suitable habitat; impacts to calves in this ranger district could be moderate if a large number of calves do not survive due to noise and related human disturbance impacts, thus impacting the population. Noise impacts to calving and fawning areas under SLT would be short term because high-level noise disturbances would not last for more than six months to a year (refer to Section 4.5).

- *Measurement Indicator #4* ROAD DENSITY INCREASES

Seismic operations, exploration wells, and new field development may all require new temporary roads or upgrading of designated roads (as defined in 36 CFR 1212.1 Subpart A). Roads can both fragment habitat and put individual animals at higher mortality risk from increased collisions and/or hunting. Regarding fragmentation, any reduction in the ability of mule deer or elk to move about freely on winter ranges reduces their options for coping with a variety of environmental conditions (e.g., snow depth, predator avoidance, wind, etc.) and

human disturbances (see general discussion of fragmentation impacts to wildlife in Section 4.5). Flexibility in movement across ranges is ultimately reflected in the survival and productivity of the population, in that populations can regulate density, and this enhances their ability to recover from population declines (WFGD 2004). In addition to fragmentation impacts, new temporary road construction into previously isolated areas has the potential to impact big game species because some roads may create increased public access and traffic (if they are open to the public following oil and gas activities, which would be decided in site-specific NEPA analysis), which may lead to intentional or unintentional harassment, poaching, and increased harvest levels by legal hunting. In this way the security of the habitat is diminished. Road kills may also increase. Elk may adjust to low levels of vehicular traffic, particularly if there are visual barriers between the elk and the road (USFS 1995b). Mule deer have been shown to avoid areas within 660 feet of roads, the level of avoidance being greater in shrub habitats than in conifer woodlands (USFS 1995b).

Less than one mile of new roads per well would be constructed. This could be below the threshold of two miles per square mile of habitat; however, these may be additive and increase the OMRD well above this threshold in some areas. Increases in OMRD within the subwatersheds that have the greatest OMRD, such as in the Cedar City and Powell Ranger Districts, have the potential to substantially impact mule deer and elk. A substantial increase in roads, such as road development for a production field, within the subwatersheds that occur within crucial winter ranges for mule deer or elk, would have long-term impacts (impacts from roads reclaimed within ten years would be short term). Impacts to big game from new temporary roads would be moderate to major because (population-level) habitat effectiveness and security would be diminished.

- *Measurement Indicator #7* COMPLIANCE WITH UDWR POPULATION OBJECTIVES

Oil and gas disturbances would be in compliance with UDWR population objectives for mule deer and elk because a high level of mortality from oil and gas activities is not expected. A production field in the vicinity of crucial winter range has the potential to impact mule deer or elk on a population level if a large herd is displaced into less suitable habitat and experience adverse reproductive effects. Population-level impacts that reduce the population to levels substantially below objectives are not likely, however, because mule deer and elk populations on the Dixie National Forest are currently at (or above) objectives and are not considered to be at risk. Impacts under SLT with regard to population objectives would be neutral.

SENSITIVE RAPTORS

Restrictions around bald eagle nests are discussed in the Lease Notice section. General impacts to raptors are described in Section 4.5.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Habitat impacts to flammulated owls (ponderosa pine, Douglas-fir) and peregrine falcon (rim habitat) would be short to long term, whether exploration (short term) or production activities (long term) occurred in suitable habitat, and on vegetation type (grasses and some shrubs would generally be short term impacts; forests would be long term impacts). Impacts would be minor to moderate (Table 4.6-6). Much of the goshawk habitat in the Pine Valley Ranger District is located either in recreation areas, conifer stringers on the North and South range of Pine Valley Mountain, campgrounds or just off of the wilderness boundary where little to no oil

and gas disturbance will occur, so in this ranger district, impacts to goshawk would be negligible to minor.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

If oil and gas activities occurred within a 0.5-1 mile radius of nesting habitat for raptors, foraging areas would be reduced and previously suitable home ranges may become less suitable. Raptors may be forced into areas that contain fewer prey species or a different community of other raptors that may be more competitive for prey items or that may prey directly on sensitive raptors species. Fragmentation impacts would be long term and moderate to major because reproduction and nesting success would be affected by these changes.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Noise impacts to sensitive raptors would be similar to those described for raptors in Section 4.5. Impacts from seismic activities and exploratory drilling under SLT are likely to be temporary, but could be moderate, depending on the species and the number of individuals affected. Extended noise disturbances could have moderate to major impacts if birds were nesting; these would be population-level impacts if enough individuals were affected. Influence buffers for sensitive raptors are listed below, following Romin and Muck (2002) and the Dixie LRMP Goshawk Amendment for nesting raptors. Within these dates and buffer zones, noise impacts could be moderate. Moderate noise impacts leading to nest impacts would be short term because raptors are likely to use a different nesting location the following year.

Table 4.6-7 Respective Buffer Zones and Sensitive Periods for Sensitive Raptors that May Correlate to Adverse Noise Impacts

Species	Zone of influence (miles)	Sensitive period	Activity
Bald eagle	1.0	1 Dec – 15 Feb	nesting
Peregrine falcon	1.0	1 Feb – 31 Aug	nesting
Northern goshawk	0.5	1 Mar – 30 Sept	nesting
Flammulated owl	0.25	1 Apr – 30 Sept	nesting

Information for all species taken from Romin and Muck (2002) and the Dixie National Forest Plan Goshawk Amendment.

- *Measurement Indicator #4* INCREASES IN INVASIVE PLANTS

If seismic activities occurred, buggy surveys could introduce invasive plants that may adversely impact prey habitat where raptors forage. Adverse changes in vegetation composition within prey habitat may lead to a decrease in the prey base. Indirect impacts would be long-term and minor because reproduction would not be affected.

GREATER SAGE GROUSE

Studies on the impacts of coalbed methane developments on greater sage-grouse in Wyoming (e.g., Holloran 2005, Walker et al. 2007, Doherty et al. 2008) have shown that sage-grouse are adversely affected by these types of developments. However, sage-grouse habitat in Wyoming is very open and flat, unlike on the Dixie (see Section 3.6.3.3), and although these studies were considered in this impact analysis, unique habitat conditions and limited development predicted in the RFDS on the Dixie dictated the impact determinations made herein more so than the Wyoming studies. Connelly et al. (2004), Connelly et al. (2000), Beck (2006), Beck et al. (2003),

Parrish et al. (2003), and USFS (1995b) also provided context for the following impact determinations.

The most adverse potential impact to greater sage-grouse under SLT is disturbance of leks, and any oil and gas activities that occurred within two miles of a lek may also disturb sage grouse nesting and brooding activities (80% of all nests occur within this radius; USFS 1995b). A loss of leks or active nests on the Dixie National Forest could limit breeding opportunities and recruitment, thus leading to declines in sage grouse populations.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

A loss of summer brooding habitat would have a moderate impact on sage grouse because up to 18 percent of the habitat would be disturbed if the maximum predicted disturbance occurred in brooding habitat (Table 4.6-6); a loss of leks would have a moderate to major impact because these areas are limited (Table 4.6-6) and would be long term because sage grouse would probably not return to reclaimed leks.

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Impacts of fragmentation on wildlife are discussed in Section 4.5. Construction of roads and linear facilities within suitable sage grouse habitat would result in fragmentation. Because sage grouse populations can be migratory and populations that are non-migratory utilize large home ranges (Connelly et al. 2000), linear disturbances that isolate portions of habitat disrupt seasonal movements and prevent sage grouse from utilizing all parts of their habitat. Areas that currently contain a substantial number of roads, on the Cedar City and Powell Ranger Districts, are the most vulnerable to fragmentation impacts. Fragmentation can lead to increased mortality as population pressures would increase within condensed areas. Fragmentation impacts from oil and gas disturbance in these areas would be short to long term, depending on whether exploration activities led to development and production, and moderate to major because population-level impacts could result if large numbers of individuals are restricted in their movements or number of mate choices. In addition, increased mortality rates would directly reduce population sizes.

- *Measurement Indicator #3* NUMBER OF VISITS AND NOISE LEVELS

Noise from seismic activities, exploration drilling, and production field development would displace sage grouse from the vicinity of operations. Sage grouse may return to a disturbed site after oil development activities have ceased, but may not attain pre-disturbance population levels. In general, disturbed leks and breeding areas will not be as productive as undisturbed sites (Connelly et al. 2000) and many studies have documented lek abandonment and lower lek attendance by males and yearling females caused by oil and gas activities (Beck 2006). Noise impacts from oil and gas activities under SLT in the vicinity of leks (within one mile) or brooding areas (between 1 May to 15 July) could be moderate or major and long term because lek or habitat abandonment is more likely at this distance and abandonment would be a population-level impact. Noise impacts only in brooding habitat that did not affect actual leks could be moderate to major if a substantial number of sage grouse were displaced from 1 May to 15 July because the reproductive rate of the population could be affected during this time.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Under SLT, the spread of invasive plants would be possible (particularly for seismic activities) in conjunction with any ground disturbance or overland travel associated with oil and gas

development or production. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Invasive plants would diminish the value of sage grouse habitat (sagebrush) because species such as brome grasses and other annuals are not as nutritious a forage plant and cannot provide shelter or cover for sage grouse as effectively as sagebrush. Adverse impacts from the spread of invasive plants in sage grouse brooding habitat could be long term because the functionality of this habitat would be diminished for the long term, as described for pygmy rabbit. Impacts would be minor because only some individuals would be affected. Some individuals would need to seek out more suitable habitat areas, whereby they could be more vulnerable to predators, and areas that they move into may be less suitable habitat due to fires, urbanization, roads or trails, or relatively poor sagebrush health.

THREE-TOED WOODPECKER

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Impacts to three-toed woodpeckers from habitat loss would be minor and long term due to the species' preference for mature stands containing snags and downed wood that take many years to regenerate. Spruce fir forest habitat may be lost (1-2%; see Section 4.9 – Vegetation) on the Cedar City, Powell, or Escalante Ranger Districts as a result of oil and gas activities. Impacts would be minor due to the small amount of habitat that could be disturbed relative to what is available on the Dixie National Forest.

SENSITIVE PLANTS

Under SLT, oil and gas activities that occurred in sensitive plant occurrence areas would disturb sensitive plants unless the 200-meter allowance prevented occupation of these areas. Under SLT, operations could be physically moved 200 meters (656 feet). However, a loss of sensitive plant populations or suitable habitat (see *Measurement Indicator #1*) would still be likely under these allowances. Direct impacts to sensitive plants would be long term and moderate because entire populations could be affected if a large number of individual plants cannot be avoided under SLT.

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Impacts from a loss of suitable habitat would be long term and moderate, as for direct impacts to populations, especially in the case of plants growing on unstable substrates that cannot be reclaimed. Bristlecone pine/rock garden areas are one example of a habitat that is not easily reclaimed. Direct disturbance (loss) of bristlecone pine areas would constitute long term and moderate impacts to sensitive plants that grow in these areas, including Navajo Lake milkvetch, Cedar Breaks biscuitroot, Podunk groundsel, and rock tansy. Bristlecone pine trees are a central part of rock garden communities and take 50 years to mature before reproducing. For this reason, disturbing these long-lived species sets back the succession process in the community for at least this period of time or indefinitely, if trees do not reestablish. Trees may not reestablish because in addition to slow growth, bristlecone pine trees exhibit poor competitive abilities (Schoettle 2004).

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Oil and gas disturbances within habitat for sensitive plants would lead to increased isolation of sensitive plant populations and for some species, may further reduce the likelihood of genetic diversity being introduced into populations that contain few individuals. Small population sizes

increase the likelihood of local extinction and ultimately reduce the number of populations within a species and the likelihood that the species can persist under changing conditions. Fragmentation that leads to further isolation of sensitive plant populations would have long term and moderate impacts on sensitive plants.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

Seismic activities could introduce invasive plants that would directly compete with sensitive plants and reduce the area and resources available for sensitive species. Invasive species are likely to replace native plants if both are present. These impacts would be long term and minor to moderate, depending on the sensitive plant species and amount of suitable habitat. However, it should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects.

MIS SPECIES

- *Measurement Indicator #1* ACRES OF HABITAT DISTURBANCE RELATIVE TO AVAILABLE HABITAT

Under SLT, oil and gas activities would result in habitat losses for MIS. Within most major vegetation communities on the Dixie National Forest, oil and gas activities would not disturb more than five percent of the habitat, assuming all exploration and a production field occurred within one habitat type (and within one ranger district; Table 4.9.3 – Percentage habitat disturbance table in Section 4.9, Vegetation). As a result, habitat loss would be minor and short to long term, depending on the activity (exploration = short term; production = long term) and vegetation type (grasses and some shrubs = short term; forests = long term), for terrestrial MIS that depend on major vegetation types, including mule deer, elk, turkey, goshawk, and flicker. Exceptions may include mature forest areas that are more limited than forested vegetation types as a whole, and take longer to replace; old growth habitat losses would be moderate and long term. Regarding habitat losses for aquatic species, aquatic habitat impacts are described in detail in Sections 4.5 (Fisheries) and 4.7 (Water and Watershed Resources). Oil and gas activities that occurred near or within aquatic habitats under SLT may decrease habitat and the effectiveness of habitat because the allowances to protect waters under SLT are relatively limited. Impacts to aquatic MIS from oil and gas activities under SLT would have the potential to be long term and minor to major (see Section 4.5 for more extended justification).

- *Measurement Indicator #2* FRAGMENTATION OF HABITAT

Disturbance of MIS habitats would generally reduce the effectiveness of remaining undisturbed MIS habitats because remaining habitats may not provide the same quality of resource base, including prey species and forage, and may not provide the same level of isolation from human disturbances. Fragmentation impacts in MIS habitats would be long term and minor to moderate depending on the species and amount of continuous undisturbed habitat.

- *Measurement Indicator #5* INCREASES IN INVASIVE PLANTS

In some riparian areas, tamarisk, whitetop, and Russian olive are replacing native riparian vegetation such as willows and cottonwoods. Invasive grasses and species such as rabbitbrush also replace native vegetation and create fewer shaded areas and less stable banks. As a result, higher water temperatures and higher rates of sedimentation characterize the habitat, both of which degrade aquatic habitats and specifically make habitat less suitable for salmonids that require cold, clear water to spawn. It should be noted that weed invasions are not likely considering standard measures required by the Dixie National Forest on all projects. Impacts

from the spread of invasive species would be long term and minor to major, depending on the fish species, number of individuals that are not able to tolerate a slightly higher water temperature and reduced shade levels, and are forced to seek out more suitable habitat. If a substantial number of individuals expended energy to seek out alternate habitat then the reproductive rate of the population could be affected and impacts would be moderate.

- *Measurement Indicator #9* COMPLIANCE WITH MIS GUIDELINES (USFS 1986)

The Guidelines for MIS (Management Area 4B – Wildlife and Fish Resource Management; USFS 1986:4-84) and the likelihood of compliance with the Guideline under SLT are summarized in Table 4.6-8.

Table 4.6-8 Fish and Resource Management Guidelines for MIS (USFS 1986, and various amendments including USFS 2010a) and Compliance under SLT.

Guideline	Terrestrial species: big game, goshawk, wild turkey, and flicker	Aquatic species (fisheries)
Maintain habitat capability at a level at least 80% of potential capability for all emphasized species (terrestrial) and for aquatic species, maintain stream habitat objectives revised in USFS (2010a)	MAY NOT COMPLY Production field development under SLT within mature aspen or mature conifer communities may not comply with the Guideline (all terrestrial species).	MAY NOT COMPLY Oil and gas activities under SLT have the potential to degrade aquatic habitat (see TR 4.0, 7.0, and 8.0) thus any large-scale disturbances within 300 feet of streams may not comply with the Guideline.
Maintain habitat needed to support the coordinated population goals	WOULD COMPLY Population goals are being met for MIS on the Dixie National Forest; terrestrial species have generally increased in the past few years due to increased precipitation. Levels of mortality that would affect population numbers are not expected. However, due to highly variable population numbers, population goals could fluctuate and not comply.	MAY NOT COMPLY MIS fisheries are stable but currently below population goals due to recent fires that have degraded habitat. Any further impacts to streams from oil and gas activities may not comply with the Guideline.
Maintain hiding cover (75% of all road edges) that hides 90% of an adult deer or elk from 200 feet away.	WOULD COMPLY Oil and gas activities are unlikely to remove a substantial amount of vegetation along existing roads, thus 75% of hiding cover would likely be maintained.	Not applicable

Guideline	Terrestrial species: big game, goshawk, wild turkey, and flicker	Aquatic species (fisheries)
In forested habitats, maintain 50% minimum hiding cover for deer and elk that is well distributed over the unit, and maintain 30% thermal cover in the unit.	WOULD COMPLY Oil and gas activities would not disturb a substantial portion of cover in any one area. At the ranger district level, these proportions of hiding and thermal cover would be maintained even if the maximum amount of disturbance from a production field occurred.	Not applicable

4.6.5 Impacts by Alternative

The degree to which the connected action impacts (Section 4.6.4) would differ by alternative is discussed in this section. Each alternative involves a unique set of leasing options for each resource component, which would restrict the locations and the nature of oil and gas activities that are allowed wherever these resources occur.

Table 4.6-9 shows the acres of each resource component for recreation under each leasing option, by alternative. Table 4.6-9 incorporates the amount of overlap with more restrictive leasing options (assigned to other resources) in addition to the leasing option assigned directly to each resource component. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.

In this section, impacts are generally discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts are highlighted (see Table 4.6-9).

Impacts by *Measurement Indicators* are summarized in Table 4.6-10 (*Measurement Indicators #1 - #5 and #7*) and Tables 4.6-11 and 4.6-12 (*Measurement Indicator #6)*. General differences between alternatives regarding special status species are outlined in the text below. *Measurement indicator #8* is not discussed in this section or in Table 4.6-10 because the impacts in terms of the fisheries classification system would be the same under all alternatives. Impacts with regard to this *Measurement Indicator* would be negligible. *Measurement indicator #9* is discussed in the previous section and only applies to MIS species.

Table 4.6-9 Acreage of Resource Components under each Leasing Option, by Alternative

Resource Component	Leasing option[3]	Alternative[1, 2]						
		A	B	C	D1	D2	E1	E2
California condor rim habitat (Exp/ Nonessential)	NA	32,960	32,960	32,960	32,960	32,960	32,960	32,960
	NL	342,453	233,678	7,395				
	NSO		99,124	297,260	122,454	13,718	114,025	
	TL				219,999 2/1-8/31	328,735 2/1-8/31		

Resource Component	Leasing option[3]	Alternative[1, 2]						
		A	B	C	D1	D2	E1	E2
	CSU		9,651	37,798				
	SLT						228,428	342,453
California condor rim habitat (Endangered – with Lease Notice)	NA	35,750	35,750	35,750	35,750	35,750	35,750	35,750
	NL	30,134	24,902					
	NSO		3,548	27,112	16,888	1,655	16,614	
	TL				13,247 2/1-8/31	28,480 2/1-8/31		
	CSU		1,684	3,022				
	SLT						13,521	30,134
Utah prairie dog colonies	NA							
	NL	49,628	38,263	88				
	NSO		11,365	49,540	49,628	49,628	753	
	TL							
	CSU							
	SLT						48,875	49,628
Designated critical Mexican spotted owl habitat	NA							
	NL	18,048	18,048					
	NSO			16,653	12,014	929	11,923	
	TL							
	CSU			1,395	6,033	17,119		
	SLT						6,124	18,048
Potential (unverified) Mexican spotted owl habitat	NA	23,819	23,819	23,819	23,819	23,819	23,819	23,819
	NL	23,713	14,188	1,000				
	NSO		9,518	22,000	4,960	2,178	3,834	
	TL							
	CSU		7	713	18,754	21,536		
	SLT						19,879	23,713
Mexican spotted owl PAC	NA							
	NL	732	732					
	NSO			732	731	72	730	
	TL							
	CSU				2	660		
	SLT						2	732
Fisheries habitat	NA	1,264	1,264	1,264	1,264	1,264	1,264	1,264
	NL	22,201	22,201	484				
	NSO			21,717[4]	4,317	817	3,731	
	TL							
	CSU				9,222	12,721		
	SLT						9,807	13,539
Boreal toad habitat	NA							
	NL	50,166	47,191					
	NSO		2,976	38,147	599	589	10	
	TL							
	CSU			12,020	49,567	49,577		
	SLT						50,156	50,166
Pygmy rabbit habitat	NA	180	180	180	180	180	180	180
	NL	50,571	33,235	190				
	NSO		17,336	36,205	13,924	9,018	5,474	
	TL							
	CSU			14,176	36,646	41,553		
	SLT						45,097	50,571

Resource Component	Leasing option[3]	Alternative[1, 2]						
		A	B	C	D1	D2	E1	E2
Sensitive bat habitat	NA	1,115	1,115	1,115	1,115	1,115	1,115	1,115
	NL	1,336	1,096	154				
	NSO		239	1,177	1,194	971	694	
	TL							
	CSU			4	142	395		
	SLT						642	1,336
Goshawk nest areas[5]	NA	1,055	1,055	1,055	207	207	207	207
	NL	62,276	45,527	4,575				
	NSO		19,749	57,702	5,483	2,261	3,512	
	TL							
	CSU				13,895	17,118		
	SLT						15,866	19,378
Goshawk PFA	NA	1,720	1,720	1,720	1,720	1,720	1,720	1,20
	NL	82,617	58,248	5,626				
	NSO		24,180	75,575	26,174	9,463	18,435	
	TL							
	CSU		190	1,416	56,443	73,154		
	SLT						64,182	82,617
Sage grouse leks	NA							
	NL	42,816	42,816					
	NSO			42,816	16,529	16,529	1,609	
	TL							
	CSU							
	SLT						14,920	16,529
Sage grouse brood rearing habitat	NA							
	NL	12,977	12,977					
	NSO			8,874	4,551	4,363	188	
	TL				8,426 5/1-7/15	8,614 5/1-7/15		
	CSU			4,103				
	SLT						12,789	12,977
Peregrine falcon nest areas	NA	2,259	2,259	2,259	2,259	2,259	2,259	2,259
	NL	15,596	10,411	629				
	NSO		5,184	14,967	3,356	955	2,408	
	TL							
	CSU				12,239	14,640		
	SLT						13,188	15,596
Peregrine falcon rim habitat	NA	68,710	68,710	68,710	68,710	68,710	68,710	68,710
	NL	372,588	258,580	7,395				
	NSO		102,673	324,373	139,342	15,373	130,639	
	TL				233,246 2/1-8/31	357,215 2/1-8/31		
	CSU		11,335	40,820				
	SLT						241,949	372,588
Bald eagle winter concentration areas	NA							
	NL	11,265	9,844	2,616				
	NSO		1,421	8,648	4,937	3,719	1,226	
	TL							
	CSU				6,328	7,546		
	SLT						10,038	11,265
Flammulated owl habitat	NA	43,361	43,361	43,361	43,361	43,361	43,361	43,361

Resource Component	Leasing option[3]	Alternative[1, 2]						
		A	B	C	D1	D2	E1	E2
	NL	377,180	250,111	28,192				
	NSO		127,069	280,980	86,268	38,385	55,038	
	TL							
	CSU			68,008	290,912	338,795		
	SLT						322,143	377,180
Sensitive plant species habitat and occurrences	NA	14,757	14,757	14,757	14,757	14,757	14,757	14,757
	NL	110,251	72,194	4,628				
	NSO		38,058	91,207	40,623	18,189	25,145	
	TL							
	CSU			14,417	69,628	92,062		
	SLT						85,106	110,251
Big game winter range	NA	553	553	553	553	553	553	553
	NL	169,915	169,915	130				
	NSO			139,100	67,408	19,417	49,776	
	TL				102,507 12/1-4/15	150,498 12/1-4/15		
	CSU			30,685				
	SLT						120,139	169,915
Big game summer range	NA	874	874	874	874	874	874	874
	NL	402,344	402,344	25,963				
	NSO			327,684	197,949	34,895	171,168	
	TL			48,696 5/15-7/5	188,757 5/15-7/5	349,473 5/15-7/5		
	CSU				15,636	17,974		
	SLT				1	1	231,175	402,344

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.
[4] Includes a 500-foot buffer under Alternative B and Alternative C; all other buffers for fisheries habitat are 300 feet.
[5] Alternative D and Alternative E for goshawk nests area a smaller buffer area and therefore less total acreage.

4.6.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. Under Alternative A, there would be no adverse impacts to special status species or habitats.

4.6.5.2 Alternative B

Chapter 2 of the EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative B (Table 2.5-2) and where those acres are located (Figure 2.5-2 (a-d)). Approximately 75 percent of the Dixie National Forest would not be available for lease under Alternative B; of the leasable lands, 20 percent would be NSO and 4 percent would

be CSU. As under all alternatives, 6 percent of the Dixie National Forest is legally unavailable for leasing (NA).

All TEC species and habitat would be covered by NSO or NL leasing options under Alternative B, with the exception of California condor rim habitat (3% CSU) and Mexican spotted owl "potential" habitat (<1% CSU). Thus, there may be fragmentation impacts in rim habitat for California condor and peregrine falcon, as well as within Mexican spotted owl habitat under Alternative B. Noise impacts to condor from seismic activities could be minor to moderate; habitat losses would be negligible. Noise impacts from seismic activities would be negligible or minor for Utah prairie dogs and could be moderate in Mexican spotted owl "potential" habitat. Habitat impacts to Utah prairie dogs could be minor under Alternative B because 23 percent of the colony buffer area could be disturbed.

There would be no impacts to sensitive fisheries, greater sage-grouse, or mule deer and elk under Alternative B because habitat for these species would be NL.

Impacts to Sensitive species and MIS under Alternative B could occur from seismic activities, as most resource components are covered at least partially by NSO leasing options. Many resource components are covered completely by NL for other resources under Alternative B, including fisheries habitat, sage grouse leks, sage grouse brooding habitat, and big game ranges. No impacts would occur to those resource components under Alternative B. Impacts to boreal toad would be minor because a small proportion of mapped habitat (six percent) would be NSO and subject to invasive species or short-term habitat loss from seismic activities. Sensitive raptors may be disturbed by seismic noise however impacts would be negligible. Pygmy rabbit and sensitive bat habitat would also have a slight potential for impacts due to the risk of invasive plant proliferation or noise.

There would be "No Impact" to sensitive fishes or sage grouse. For all other Sensitive species, oil and gas activities may affect individuals but would not affect population persistence ("May Impact;" *Measurement Indicator #6*; Table 4.6-12). Although direct disturbance of sensitive raptor nests or sensitive bat roosts, for example, are not likely under Alternative B, foraging and other suitable habitat (that which is mapped in the analysis and that which is not) could be disturbed by oil and gas developments. For most Sensitive species, therefore, oil and gas activities "May Impact" individuals.

4.6.5.3 Alternative C

Alternative C has less restrictive leasing options than Alternative B and more restrictive options than Alternative D. Under Alternative C, IRAs would fall under a NSO leasing option regardless of whether the 2001 Roadless Area Conservation Rule is in place or not. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative C (Table 2.5-3) and where those acres are located (Figure 2.5-3 (a-d)). Under Alternative C, 76 percent of the Dixie National Forest would be NSO. Six percent would be NA. In addition, linear features (e.g., roads, pipelines) would be allowed as perpendicular stream crossings under NSO outside of Fisheries Habitat.

Impacts to California condors would be as described under Alternative B. Noise impacts to spotted owls could be short term and moderate in PACs or Critical Habitat due to NSO (seismic); however, it is highly unlikely that activities would be authorized at the site-specific development stage within 0.5 miles of a known nest. Impacts to Utah prairie dogs would be minor under Alternative C due to the potential for weed infestations after seismic activities

(under NSO), as under Alternative B. Noise impacts to Utah prairie dogs would be minor to moderate.

Alternative C would have more adverse impacts to sensitive species than under Alternative B. Under Alternative C, there would be potentially moderate impacts to Mexican spotted owl (habitat fragmentation), Utah prairie dog (noise), pygmy rabbit (habitat fragmentation), big game (habitat fragmentation and increased road density), boreal toad (fragmentation and risk of invasive plant infestation), and sensitive plants (habitat fragmentation). "May Impact" would apply to all Sensitive species (*Measurement Indicator #6*; Table 4.6-12).

4.6.5.4 Alternative D1 (NSO in IRAs)

Alternative D has less restrictive leasing options than Alternative C and more restrictive options than Alternative E. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative D (Table 2.5-4) and where those acres are located (Figures 2.5-4 (a-d)). Under Alternative D1 (NSO in IRAs), 33 percent of the Dixie National Forest would be NSO. Six percent would be NA.

Impacts to TEC species would be similar under Alternative D1 to those under Alternative C. Impacts to some sensitive species from habitat losses or fragmentation would be more adverse under Alternative D1 than under Alternative C. These sensitive species include pygmy rabbit and sensitive plant species.

Due to the large proportion of habitat within IRAs, impacts to Mexican spotted owl would be measurably lower under Alternative D1 than under Alternative D2 (CSU in IRAs). Impacts to other special status species under Alternative D1 would not be measurably different than under Alternative D2 (below) in intensity or duration. Sensitive bat habitat and big game winter range are mostly within IRAs; however, potential impacts under both Alternative D1 and Alternative D2 would be minor and would not differ.

4.6.5.5 Alternative D2 (CSU in IRAs)

Under Alternative D2 (CSU in IRAs), 8 percent of the Dixie National Forest would be NSO. Six percent would be NA.

In general, a substantial portion of TEC species habitat would carry CSU (Mexican spotted owls) or TL (California condors) leasing options that are designed to avoid direct "take" but could still lead to habitat losses, fragmentation, impacts from noise, or weed invasions under this alternative. Impacts for all TEC species would be less adverse than under Alternative E, but moderate or major impacts to some species are possible.
Alternative D2 could have impacts on most Sensitive species and MIS. Although CSU or TLs would be in place, the oil and gas activities would still occur and would cause some impacts. Several resource components with moderate or major associated impacts under SLT, including most Sensitive species, would likely have fewer associated impacts under Alternative D2, including Utah prairie dog, MIS and sensitive fishes, pygmy rabbit, and sage grouse. "May Impact" would apply to all Sensitive species (*Measurement Indicator #6*; Table 4.6-12).

4.6.5.6 Alternative E1 (NSO in IRAs)

Alternative E has the least restrictive leasing options. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative E1 with NSO in IRAs (Table 2.5-5) and where those acres are located (Figures 2.5-5 (a-d)).

Thirty three percent of the Dixie National Forest is within IRAs and would be NSO. Six percent of the Forest would be NA.

The intensity and duration of impacts to most TEC species would be the same as described under SLT with the exception of Mexican spotted owls. Critical habitats for spotted owls overlap with IRAs, which are NSO under this alternative. For Mexican spotted owls, habitat impacts would not occur in PACs (>99% occurs within IRAs) and would be far less likely within Critical Habitat (66% occurs within IRAs). Regarding Utah prairie dog, major impacts are possible under this alternative with regard to habitat loss and noise. Sensitive species and MIS with enough overlap to reduce the intensity of impacts due to NSO in IRAs include big game (29% of winter range is within IRAs; 42% of summer range is in IRAs), peregrine falcon (30% of rim habitat is within IRAs), and sensitive bats (28% of available habitat is within IRAs). In this analysis, impacts are measurably lower, relative to Alternative E2, only for Mexican spotted owl (see Table 4.6-10). Major impacts may occur to the following species: Utah prairie dog, pygmy rabbit, sensitive bats, big game, and greater sage-grouse.

Under Alternative E1, determinations (Table 4.6-12) under connected actions would be the same as under Alternative E2 (below), with the exception of Mexican spotted owls.

4.6.5.7 Alternative E2 (SLT in IRAs)

Impacts to TEC, Sensitive species, and MIS would be the same as described under SLT. Under Alternative E2 with SLT in IRAs, leasing would be allowed on 94 percent of the Forest.

Regarding determinations, actions “May Impact” would apply to all species except sensitive fish (“Will Impact;” *Measurement Indicator #6*; Table 4.6-12).

Table 4.6-10 Impacts with Respect to Measurement Indicators #1 - #5, and #7

Resource			ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
TEC									
Endangered fish[1]		*MI #1*	No effect	negligible LT	negligible LT	negligible LT	negligible LT	minor-mod LT	minor-mod LT
California condor		*MI #1*	No effect	negligible ST	negligible ST	neg-minor ST	neg-minor ST	neg-minor ST	neg-minor ST
		MI #2	No effect	neg-minor LT	neg-minor LT	minor LT	minor LT	minor LT	minor LT
		MI #3	No effect	minor ST	minor-mod ST	minor-mod ST	minor-mod ST	moderate ST	moderate ST
Utah prairie dog[3]		*MI #1*	No effect	neg-minor ST	minor ST	minor ST	minor ST	mod-major LT	mod-major LT
		MI #2	No effect	negligible LT	negligible LT	negligible LT	negligible LT	minor-mod LT	moderate LT
		MI #3	No effect	minor ST	minor-mod ST	minor-mod ST	minor-mod ST	mod-major ST-LT	mod-major ST-LT
		MI #5	No effect	minor LT	minor LT	minor LT	minor LT	minor LT	minor LT
Mexican spotted owl	Critical Habiat[4]	*MI #1*	No effect	No effect	minor LT	minor LT	moderate LT	minor-mod LT	mod-major LT
		MI #3	No effect	No effect	minor -mod ST	minor -mod ST	moderate ST	moderate ST	mod-major LT
	"Potential" habitat	*MI #1*	No effect	negligible ST	minor ST	minor ST	minor ST	minor ST	minor ST
		MI #3	No effect	neg-minor ST	minor-mod ST	minor -mod ST	moderate ST	moderate ST	moderate ST
	PAC[4]	*MI #1*	No effect	No effect	neg-minor ST	neg-minor ST	minor-mod LT	neg-minor ST	mod-major LT
		MI #3	No effect	No effect	minor-mod ST	minor-mod ST	moderate ST	moderate ST	mod-major LT
	All habitats	*MI #2*	No effect	minor LT	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
Western yellow-billed cuckoo		*MI #1*	No effect	negligible LT	minor LT	minor LT	minor LT	minor LT	minor LT

Resource			ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Greater sage-grouse	Brood rearing habitat	*MI#1*	No effect	No effect	moderate ST-LT	moderate ST-LT	moderate ST-LT	mod-major ST-LT	mod-major ST-LT
		MI #2	No effect	No effect	minor ST-LT	moderate ST-LT	moderate ST-LT	mod-major ST-LT	mod-major ST-LT
		MI #3	No effect	No effect	neg-minor ST-LT	neg-minor ST-LT	neg-minor ST-LT	mod-major ST-LT	mod-major ST-LT
	Leks	*MI#1*	No effect	No effect	minor ST	moderate ST	moderate ST	mod-major LT	mod-major LT
		MI #3	No effect	No effect	negligible ST	neg-minor LT	neg-minor LT	mod-major LT	mod-major LT
	All habitats	*MI #5*	No effect	No effect	minor LT	minor LT	minor LT	minor LT	minor LT
Sensitive /MIS									
MIS and Sensitive fishes		*MI #1*	No effect	No effect	negligible LT	mod-major LT	mod-major LT	mod-major LT	mod-major LT
		MI #2	No effect	No effect	negligible LT	mod-major LT	mod-major LT	major LT	major LT
		MI #5	No effect	No effect	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
Pygmy rabbit		*MI#1*	No effect	neg-minor ST	neg-minor ST-LT	mod ST-LT	mod ST-LT	mod-major ST-LT	mod-major ST-LT
		MI #2	No effect	negligible LT	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
		MI #3	No effect	neg-minor ST	minor ST-LT	minor ST-LT	minor ST-LT	mod-major ST-LT	mod-major ST-LT
		MI #5	No effect	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
Sensitive bats[3]		*MI#1*	No effect	neg-minor ST	minor ST-LT	minor ST-LT	minor ST-LT	mod-major ST-LT	mod-major ST-LT
		MI #2	No effect	negligible LT	neg-minor LT	minor LT	minor LT	moderate LT	moderate LT
		MI #3	No effect	neg-minor ST	minor ST	minor ST	minor ST	mod-major ST-LT	mod-major ST-LT
		MI #5	No effect	neg-minor LT	minor LT	minor LT	minor LT	minor LT	minor LT

Resource		ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Boreal toad	*MI#1*	No effect	minor ST	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
	MI #2	No effect	negligible LT	moderate ST-LT	moderate ST-LT	moderate ST-LT	moderate ST-LT	moderate ST-LT
	MI #5	No effect	minor LT	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
Big game (MIS)	*MI#1*	No effect	No effect	negligible-minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT	minor ST-LT
	MI #2	No effect	No effect	moderate LT	major LT	major LT	major LT	major LT
	MI #3	No effect	No effect	negligible ST	negligible ST	negligible ST	moderate ST	moderate ST
	MI #4	No effect	No effect	moderate[2,3] ST-LT	mod-major[2,3] ST-LT	mod-major[2,3] ST-LT	mod-major[2,3] ST-LT	mod-major[2,3] ST-LT
	MI #7	No effect	No effect	neutral	neutral	neutral	neutral	neutral
Sensitive raptors	*MI#1*	No effect	neg-minor ST	negligible-minor ST-LT	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT	minor-mod ST-LT
	MI #2	No effect	minor LT	minor LT	minor LT	minor LT	moderate LT	mod-major LT
	MI #3	No effect	negligible ST	negligible ST	negligible ST	negligible ST	moderate ST	moderate ST
	MI #5	No effect	minor LT	minor LT	minor LT	minor LT	minor LT	minor LT
Sensitive plants	*MI #1*	No effect	neg-minor LT	minor LT	moderate LT	moderate LT	moderate LT	moderate LT
	MI #2	No effect	negligible LT	moderate LT	moderate LT	moderate LT	moderate LT	moderate LT
	MI #5	No effect	min-mod LT	min-mod LT	min-mod LT	min-mod LT	min-mod LT	min-mod LT

[1] Impacts most likely within Pine Valley Ranger District
[2] Impacts most likely within Cedar City Ranger District
[3] Impacts most likely within Powell Ranger District
[4] Impacts most likely within Escalante Ranger District
Measurement Indicator #6 is summarized in Tables 4.6-11 and 4.6-12. *Measurement Indicator #8* is not presented here because there would be no impacts. *Measurement Indicator #9* is summarized at the end of Section 4.6.4.7.
LT = long term; ST = short term; neg = negligible; mod = moderate.

Table 4.6-11 Effects Determinations (Measurement Indicator #4).

Resource	ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Virgin Riverchub	NE	NE	NE	NE	NE	NE	NE
Woundfin	NE	NE	NE	NE	NE	NE	NE
California condor (Experimental/Nonessential)	NE	WNJ	WNJ	WNJ	WNJ	WNJ	WNJ
California condor (Endangered)	NE	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA
Utah prairie dog	NE	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA
Mexican spotted owl	NE	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA	MA-LAA
Western yellow-billed cuckoo	NE	NE	NE	NE	NE	NE	NE

NE = No Effect; WNJ = Will Not Jeopardize the continued existence; MA-NLAA = May Affect - Not Likely to Adversely Affect; MA-LAA = May Affect - Likely to Adversely Affect

Table 4.6-12 Determinations of Impacts to Viability from the BE (Measurement Indicator #6).

Resource	ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Bonneville cutthroat trout	NI	NI	MIIH	MIIH	MIIH	WIFV	WIFV
Colorado cutthroat trout	NI	NI	MIIH	MIIH	MIIH	WIFV	WIFV
Southern leatherside	NI	NI	MIIH	MIIH	MIIH	WIFV	WIFV
Boreal toad	NI	NI	MIIH	MIIH	MIIH	MIIH	MIIH
Pygmy rabbit	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Townsend's big-eared bat	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Spotted bat	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Bighorn sheep	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Bald eagle	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Goshawk	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Greater sage-grouse	NI	NI	MIIH	MIIH	MIIH	MIIH	MIIH
Peregrine falcon	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Three-toed woodpecker	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Flammulated owl	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH
Sensitive plants	NI	MIIH	MIIH	MIIH	MIIH	MIIH	MIIH

NI = No Impact
MIIH = May Impact Individuals or Habitat but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
WIFV = Will Impact individuals or habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of Viability to the population or species

4.7 Water and Watershed Resources

4.7.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.7-1 provides an example how these terms would apply to Water and Watershed Resources.

Table 4.7-1 Terms used to Describe Effects to Water and Watershed Resources

Attribute of Effect		Description relative to Water and Watershed Resources
Quality	Beneficial	A reduction in the amount of fine sediment delivered to a stream.
	Adverse	An increase in the amount of fine sediment delivered to a stream.
Magnitude (Intensity)	Negligible	An increase in the amount of fine sediment delivered to a stream that is so small it cannot be effectively measured using existing methods.
	Minor	An increase in the amount of fine sediment delivered to a stream that can be effectively measured using existing methods. However, the increase is small relative to current conditions and would not change physical and biological conditions in the stream
	Moderate	An increase in the amount of fine sediment delivered to a stream that can be effectively measured using existing methods. The increase is large enough that it may result in changes to physical and biological conditions in the stream.
	Major	An increase in the amount of fine sediment delivered to a stream that can easily be effectively measured using existing methods and may be visually apparent. The increase is large and would change physical and biological conditions in the stream.
Duration	Temporary	An increase in sediment delivery during construction of a facility (i.e., road, well pad) that does not occur once construction is completed.
	Short-term	An increase in sediment delivery due to exploration activities (i.e., construction of exploratory well pads or access roads). The increase in sediment delivery is limited only to the time needed for exploration and reclamation, 10 years or less.
	Long-term	An increase in sediment delivery due to the construction of production facilities (i.e., a production field and associated roads). The life of the production field and the time needed for reclamation would exceed 10 years.

4.7.2 Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DESCRIPTION OF POTENTIAL SOURCES OF POLLUTANTS, THE TYPES OF POLLUTANTS, AND THE EFFECT TO SURFACE WATERS AND GROUNDWATER
- *Measurement Indicator #2* POTENTIAL TO INCREASE SEDIMENT IN SURFACE STREAMS
- *Measurement Indicator #3* RELATIVE POTENTIAL FOR INCREASING MILES OF ROADS WITHIN MUNICIPAL WATERSHEDS AND LAVA FIELDS OVER SENSITIVE AQUIFERS

- *Measurement Indicator #4* NARRATIVE DESCRIPTION OF POTENTIAL EFFECTS TO SURFACE WATER FLOW AND GROUNDWATER AVAILABILITY
- *Measurement Indicator #5* ACRES OF DISTURBANCE

4.7.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E it is assumed that activities described under the Reasonably Foreseeable Development Scenario (RFDS) would occur. However, depending on the alternative, activities described under the RFDS would be restricted in some locations. These activities include 60 to 120 acres (depending upon ranger district) of surface disturbance associated with seismic surveys, 83 to 332 acres (depending upon ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field (per ranger district). The locations of activities are not yet known.

As is discussed in further detail below, water and watershed resources could be affected by any land disturbing activity and/or spills of polluting substances. Increased erosion is one result of land disturbing activity, and if the disturbance occurs in close proximity to a stream or within wetlands, floodplains, or riparian areas, it could result in sediment delivery to streams. Increased erosion and sediment delivery could have effects on water quality and channel stability, which in turn could affect fisheries and downstream users. If spills of polluting substances and chemicals were to reach wetlands, floodplains, riparian areas, or streams, the level of significance of these events would depend on the composition and amount of contaminant and the conditions of the receiving resource.

Of all the activities predicted by the RFDS, seismic surveys present the lowest potential for impacts to water and watershed resources. Impacts associated with seismic surveys result primarily from overland travel by wheeled vehicles, which can leave wheel ruts, compact soils, and crush vegetation. Soil compaction increases runoff rates and erosion. Wheel ruts can further increase erosion by channeling flow. The crushing of vegetation associated with overland travel could reduce this effect because the vegetation would still intercept precipitation and could also provide a protective cover for the soil. Furthermore, *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C) specify that operation of mechanical equipment off designated routes should be avoided during periods when soils are susceptible to puddling, rutting, and compaction. Overall, the amount of disturbance should be small enough that given the BMPs, any increases in erosion would be localized and range from negligible to minor and be short term.

The greatest potential for impacts to water and watershed resources comes from roads, which due to topographical constraints may be built in close proximity to streams, often within floodplains or riparian areas. While the specific impacts of roads vary somewhat by resource and are discussed in additional sections below, the primary impacts of roads on water and watershed resources can be generalized to primarily include fragmentation or loss of wildlife habitat, increases in erosion and sediment delivery to streams, and the alteration of hydrology. These impacts result from the fact that runoff rates and erosion are typically increased when vegetation is removed and soil is exposed and compacted. In addition, roads often act as extensions of the stream channel network by capturing and channeling surface water runoff, water that would naturally infiltrate the soil under undisturbed conditions.

The construction of well pads would also require land clearing and the impacts would be similar to those described for roads. However, well pads are not likely to be located as close to water and watershed resources as roads, which reduces the potential for impacts. For roads or well pads that are a part of exploration activities, the impacts would be short term because reclamation activities would return the ground surface and the vegetative cover to a stable condition. Reclamation sufficient to provide erosion protection can be expected to take one to three growing seasons. Prior to reclamation, the level of impacts to water and watershed resources could vary from negligible to major depending upon the site-specific circumstances associated with the location of the facility (i.e., how close to surface water or watershed resources the disturbance is, what the ground slope is where the disturbance occurs, and the erosion characteristics of the disturbance). In the case of a production field, impacts would be of the same type as for exploration, but could be increased in scale because of a greater percentage of land cleared within a given watershed, and long term because the production field operations would last for a greater time.

In exploration and production instances, increases in runoff rates may not result in realized increases in stream runoff, erosion, or sedimentation because of sediment and runoff control BMPs that would retain runoff. To help ensure that this is the case, Appendix C includes a requirement, which dictates site drainage, including berming and ditching criteria. Appendix C also includes a requirement that the operation of mechanical equipment on designated routes should be avoided during periods when routes are susceptible to puddling or rutting unless mitigation (such as drainage and surfacing) is provided.

Oil and gas activity also has the potential to impact water and watershed resources through the inadvertent release of hydrocarbons or chemical pollutants during overland travel or during the construction or use of the cleared land. This may include fluid leaks from vehicles or equipment, fuels or chemicals spilled during exploration or production, or improperly managed storm water runoff that contacts pollutants on drill sites and storage yards, etc. These types of impacts to water and watershed resources would likely be short term, and could be minor to major. This subject, as well as other details for impacts to water resources is discussed in greater detail throughout the following subsections.

Table 4.7-2 lists the leasing options assigned to the watershed resource components under each alternative. Descriptions of leasing options (and associated impacts on water and watershed resources) are described in Section 4.7.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) whenever the applicable resource component occurs on the Dixie National Forest.

Table 4.7-2 Leasing Options Assigned Under Each Alternative

Resource Component	Alternative				
	A	B	C	D	E
Lava Fields over Sensitive Aquifers (58,585 acres)	NL	NL	NL	NSO-18	SLT
Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas (including riparian vegetation)[1]	NL	NSO-19 500 ft buffer NL 300 ft buffer	NSO-20 300 ft buffer	CSU-22 300 ft buffer	SLT
Municipal	NL	NL	NSO-21	CSU-23	SLT

Watershed (53,403 acres)					

[1] Includes a 300-foot buffer (410,550 acres), except for Alternative B, which includes a 500-foot buffer (662,835 acres).

As evident throughout the following sections, impact analysis of the RFDS is difficult for water and watershed resources. First, without knowing exactly where a specific action might occur, there is uncertainty saying what the level of impact to water resources might be – it could range from minor to major depending upon many factors such as proximity to water and watershed resources, soil type, geology, season, etc. Second, assuming that all of the environmental protection measures that the Dixie National Forest would have at its disposal (including at the least the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements*, Appendix C), even under SLT, are met, as well as all of the other requirements of the various Clean Water Act laws, and assuming that spills or failures of environmental protection measures rarely occur, impacts to water resources could most likely be considered to be negligible or minor; however, there is uncertainty in this prediction. There is at least some indefinable probability that spills or failures in environmental protection measures could occur, with consequent impacts to water resources ranging from negligible to major. The history of oil and gas activities throughout the country indicates that even though improvements have been made in procedures, chemicals used, and environmental protection; unforeseen spills, ruptures, and leaks, can occur. The recent track record of oil and gas companies may be quite good, but it is not perfect – nor can it be expected to be perfect in the future. Last, the level or potential for impacts to water and watershed resources is not so much tied to acreages, but often more tied to proximity of the activities to water sources; while the former is available conceptually in this impact analysis, the latter is not available because specific site locations for future oil and gas activities are not known.

4.7.4 Impacts of Connected Actions by Leasing Option

This section summarizes the leasing options described in Chapter 1 and describes the impacts from connected actions under each leasing option. Leasing options would dictate the conditions under which impacts from connected actions (as described in the RFDS) may occur. Impacts to water and watershed resources considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.7.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.7.4.1 Not Legally Available (NA)

There would be no effects to water or watershed resources occurring in areas not legally available for leasing (Section 1.5.2).

4.7.4.2 No Lease (NL)

A NL leasing option does not allow leasing on specified lands for the protection of resources. These lands would not be administratively available for leasing and no direct disturbances associated with oil and gas leasing would occur on lands with an NL leasing option. Under Alternative A, NL is applied to the entire Dixie National Forest. Under Alternative B, NL is applied to lava fields over sensitive aquifers, the 300-foot buffer around all waterbodies, and to municipal watersheds. Under Alternative C a NL stipulation is applied to lava fields over

sensitive aquifers. Where NL applies to lava fields over sensitive aquifers, the intent is to avoid direct and indirect effects associated with ground disturbance. Where NL applies to the 300-foot buffer, the intent is to prevent the direct effects associated with ground disturbance from altering watershed resources or delivering pollutants (including sediment) to surface water features and the associated indirect effects on aquatic habitat and human uses. Where NL applies to municipal watersheds, the intent is to provide the maximum level of protection possible to these water sources that are used for community water supplies. This is needed because any sediment production and/or release of potentially polluting materials to municipal water supplies could be considered significant due to the fact that these areas are managed for culinary water production.

Under Alternative A and there would be no direct or indirect effects from oil and gas leasing. For lava fields over sensitive aquifers and municipal watersheds, NL would eliminate the potential for impacts from leasing activities. For watershed resources and surface water, NL applied to the 300-foot buffer would prevent direct disturbance, but indirect effects could occur as a result of oil and gas activity on adjacent land as described in Section 4.7.4.6. Potential indirect effects include sediment deposition from erosion outside the buffer, hydrocarbon or chemical spills, and the alteration of natural surface water infiltration rates and flow paths. The severity of these effects would depend on the location of these facilities relative to the stream network and other watershed resources. Given the width of the buffer, it is likely that sediment and spilled or leaked materials would settle out prior to reaching a stream. However, a large unattended release would still have the potential to enter a stream, depending upon the circumstance. In general, with proper implementation of BMPs applicable to road and well pad construction, the indirect impacts would likely range from negligible to moderate and be short term for exploration activities and long term for production facilities.

4.7.4.3 No Surface Occupancy (NSO)

There are two separate NSO leasing stipulations that would apply to water and watershed resource components. The first NSO is discussed in this section and the second, which allows perpendicular stream crossings, is discussed below under the heading “NSO with Road Crossings.” The first NSO would be a general NSO that prohibits occupancy or use of the land for oil and gas related activities (i.e., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). However, it would allow for directional drilling into an NSO area from outside its boundaries and would allow for seismic activities following appropriate NEPA analysis. This leasing option is intended to prevent the most likely sources of pollutants and water-related impacts – those related to surface occupancy – from occurring, while still allowing certain uses, which have some, but more minimal potential for impacts. This first NSO is applied to lava fields over sensitive aquifers under Alternative D. It is also applied to a 500-foot buffer around streams, lakes, reservoirs, springs, and wetlands under Alternative B and to municipal watersheds under Alternative C. Further, similar NSO leasing option is applied to IRAs under Alternative B and C and Alternatives D1 and E1. Impacts under this type of NSO are discussed below (including relevant *Measurement Indicators*).

WATERSHED RESOURCES AND SURFACE WATERS

The 500-foot buffer to which NSO is applied under Alternative B and extends 200 feet beyond the outer edge of the 300-foot buffer, which would be under NL in Alternative B. The only disturbance that could occur within the 200 feet between the outer edge of the 300-foot buffer and the inner edge of the 500-foot buffer would be seismic exploration following appropriate NEPA analysis. The impacts of seismic exploration to streams, wetlands, floodplains, and

riparian areas are described in Section 4.7.4.6. They include a small potential for increased erosion and pollutant spills. Spills in this situation could only come from equipment used for the seismic surveys and would be limited to small quantities of fuel, coolant, or lubricants. The impacts of both these disturbances are described in detail in Section 4.7.4.6. These impacts would likely be negligible to minor and short term due to the low amount of disturbance expected and the ability of the resource to recover following minor disturbance. Indirectly, oil and gas activity in adjacent areas could cause erosion in upland areas that may be deposited in wetlands, floodplains, or riparian areas. If the disturbance was large, sediment could reach streams. Other potential indirect impacts may include the alteration of natural infiltration and flow paths, and hydrocarbon or chemical spills. All potential indirect effects are discussed in further detail in Section 4.7.4.6. The severity of these effects would depend on the location and type of disturbance and with proper implementation of BMPs could range from negligible to moderate and be short and long term.

Also, see *Measurement Indicators #1*, *2*, *4*, and *5* below.

GROUNDWATER

NSO applied to lava fields over sensitive aquifers and municipal watersheds would greatly reduce the potential for impacts to these resource components and would only be slightly less protective than a NL leasing option. NSO would not allow road construction and would eliminate much of the potential for spills (as noted and discussed further elsewhere in this section, roads represent one of the greatest potentials for sediment impacts and other water quality impacts due to spills). Further, as other facilities would also be prohibited (i.e., well pads), it would also greatly reduce the potential for most other spills not related to roads to occur or reach these areas.

The intent of applying NSO to lava fields over sensitive aquifers is to prevent the direct effects associated with road building sediments and pollutants that may escape and mix with groundwater, thereby potentially degrading these aquifers over the long term; aquifer cleanup would be difficult and costly. In most cases, sediments, and even small amounts of pollutants, would not present a risk of contamination to groundwater. However, lava fields over sensitive aquifers are unique in that they have extremely high permeability and macro pore spaces. The pore spaces are large enough that any pollutants, including sediment, can rapidly enter the aquifer. Although an oil play is unlikely to occur near lava fields, there is a potential for impacts to groundwater if directional drilling were to occur beneath lava fields over sensitive aquifers. In general, if there is a risk of groundwater contamination, wells would be cased to prevent contamination of groundwater. BLM Onshore Oil and Gas Order No. 2 (43 CFR 3160) requires cementing or casing for any water bearing formation which contains total dissolved solids equal to or less than 10,000 mg/L. However, if wells were improperly cased or sealed, leaking of contaminants into the aquifer could occur. The potential for this is very small since proper casing of wells is well regulated. If contamination were to occur, the impacts would be long term and would range from moderate to major. Although some roads currently cross lava field over sensitive aquifers and travel access is allowed, the potential for a spill to occur in large enough proportions from existing approved access is much less than the potential scale of spills from commercial oil and gas drilling or production activities. Directional drilling would not be likely to impact municipal watersheds. There would be no indirect impacts as discussed in Section 4.7.4.2.

Also, see *Measurement Indicators #1* and *3* below.

WATER QUALITY

NSO limits surface disturbance to seismic activity (following appropriate NEPA analysis) and greatly reduces the potential for direct effects to water quality. Impacts to water quality would be as described above for watershed resources, surface water, and groundwater.

WATER USES

The types of potential impacts to water uses would be similar as described for SLT in Section 4.7.4.6. However, given the protections provided by NSO, as described above, both the probability and magnitude of the effects would be less under NSO than SLT. The magnitude of impacts would follow the magnitude of impacts outlined above for surface water and ground water and, in general, would be negligible to minor and short and long term. If impacts to groundwater occurred, they would likely be of a greater magnitude, as described above.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DESCRIPTION OF POTENTIAL SOURCES OF POLLUTANTS, THE TYPES OF POLLUTANTS, AND THE EFFECT TO SURFACE WATERS AND GROUNDWATER

As described in the sections above, seismic exploration has the potential to spill small quantities of fuel, coolant, or lubricants. Improper casing or sealing of wells would have the same impact as described for this measurement indicator in Section 4.7.4.6.

- *Measurement Indicator #2* POTENTIAL TO INCREASE SEDIMENT IN SURFACE STREAMS

The potential for an increase in sediment delivery to streams is greater than for the NA or NL leasing options because seismic exploration would be allowed following appropriate NEPA analysis. However, the potential for increased sediment delivery to surface streams from seismic exploration is minimal due to the small amount of disturbance. Indirectly, oil and gas activity on land adjacent to areas under NSO could contribute sediment as described for SLT (Section 4.7.4.6)

- *Measurement Indicator #3* RELATIVE POTENTIAL FOR INCREASING MILES OF ROADS WITHIN MUNICIPAL WATERSHEDS AND LAVA FIELDS OVER SENSITIVE AQUIFERS

Roads would not be allowed in these areas under NSO.

- *Measurement Indicator #4* NARRATIVE DESCRIPTION OF POTENTIAL EFFECTS TO SURFACE WATER FLOW AND GROUNDWATER AVAILABILITY

The alteration of flow into wetlands from disturbance in upland areas could decrease groundwater recharge and decrease the capability of wetlands to moderate stream fluctuations.

- *Measurement Indicator #5* ACRES OF DISTURBANCE

The only type of direct disturbance that could occur under this type of NSO is seismic activity following appropriate NEPA analysis. As a result, up to 60 acres of seismic exploration could occur on the Pine Valley Ranger District and 120 acres on the Cedar City, Powell, and Escalante Ranger Districts.

NSO WITH ROAD CROSSINGS (ALTERNATIVE C ONLY)

The second type of NSO leasing option would apply to the 300-foot buffer in Alternative C. This NSO leasing option would prohibit occupancy or use of the land for facilities such as well pads and central tank batteries, but would allow roads, pipelines, and similar linear features for short distances perpendicular to streams (with the exception of Fisheries Habitat; see Section 4.6). This would allow, for example, a culvert to be installed to cross a stream. However, roads and linear features could not be constructed along, or parallel, to streams or any other waterbody within the 300-foot buffer. This reduces, but does not eliminate, the amount of disturbed area that could be in close proximity to a stream. While this application of NSO would be less protective for streams than the type of NSO discussed above, it was developed in recognition of the need for road crossings within a landscape that is dissected by streams. When areas with the different NSO leasing options overlap, the more restrictive NSO would apply (NSO without road crossings). Under this type of NSO, direct disturbance that could occur would include seismic exploration as described above and road-stream crossings. Road-stream crossings could have impacts to stream channels as described in Section 4.7.4.6 including the introduction of sediment, increased bank erosion, and alteration of local hydrological conditions. Impacts of stream crossings would range from minor to moderate and could be short and long term. Indirect effects would be the same as described for SLT in Section 4.7.4.6.and would range from negligible to moderate and be short to long term depending on the location and type of disturbance.

Measurement Indicators

The types of impacts for the measurement indicators would be the same under this type of NSO as described above for the first type of NSO. However, the probability for spills (*Measurement Indicator #1*) and increased sediment introduction (*Measurement Indicator #2*) is increased due to the increased proximity of roads to watershed resources and surface water. Also, the amount of disturbance would be increased as described for *Measurement Indicator #5* below.

- *Measurement Indicator #5* ACRES OF DISTURBANCE

Up to 60 acres of seismic exploration could occur on the Pine Valley Ranger District and 120 acres on the Cedar City, Powell, and Escalante Ranger Districts. In addition, approximately 0.5 acres (600 linear feet) of roads could be constructed at each stream crossing. As the number of possible stream crossings is unknown, a conservative estimate is to assume that disturbance could be up to the maximum estimated for road construction on each ranger district. This would be up to 53.5 acres for the Pine Valley Ranger District, 160.5 acres for the Cedar City Ranger District, and 214.0 acres for both the Powell and Escalante Ranger Districts. As a result, total acres disturbed would be 113.5 acres for the Pine Valley Ranger District, 280.5 acres for the Cedar City Ranger District, and 334.0 acres for the Powell and Escalante Ranger Districts.

4.7.4.4 Timing Limitation (TL)

A TL leasing option is not applied directly to any of the water or watershed resource components.

4.7.4.5 Controlled Surface Use (CSU)

CSU provides for controlled but generally allowed surface use on all or portions of a lease. Operations would be held to special operational constraints that may otherwise exceed the mitigation provided by SLT, regulations, and operating orders. Under Alternative D, a CSU leasing option would be applied within municipal watersheds and to the 300-foot buffer around

waterbodies located outside of a municipal watershed. The CSU applied to the 300-foot buffer would allow surface use or occupancy that does not involve blading or other mechanical disturbance of the soil surface. Platforms or other stabilizing structures would need to be used if facilities such as a well pad or portions of a road needed to extend into these areas. The exception would be for perpendicular stream crossing as explained above for NSO with Road Crossings. The intent of this CSU is to allow operators some flexibility in the location of facilities, while preventing the impacts to water and watershed resources associated with surface disturbance and erosion. Given the level of restrictions, this CSU would provide similar protection to water and watershed resources as NSO. However, as facilities may be placed in increased proximity to water, there would be an increased potential for spills. As described in Section 4.7.4.6, the impacts of a spill would range from negligible to major, and generally be long term.

A separate CSU leasing option would be applied to municipal watersheds under Alternative D. The CSU would allow surface use and occupancy, with the caveat that proposed activities would be delayed until the Dixie National Forest finds the lessee has sustained its burden of proof and that the proposed activities do not create a foreseeable and substantial risk of pollution to the municipal watershed. This CSU is intended to decrease the risk of pollution described in Section 4.7.4.6 by adding additional oversight. As risks are inherent to all types of oil and gas activity, some potential still exists. However, it is anticipated that the additional oversight should decrease the impacts described in Section 4.7.4.6 to negligible to moderate. Impacts could be short or long term.

Measurement Indicators

The types of impacts for the measurement indicators would be the same under these CSU leasing options as described for NSO. However, the probability for spills (*Measurement Indicator #1*) is increased due to the increased proximity of oil and gas facilities to watershed resources and surface water. Also, the amount of disturbance in municipal watersheds would be increased as described for *Measurement Indicator #5* below.

- *Measurement Indicator #5* ACRES OF DISTURBANCE

The maximum amount of disturbance that could occur within municipal watershed would be the same as describe for SLT in Section 4.7.4.6 (up to 396.9 acres on the Pine Valley Ranger District, 622.9 acres on the Cedar City Ranger District, and 705.9 acres on the Powell and Escalante Ranger Districts).

4.7.4.6 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT) and the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2. Under SLT, anywhere within the leasehold is available for placement of a road and drill site. However, at a minimum, SLT would allow operations to be moved up to 200 meters (656 feet) and be delayed for up to 60 days if the authorizing officer deems it necessary to protect a resource.

Under Alternative E, SLT would be applied on all water and watershed resources components (lava fields over sensitive aquifers, the 300-foot buffer around all waterbodies, and municipal watersheds), including within IRAs if the 2001 Roadless Area Conservation Rule is not in effect (Alternative E2).

While SLT does not apply specific protection to any of the water or watershed resource components, the ability to move operations by up to 200 meters (656 feet) and compliance with other environmental protection laws and regulations would provide a level of protection. For surface waters and watershed resources, if all facilities and operations, including roads, were moved the maximum distance (200 meters, 656 feet) from these resources, the protection would be similar to that under NSO. However, aside from compliance with laws and regulations, it is possible that impacts could occur, most likely be due to an accident or unanticipated event. As a result, SLT is generally less protective than NSO or NL.

As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities (Table 4.7-3)

WATERSHED RESOURCES AND SURFACE WATER

Wetlands: Under SLT, direct impacts to wetlands could occur as a result of seismic exploration, construction, and reconstruction of roads, construction of exploratory well pads and associated facilities, and construction of production wells with their associated facilities. Seismic exploration has the least potential for impacts, but if conducted within wetland areas could result in soil compaction and vegetation removal. Due to the low gradient nature of most wetland areas, these impacts may not increase erosion but could temporarily raise turbidity levels (if surface water is present) and reduce wildlife habitat. Further, under all activities (i.e., seismic exploration, exploratory drilling, and production) the possibility for pollutant spills exists if operations were conducted within or in direct proximity to a wetland. Spills could directly kill wetland vegetation and aquatic organisms, which would decrease the wetlands ability to buffer water flow and reduce the uptake of organic nutrients.

The construction of well pads and access roads in wetland areas would result in the removal of wetland vegetation and the filling of wetlands with soil necessary for the construction of these facilities. Section 404 of the Clean Water Act would require a permit from the US Army Corp of Engineers for the discharge of fill material into a wetland. If a permit were granted, the conversion of wetlands to upland habitat would reduce habitat and/or forage for wildlife, reduce the ability of wetlands to trap sediments and pollutants, and alter hydrology. Changes in hydrology would primarily consist of the decreased ability of wetlands to capture high flows and store the water for slow release. As a result, streams may receive higher flows or higher flow velocities, which could lead to increased stream erosion and changes to stream channel morphology. Under SLT, these impacts could range from minor to major. However, many of the impacts could be avoided by the ability to move operations by up to 200 meters (656 feet), Section 404 of the Clean Water Act, and adherence to BMPs. The duration would be short term for impacts due to seismic exploration and possible spills, and long term for any filling of wetlands.

Table 4.7-3 Maximum Projected Road Construction and Total Disturbance that could occur under SLT, by Ranger District

Ranger District	Activity	Roads (miles)[1]		Total[1,2,3] Disturbance (Acres)
		New Roads	Reconstructed Roads	
Pine Valley	Seismic Exploration (100 miles)			60.0
	Exploratory Wells (5 wells)	3.3	19.6	83.0
	Production Wells (19 wells)	10.0		253.9

Cedar City	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (15 wells)	9.9	58.8	249.0
	Production Wells (19 wells)	10.0		253.9
Powell	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (20 wells)	13.2	78.4	332.0
	Production Wells (19 wells)	10.0		253.9
Escalante	Seismic Exploration (200 miles)			120.0
	Exploratory Wells (20 wells)	13.2	78.4	332.0
	Production Wells (19 wells)	10.0		253.9
[2]Forest Total	Seismic Exploration			420.0
	Exploratory Wells	39.6	235.2	996.0
	Production Wells	10.0		253.9

[1] Miles and acres of roads are a part of the estimated total disturbance, which also includes well pads, production facilities, power lines, pipelines, and truck loading areas (BLM 2007a).
[2] For the purpose of this analysis it is assumed that a single production field could be located on any of the ranger districts; however, only a single production field is predicted for the entire forest. As a result the total disturbance for production wells is the same for each ranger district and the Forest total.
[3] Assumes the greatest amount of disturbance predicted in a ranger district occurred.

Due to the protections inherent within SLT, indirect impacts to wetlands are more likely to occur than direct effects. Oil and gas exploration and development on lands adjacent to wetlands would generally involve some degree of surface disturbance and vegetation removal, both of which can lead to increased erosion. This can result in an increase in the amount of sediment delivered to wetlands. While wetlands function to capture sediment and pollutants, excessive amounts of sediment would fill in wetland areas and lead to similar impacts as described above for the direct fill of wetlands. Further, pollutant spills on upland areas may reach wetlands and have similar impacts as already described. Surface disturbance, particularly roads, can also alter the natural drainage pattern of upland areas, which can result in either increased or decreased surface water runoff to wetlands. Decreases in the amount of water delivered would dry up wetlands, which would kill wetland vegetation and alter groundwater infiltration patterns. Increased flow would scour wetlands of sediments, delivering these sediments to adjacent waterbodies. The severity of these effects would depend on the location and type of disturbance; however, application of the BMPs for road construction and drainage and for the control of pollutants and sediment on well pads should limit any affects to areas in the immediate vicinity of the disturbance. As a result, the effects would most likely be negligible to minor, but could range as high as moderate if located directly adjacent to wetlands. Effects would be mostly short term. Adverse impacts to hydrology, such as stream erosion, would be difficult to restore and could result in more long-term impacts.

Stream Channels: Oil and gas activities are not likely to occur in live waters and most direct impacts to stream channels are unlikely. Direct impacts may occur, however, from road crossings of streams. Road crossings usually require the installation of a culvert or bridge. Forest Service Handbook (FSH) 7709.56b (Section 1.41, Subpart 10d) specifies that bridges and major culverts should be designed to accommodate the 50-year and 100-year floods. Minor culverts should be designed to accommodate the 25-year and 50-year floods. Although these design constraints should prevent large changes to stream hydrology and/or morphology, it is possible that culverts and bridges would create local flow constrictions and increase local flow velocities under extreme flow conditions. This would result in scouring of the streambed downstream of the bridge or culvert and may increase streambank erosion. Further, although the BMPs in Appendix C specify that sediment control measures would be used when constructing stream crossings, some temporary increase in bank erosion and sediment delivery to streams is still expected to occur during culvert or bridge installation. Given the design

criteria and BMPs described, these types of direct effects should be constrained to the immediate vicinity of the stream crossing and would generally be negligible to minor. They would be short term for exploration roads and long term for roads associated with a production field.

Indirect effects to stream channels could also occur as a result of upland erosion or the construction of roads in wetlands, floodplains, and riparian areas. The quantity of eroded material that makes its way to a stream are wholly dependent upon site-specific factors including: soil characteristics, ground slope, distance between the disturbance and the stream, and condition of the wetland, floodplain, or riparian areas, among others. For example, in certain areas, site conditions might tend toward producing minor surface erosion from sheet flow, which typically would produce small-sized sediment particles. If this were combined with either a long, low-gradient distance (or a shorter distance with a wetland or riparian area between the source and the stream), these particles would likely be deposited before reaching the channel. In other areas, site conditions could produce gullies or mass earth movements with a direct connection to a stream system, thus adding large amounts of sediment with varying particle sizes to a stream. Generally speaking, activities on steeper slopes would be more likely to erode and transport sediment to a stream, and would take longer to reclaim, all combining to have a greater potential impact to surface water resources.

The type of construction activity also dictates the potential for erosion. Well pads are typically bermed and would be sloped toward a reserve pit located near the cut/slope, trapping most surface water runoff and sediment on site. However, erosion could still occur on the fill slopes below the drill pad. In forested areas, roads have been shown to be the largest contributors of sediment to the aquatic system (Kreutzweiser and Capell 2001). Several factors affect the amount of sediment that can come from roads including, slope, road surface area, drainage structures installed, the type of surfacing, the amount of cut and fill required, and the amount of traffic (Sheridan and Noske 2007). Sheridan and Noske (2007) found that sediment production was highest for unsurfaced roads with moderate amounts of traffic and for surfaced roads (gravel) with high traffic levels. Due to their temporary nature, roads associated with exploratory wells would not likely be surfaced and could be local contributors of sediment depending upon the other factors. Surfaced roads associated with a production field would likely be contributors of sediment due to large amounts of traffic resulting from trucking the oil to market as predicted by the RFDS. Further, roads have been shown to act as extensions of the stream channel network by capturing and channeling surface water runoff, water that would naturally infiltrate the soil under undisturbed conditions. The result is that forest roads, especially when built in close proximity to streams channels, can increase the magnitude and frequency of peak flows (Jones et al. 2000). Both of these processes (increased sediment delivery and increased flood frequency) can affect stream channel morphology. Increased sedimentation can lead to channel aggradations, whereas increased flows can result in stream channel incision.

One measure by which roads and their potential to cause sediment-related water quality impacts can be assessed is road density. For wildlife uses on the Dixie National Forest, a density of 2 miles of road per square mile is considered dense and problematic. Using a similar measure to qualitatively assess road-related impacts to water resources, it can be said that a developed well field may likely exceed that density, and thus be more likely to cross some threshold of sediment potential than an exploration program under SLT, whereby exploration is more likely to be spread out. The location of the road (or any other disturbance) also affects its potential to contribute to sediment production and increased runoff. Construction activities in areas with steep slopes and less permeable soils often result in increased runoff. On a local level, and/or where the impacted acreage represents a higher percentage of the watershed

area, the increased runoff volumes could trigger gully development and/or accelerated stream bank erosion in receiving streams. It could also exacerbate instability in previously existing deteriorated or vulnerable streams. Construction activities in other areas (those with flatter gradients, more permeable soils, or lower natural drainage density, for example) might only negligibly increase local runoff.

As the location of disturbance is impossible to predict, the impacts could range from negligible to major depending upon the amount and location relative to the affected stream channel, the type of road design, and the amount of traffic on the road. Effects could be short to long term depending upon the length of time the road is in service.

Floodplains: Oil and gas activity would directly impact floodplains primarily by removing vegetation and reducing the connectivity between streams and floodplains. The removal and/or degradation of floodplain vegetation could result at any phase of development, including seismic exploration. The removal of vegetation would reduce the ability of floodplains to slow water velocities during high flow events, reduce bank stability, increase erodibility of floodplains soils, and destroy structure that provides habitat for aquatic organisms during periods of inundation. Impacts to stream-floodplain connectivity would occur as a result of any development in the floodplain area; however, as described above, roads on National Forest System lands often run parallel to streams and have the greatest potential for impacts (Trombulak and Frissell 2000). These roads are usually constructed above the normal high-water mark and may be lined by riprap on the streambank side to prevent erosion. These roads essentially serve as dikes and may not allow streams to overflow onto parts of their floodplains. A reduction in stream-floodplain connectivity would increase flow velocities, decrease the availability of rearing and foraging habitat important to fish and other aquatic organisms, and reduce the amount of organic matter delivered to streams. An increase in flow velocities can result in increased stream erosion and subsequent changes in stream channel morphology, including bank erosion, channel widening, channel incision, and sedimentation.

Under SLT, a total of up to 32.9 miles of roads are possible adjacent to streams on the Pine Valley Ranger District, 78.7 miles on the Cedar City Ranger District, and 101.6 miles on the Powell and Escalante Ranger Districts. While this represents less than one percent of stream miles on the respective ranger districts, the local direct impacts to stream channels and floodplains could range from minor to moderate. Most impacts could be avoided if operations were moved up to the maximum amount possible (200 meters, 656 feet) and constructed in compliance with the laws and regulations mentioned. In addition, many floodplain areas may be considered jurisdictional wetlands and avoidance, minimization, or mitigation of impacts to these areas would be required by Section 404 of the Clean Water Act. Indirect impacts to floodplains would primarily be short term and negligible to minor and would consist primarily of impacts to vegetation as a result of sediment delivery to floodplain areas.

RiparianAreas: Similar to other resources discussed in this section, the greatest potential for impacts is from roads. The removal of riparian vegetation for road construction would reduce wildlife habitat important to a variety of terrestrial animals, particularly bird species. In aquatic ecosystems, removal of riparian vegetation can decrease cover for fish and other aquatic organisms, reduce inputs of organic matter and woody debris, and decrease shade levels (Trombulak and Frissell 2000). As riparian areas purify water, trap sediments, buffer stream flows, and stabilize streambanks, the impacts of a reduction in riparian vegetation cover or condition can translate to streams in a similar way as described above for wetlands. These impacts can include increased flooding, increased stream erosion, and decreased base flows. As mentioned for stream channels, increased flow can lead to channel incision, which can lower

local water tables and reduce the water available to riparian vegetation. The result is a negative feedback loop, where impacts to riparian areas can result in impacts to stream channels, which in turn can further impact riparian areas. Given the amount of disturbance that could occur within riparian areas under SLT, including roads (Table 4.7-3, *Measurement Indicator #5*), impacts would range from negligible to minor for seismic activity and minor to moderate for roads and well pads. Impacts would be both long and short term as changes in hydrology and stream channel conditions would be difficult to reverse in the short term.

Some amount of sediment from oil and gas activity in upland areas, particularly from roads, is likely to be delivered to riparian areas. However, given the modest amount of disturbance predicted for exploratory wells and adherence to the BMPs, the amount of sediment delivered to riparian areas would likely have negligible effects on riparian vegetation. More intense impacts could result from the roads and well pads associated with a production field but would likely still only range from negligible to minor. Other possible indirect effects may include some degradation of vegetation due to fugitive dust from adjacent facilities, but these would also be negligible and temporary.

Also, see *Measurement Indicators #4* and *5* at the end of this section.

GROUNDWATER

While direct ground-disturbing activities are not normally considered to have the potential to affect groundwater quality by introduction of sediments, there are some unique areas on the Dixie National Forest in which this could occur. These areas are where lava flows outcrop. These outcrops are highly permeable and essentially provide a direct pathway between the surface and groundwater. Road construction or pad development in these locations would likely require importing fill material, which could erode and be conveyed into the subsurface of the lava flows adversely affecting the permeability and geochemistry of the flow paths in the basalt lava rock. This impact would be site-specific, minor, and long-term, depending upon the exact circumstance. In some areas of the Cedar Ranger District, these lava fields overlie sensitive aquifers and these areas have been singled out as a resource component.

In addition to adverse water quality impacts related to sediment, contamination of groundwater could potentially occur due to inadvertent releases of pollutants from activities such as:

- Spilling fuels, lubricants, or liquid hydrocarbon product from mobile equipment;
- Spilling or releasing drilling fluids, including chemical products used during drilling or stimulation of production zones;
- Improperly casing or plugging wells; and
- Mishandling produced water.

Impacts of these activities are discussed below (under Other Water Quality Impacts) in association with surface water quality.

WATER QUALITY

Sediment-Related Water Quality Impacts: As already described above for watershed resources and stream channels in particular, oil and gas activity under SLT has the potential to increase erosion and surface water runoff. Some of the eroded material has the potential to enter streams, particularly if disturbance occurs within wetlands, floodplains, or riparian areas. This may result in adverse impacts to water quality, including raised sediment concentrations

and increases in turbidity. Fugitive dust from vehicles, roads, and other bare soil areas can also be deposited on stream or lake surfaces, thus adding fine particles that could become suspended in the water column. This could increase turbidity. Introduction of sediments into a stream can also have side effects, including raising water temperature and increasing salt load, among others.

Once sediment has reached a stream, the distance and timing of its downstream progression is highly dependent upon factors such as particle size, flow patterns, stream velocity, bed substrate, and channel morphology, among others. For example, fine sediments derived from shales and clays are likely to remain suspended in all but the slowest-moving water, temporarily causing increased turbidity and sediment concentration, but not necessarily destabilizing the stream channel, which could lead to longer term adverse water quality impacts. Particle sizes added en masse to a stream might initially be deposited rather than transported, with finer sizes being gradually winnowed away over time, or the deposit might move downstream as a slug of sediment as a result of a single large storm event. A stream with a high percentage of pools might serve as a reservoir for sediments, temporarily mitigating the water quality impact, but over the long term altering the channel morphology. While there is a reasonable potential that fine sediment will be added from fugitive dust, this impact is not likely to be substantial, even where the sources are near to the water resource. As these few examples show, the variations in sediment transport are endless and thus difficult to predict, especially for general types of disturbances in unknown locations.

As a result, it is only possible to estimate adverse sediment-related water quality impacts from connected actions in a general manner. Although they would most likely be temporary or short term in duration, their magnitude could range from negligible to major, depending upon the location of the activity and the effectiveness of environmental protection measures. The environmental protection measures that would apply to the various types of activities have been designed to reduce the potential for adverse sediment-related water quality impacts. Section 2.6 describes these to include the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007), the Onshore Oil and Gas Orders, the *Forest Service Region 4 Oil and Gas Roading Guidelines*, and *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C). For example, Operating Standards No. 4, 13, and 20 (Appendix C) require operators to implement erosion control measures. In general, the actual acreage of disturbance associated with any given well pad is relatively small, compared to the natural setting, and acreage associated with linear features such as roads and pipelines would be dispersed. This would also tend to reduce the potential for adverse sediment-related water quality impacts. Assuming that these environmental protection measures are properly implemented, that disturbance is distributed over multiple watersheds or sub-watersheds, and that project-specific NEPA analysis is completed, adverse sediment-related water quality impacts would likely be negligible or minor for the majority of leases, at least as a result of the normal course of events. If the above assumptions are not met, impacts could be greater as previously described.

Also see *Measurement Indicators #1*, *2*, and *4* below.

Other Water Quality Impacts: In addition to adverse water quality impacts related to sediment, contamination of surface water or groundwater, including Drinking Water Source Protection Zones (DWSPZ), could potentially occur due to inadvertent releases of pollutants from activities such as:

- Spilling fuels, lubricants, or liquid hydrocarbon product from mobile equipment;

- Spilling or releasing drilling fluids, including chemical products used during drilling or stimulation of production zones;
- Improperly casing or plugging wells; and
- Mishandling produced water.

Fuels and lubricants would be used in all aspects of exploration and production. They are used in vehicles of all types and in equipment such as pumps, drill rigs, compressors, and the like. Further, a developed oil field would produce liquid oil, transporting it by pipeline and storing it temporarily at the well field, and conveying it by trucks from the production field out of the Dixie National Forest to market. While these hydrocarbons would not intentionally be released in such a way as to enter streams or groundwater, accidental releases could occur. The releases could be from field maintenance of vehicles or equipment, on-site fueling, transfer to and from storage facilities, and vehicle or equipment accidents. Secondary containment at tank batteries reduces the impact of the release. Depending upon the quantity of the release and its proximity to a stream, failure of secondary containment could adversely impact surface water quality. The degree of impact to surface water could vary from negligible to major, but in most cases it would be short term. If the release were to occur over a lava field overlying groundwater, in particular a lava field overlying a sensitive aquifer, or within a DWSPZ, it could adversely impact groundwater quality. While the degree of impact would vary depending upon the quantity released, the impact could be long term if not immediately mitigated.

Drilling fluids, including chemical additives, which can contain toxic substances, would be used during exploration well drilling. During production field development these fluids would be used both for drilling production wells and a produced water disposal (injection) well. Normally, these fluids would be contained in lined reserve pits on site and properly disposed off site after drilling is complete. Appendix C includes several criteria for reserve pits to ensure that they function properly. However, their inadvertent failure and release of fluids, or an operator's failure to follow protocol for off-site disposal, could result in short-term surface water quality impacts, the degree of which would depend upon the quantity released and the proximity of the release to a stream. The inadvertent release of these fluids on a lava field or within a DWSPZ could have a longer-term impact on groundwater if it could not be immediately mitigated. Similarly, transporting any of these chemicals to the drill sites could result in accidental releases, which could impact either surface water or groundwater, again depending upon quantity and proximity, potentially affecting any of the three resource components or DWSPZ to a degree ranging from negligible to major.

While drilling and completion activities must use casing and dry hole plugging designs that are intended to protect groundwater resources (e.g., BLM Onshore Oil and Gas Order No. 2 requirement for cementing or casing any water-bearing formation, including DWSPZ), their unexpected failure could lead to potential impacts to groundwater quality. This could also occur due to failure to isolate usable groundwater from other water-bearing zones with naturally poor quality water, potentially degrading a higher quality groundwater by introducing lower quality water. Such problems would be difficult to discover, particularly in plugged and abandoned wells or in production wells where there are no operational symptoms of the problem. This type of impact, if it occurred, would likely be long term and range from moderate to major.

Water is produced as a natural byproduct of both exploration and production wells, but mostly during production. Due to the geologic occurrences that are the focus of oil and gas drilling, this produced water often contains high concentrations of Total Dissolved Solids (TDS). Because of its quality, the produced water typically cannot be discharged to surface waters, particularly within the Colorado River Basin where the Colorado River Salinity Control Forum has placed

salt load limits on any water discharges. Thus, the produced water is normally temporarily held in storage tanks at the production facilities and then either disposed on site through a permitted underground injection well to a deep formation, or is trucked off site for disposal. Off-site disposal of produced water can also involve temporary storage in tanks and re-injection in a permitted well but can also take place in permitted, lined evaporation ponds. This EIS has assumed that one injection well and no large evaporation ponds would be utilized. Routine handling of produced water would not result in impact. Any release of production water would be accidental, however it could impact water quality depending upon the quantity released and its proximity to surface waters. Again, this type of direct impact could range from negligible to major, and would most likely be temporary for streams.

There is also the concern that the reinjected produced water could migrate into groundwater associated with other formations and degrade its quality. While the configuration of hydrogeologic characteristics may differ, a study done by the USGS (Steiger 2007) found no evidence that this has occurred in the Altamont-Bluebell oil and gas field in the Uintah Basin.

The environmental protection measures that would apply to the various types of activities have been designed to reduce the potential for adverse water quality impacts. Section 2.6 describes these to include: the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007), the BLM Onshore Oil and Gas Orders, the *Forest Service Region 4 Oil and Gas Roading Guidelines,* and the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C). Assuming that these environmental protection measures are properly implemented, adverse water quality impacts would likely be short term and negligible to minor for the majority of leases, at least as a result of the normal course of events. If the above assumptions are not met, impacts could be greater.

As noted above, recent history indicates that the track record of the oil and gas industry is good, but not perfect, and it cannot be expected to be perfect. For the purposes of this document, it can reasonable be assumed that under SLT, at least one if not more, of the following could occur

- A hydrochloric acid spill as a result of hauling or use as a fracturing fluid;
- A hydrocarbon spill, due to a truck overturn or a line rupture, or similar event;
- A magnesium chloride (or other dust suppressant) release due to either a truck or tank spill or to over-application during dust control;
- Overflow of a reserve pit containing produced water; and/or
- A leak or other failure of an improperly placed, designed, or maintained reserve pit liner, resulting in a release of drilling fluids.

If one or more of these events, or similar events, occurred, it may or may not result in an impact to water resources depending upon the volume, location, proximity to waters, etc. However, it can be stated that the likelihood is greater under SLT than other leasing options with more restrictive leasing options.

Also see *Measurement Indicator # 1* below.

WATER USES

Introduction of sediment, fuels, lubricants, product oil, drilling fluids, or produced water to surface and/or groundwater systems that alter water quality, as described above, could also affect down gradient water users. The primary human users of Dixie National Forest water resources are downstream irrigators, and culinary users both on-Forest and downstream. Livestock, wildlife, and aquatic life also depend on Dixie National Forest surface water. Such water uses are often driven by the natural water quality and the reliability of the source. Water quality in the State of Utah is protected based upon its defined Beneficial Use classification, and in turn, this classification provides an indication of the types of uses a given stream segment may have (Utah Annotated Code R317-2-13).

For example, some streams on the Dixie National Forest are Beneficial Use Class 4, which means that they are protected for agricultural uses including irrigation of crops and stock watering. Class 4 streams have a TDS water quality standard for irrigation of 1,200 mg/L (ppm). If an accidental release of briny production water were to enter this stream, it would represent a violation of the water quality standard and could also temporarily affect an irrigator's ability to use this water source. If sediment-induced water quality impacts were to occur on this stream, there would not be a standards violation (there are no applicable sediment standards for Class 4 waters). While introduced sediment would not be a standards violation, there still may be impacts to an irrigator, such as a physical impact to a diversion structure as a result of sediment cause channel instability.

Some streams on the Dixie National Forest are Beneficial Use Class 3, which means that they are protected for fish and other aquatic life. For Class 3 streams, there are high state water quality standards for heavy metals. Some of the heavy metals for which water quality standards exist could be introduced into streams due to advertent chemical spills. This might only have short-term impact on water quality, but could have a longer-term impact on aquatic life if concentrations were high long enough to adversely impact aquatic species populations. Sediment impacts, which are not limited by water quality standards, could have long- or short-term impacts on aquatic life and upon humans who use those streams for fishing.

Degradation of municipal or culinary water supplies could occur if their source water were impacted. Beneficial Use Class 1 streams are those that are protected for such domestic purposes; however, within the Dixie National Forest, all such streams are in subclass 1C, which presumes that prior treatment is needed. There are numerous municipal watersheds throughout the Dixie National Forest. Since potential usage impacts to those features due to water quality impacts are not common to all action alternatives, the discussion on that subject occurs in Section 4.7.5.

In regard to groundwater supplies, there are not many currently used wells on the Dixie National Forest. However, there are some DWSPZ and sensitive aquifers, and there is at least some potential that these fresh water supplies could be affected by drilling, if proper procedures were not followed or if accidents occur. These effects could be due to: cross-contamination between aquifers, altered flow patterns as a result of withdrawal and reinjection of water into the wells, and contamination from drilling fluids and other materials. Exploration activities would be less likely to result in this occurrence than production wells because they would be plugged sooner. Further, as noted above, a USGS study (Steiger 2007) found no evidence that migration of reinjected produced water has contaminated other aquifers in the Altamont-Bluebell oil and gas field in the Uintah Basin.

For the same reasons that there is uncertainty in determining location and level of impact to water quality in general, impacts to any given water use or users are also uncertain at this level of analysis. The environmental protection measures that would apply to the various types of activities have been designed to reduce the potential for adverse water quality impacts, and would thus reduce the potential for impact to water users. However, the site-specific NEPA analysis that would occur for any given future exploration or development proposal would fully analyze this potential effect.

Also see *Measurement Indicators #1* and *2* below.

IMPACTS TO WATER QUANTITY

During exploration and production, water is primarily used to facilitate drilling and control dust. Water for either of these uses cannot be withdrawn from a nearby stream or from a groundwater source without approval of the State Engineers Office. Exploration activities generally require a limited amount of water for a limited time period and the operator purchases water from an existing, legitimate water right holder. Water could be purchased from an off-site source such as a city well, or from a water right holder who temporarily defers their use of the stream for irrigation or stock watering. Therefore, there would be no net change in diversion of water from surface water or groundwater sources due to exploration water needs.

Larger quantities of water are needed during well field development than during exploration, due to a larger number of wells and a greater road network. For these longer-term road uses, a measure such as magnesium chloride application to roads for dust control is often used to reduce the need for frequent water application. It is likely that well field development and production activities would similarly purchase water from existing water holders, as described above for exploration. There is essentially no surface water and very little groundwater available for appropriation in any of the basins within the Dixie National Forest, so operators would likely purchase water that has already been appropriated, thus it is assumed that there would be no net change in diversion of water from surface water or groundwater sources.

During production, water is often removed from the wells in conjunction with the oil and/or gas (more so with gas than oil). Such produced water would be re-injected on site into the same formation from which it was obtained, or would be trucked off site for disposal by injection or evaporation. Produced water is typically poor quality and obtained from great depth; thus it is not generally considered to be usable groundwater or to support wetlands, stream base flow, aquatic wildlife, or human uses.

All uses of water during exploration, field development, or production must comply with rules established under Utah Water Rights Law (Title 73, Chapter 3, Appropriation). Produced water would be managed in compliance with rules established under the Utah Water Quality Act (Title 19, Chapter 5) so as not to infringe upon other water users' abilities to use water to which they have a right. Therefore, the effects to the quantity of water resources, including quantities associated with the three identified components, would be expected to be negligible.

Also see *Measurement Indicator #4* below.

Measurement Indicators

- *Measurement Indicator #1* NARRATIVE DESCRIPTION OF POTENTIAL SOURCES OF POLLUTANTS, THE TYPES OF POLLUTANTS, AND

THE EFFECT TO SURFACE WATERS AND GROUNDWATER

The potential sources of pollutants, the types of pollutants, and the general effects to surface waters and groundwater are described above. As noted, whether these pollutants adversely affect water quality and by how much and for how long is uncertain because specific activity locations are not known and these impacts would vary by site location and conditions. Thus, future project-specific NEPA analyses would need to be relied upon for further analysis of this measurement indicator. However, the impacts would be negligible to minor as long as the existing environmental protection measures are properly implemented and no accidents occur.

- *Measurement Indicator #2* POTENTIAL TO INCREASE SEDIMENT IN SURFACE STREAMS

As noted above under SLT, there is an increased potential for increased sediment delivery to surface streams. The means by which this could occur was also described. Whether this increase would actually occur, its magnitude, and its duration would depend upon many factors and in part requires knowing the site-specific locations of the activities. Thus, the project-specific NEPA analyses would need to be relied upon for further analysis of this measurement indicator. However, the impacts could be kept as negligible to minor as long as environmental protection measures are properly implemented.

- *Measurement Indicator #3* RELATIVE POTENTIAL FOR INCREASING MILES OF ROADS WITHIN MUNICIPAL WATERSHEDS AND LAVA FIELDS OVER SENSITIVE AQUIFERS

Under SLT, road construction would be allowed in municipal watershed and lava fields over sensitive aquifers. As a result, total miles of new roads predicted by the RFDS (Table 4.7-3) to occur on any ranger district (13.3 miles of new road on the Pine Valley Ranger District, 19.9 miles on the Cedar City Ranger District, and 23.2 miles on both the Powell and Cedar City Ranger Districts) could occur within a municipal watershed. Lava fields over a sensitive aquifer only occur on the Cedar City Ranger District and the total amount of new roads that could occur would be 19.9 miles.

- *Measurement Indicator #4* NARRATIVE DESCRIPTION OF POTENTIAL EFFECTS TO SURFACE WATER FLOW AND GROUNDWATER AVAILABILITY

The filling of wetlands, whether via direct fill or indirect sedimentation, and an increase in the amount of roads would decrease the capability of watershed resources to moderate stream fluctuations. The result would likely be increased flow volumes and velocities during high flow events and decreased base flows during periods of low flow. In addition, the filling of wetlands and/or alteration of flow into wetlands could decrease groundwater recharge. The construction or roads within floodplain and riparian areas would also increase stream flow velocities by altering the ability of a stream to overflow its banks. Further, the construction of culverts and bridges at stream crossings by roads could create localized areas of high flows and scour.

- *Measurement Indicator #5* ACRES OF DISTURBANCE

The total disturbance that could occur relative to the different phases of oil and gas activity is listed by ranger district in Table 4.7-3. Disturbance of up to 396.9 acres could occur on the Pine Valley Ranger District, 622.9 acres on the Cedar City Ranger District, and 705.9 acres on the Powell and EscalanteRanger Districts.

4.7.4.7 Lease Notice

For DWSPZs, the lease notice states that before an Application for Permit to Drill (APD) is submitted or surface-disturbing activity is initiated, the lessee/operator must contact the BLM field office and the public water system manager to identify any zoning ordinances; best management practices (BMPs); pollution prevention measures; or physical controls that may be required within the protection zone. Onshore Oil and Gas Order No. 1 contains the full list of requirements. The lease notice for DWSPZ is contained in Appendix D.

Additional groundwater protections specific to DWSPZ are contained in Appendix C. The application of these protections, the lease notice, and BLM Onshore Oil and Gas Orders and COA would eliminate, reduce, or mitigate potential impacts to usable groundwater sources.

4.7.5 Impacts by Alternative

The degree to which the impacts of connected actions (Section 4.7.4) would differ by alternative is discussed in this section. Alternatives involve leasing options, which would restrict the locations and the nature of oil and gas impacts. Because different resource components overlap, leasing options assigned to each resource component would also overlap and the most restrictive leasing option would take precedence (refer to Section 2.3.1). The water and watershed resource components are defined in Chapter 3.

Table 4.7-4 shows the acres of wetland, floodplain, and riparian area resource components under each leasing option by alternative. Table 4.7-4 incorporates the amount of overlap with more restrictive leasing options (assigned to other resources) in addition to the leasing option assigned directly to each resource component. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option. The following resource components fall within IRAs: lava fields over sensitive aquifers (32 percent); stream, lakes, springs, wetlands, floodplains, and riparian areas (33 percent); and municipal watersheds (41 percent).

In this section, impacts are generally discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts will be highlighted and discussed.

Table 4.7-4 Acreage of Resource Components under each Leasing Option by Alternative

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C[4]	D2	D2	E1	E2
Lava Fields over Sensitive Aquifers	NA							
	NL	58,585	58,585	58,585				
	NSO				58,585	58,585	18,821	
	CSU							
	SLT						39,765	58,585
Streams, Lakes, Springs, Wetlands,	NA	23,496	38,243	23,496	23,496	23,496	23,496	23,496
	NL	387,256	545,700	7,845				
	NSO		79,658	379,411	167,052	27,431	146,332	
	CSU				220,203	359,824		

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C[4]	D2	D2	E1	E2
Floodplains, and RiparianAreas (including riparian vegetation)[5]	SLT						240,923	387,256
Municipal Watersheds	NA	7,589	7,589	7,589	7,589	7,589	7,589	7,589
	NL	45,816	45,816					
	NSO			45,816	23,548	5,901	22,594	
	CSU				22,268	39,915		
	SLT						23,222	45,816

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.
[4] NSO for Alternative B is different than for Alternative C and is described in Section 4.7.4.3
[5] Includes a 300-foot buffer (410,550 acres), except for Alternative B, which includes a 500-foot buffer (662,835 acres). As a result, acreage for Alternative B in the table is large than under the other alternatives.

4.7.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. As no new leases would be made available, there would be no direct or indirect impacts to water and watershed resources. There would be no change in the measurement indicators.

4.7.5.2 Alternative B

Alternative B would apply a NL stipulation to lava fields over sensitive aquifers, municipal watersheds, and to the 300-foot buffer around all waterbodies. It would also apply a NSO leasing option to a 500-foot buffer around these areas. All lava fields over sensitive aquifers would be NL under Alternative B. Approximately six percent (38,243 acres) of the 300-foot riparian buffer occurs in areas not legally available (NA) for leasing, approximately 82 percent (545,700 acres) would be under NL, and approximately 12 percent (79,658 acres) would have a NSO leasing option. For municipal watersheds, approximately 14 percent (7,589 acres) would be under NA and 86 percent (45,816 acres) would be NL (Table 4.7-4).

Under this alternative, disturbance (*Measurement Indicator #5*) could only occur in the 200-foot distance between the outer edge of the 300-foot buffer and the outer edge of the 500-foot buffer. Disturbance in these areas would be limited to seismic activity by NSO following appropriate NEPA analysis. As a result, up to 60 acres of seismic exploration could occur on

the Pine Valley Ranger District and 120 acres on the Cedar City, Powell, and Escalante Ranger Districts. This represents less than one percent of the total acreage available on the individual ranger districts. There would be no surface disturbance to municipal watersheds or lava fields over sensitive aquifers and essentially no potential for the types of effects described in Section 4.7.4.6. Further, there would be no potential for increasing miles of roads within municipal watersheds (*Measurement Indicator #3*).

For watershed resources and surface waters, the NSO leasing option applied under this alternative would not allow roads within the buffers, including perpendicular stream crossings. There would be no disturbance within the 300-foot buffer and only seismic exploration within the additional 200-foot area associated with the 500-foot buffer. As most wetlands, floodplains, and riparian areas are expected to be contained within the 300-foot buffer, there would be no direct impacts to wetlands, stream channels, floodplains, or riparian areas. Indirect effects to these resources could occur as a result of oil and gas activity on adjacent land as described in Section 4.7.4.6 and would include primarily the delivery of sediment (*Measurement Indicator #2*) and contaminants (*Measurement Indicator #1*) to these areas, as well as possible changes in drainage patterns (*Measurement Indicator #4*). Given the additional buffer distance (200 feet beyond the edge of the 300-foot buffer), most erosion, sediment transport, and hazardous material spills should settle out prior to entering the 300-foot buffer.

However, despite this and the BMPs described, changes to drainage patterns as a result of activity in upland areas may not be entirely buffered by the additional 200 feet and could still affect watershed resources. It is most likely that the changes would not be of a magnitude sufficient to cause more than minor impacts, with duration depending upon the type of activity.

In addition, there is some potential for the general effects described in Section 4.7.4.6 to occur to water and watershed resources outside of the defined components. Those three components represent aspects of water resources that are keyed upon in this EIS, but in fact, water and watershed resources occur across the Forest. For surface water resources, upland watershed areas, ephemeral channels, or headwater catchment areas are not included in the streams resource component, but could be impacted by the types of general effects described above. In part, because this restricts the potential areas wherein oil and gas exploration can occur, it might have the consequence of forcing disturbances to be located within a smaller area and perhaps result in a greater likelihood that a higher proportion of a small subwatershed could be disturbed, even if the identified water and watershed resource components were not directly subject to the activity. For example, while exploration activity in general might not be likely to greatly increase road density over some threshold value (such as the two miles/square mile), if enough land is excluded from exploration, the remaining available land might result in a concentration of activity and thus by default increase road density in that area. Groundwater occurs in other areas than just the identified lava fields over sensitive aquifer component, and would have at least some potential for impact, depending upon specific circumstances.

However, the environmental protection measures that would apply to the various types of activities would reduce the likelihood of impacts, assuming that they are properly implemented. That, combined with the leasing options that would be in place under this alternative, the likelihood of occurrence would be even further reduced because the areas over which the impact could occur would be limited. For example, the types of specific events listed in Section 4.7.4.6 as being assumed that could occur under SLT (hydrochloric acid spills, hydrocarbon spills, magnesium chloride releases, reserve pit overflows, failure of reserve pit liner), are less likely to occur under this alternative and much less likely to affect water resources, should they occur.

4.7.5.3 Alternative C

Alternative C would apply a NL stipulation to all lava fields over sensitive aquifers. Alternative C would apply a NSO leasing option to all other water and watershed resources. Regarding municipal watersheds, 86 percent (45,816 acres) would be NSO and 14 percent (7,589 acres) would be NA. Approximately six percent (23,496 acres) of the 300-foot buffer areas would be within areas not legally available for leasing (NA) and approximately 7,845 acres (two percent) would be within areas with a NL option. The remaining 92 percent (379,411 acres) would be available under NSO.

Direct impacts to watershed resources and surface water would be limited to seismic exploration following appropriate NEPA analysis and a small amount of road, culvert, and bridge construction within the 300-foot buffer. The impacts of seismic exploration would be as described for SLT in Section 4.7.4.6. Road-stream crossings would also have impacts as described in Section 4.7.4.6 including the introduction of sediment, increased bank erosion, and alteration of local hydrological conditions; however, most of the impacts associated with road and stream crossings would be avoided by following existing requirements contained in Appendix C and the Gold Book (BLM and USFS 2007). In general, the impacts of road stream crossings under Alternative C would be less severe than described in Section 4.7.4.6 because only small amounts of these water and watershed resources would be affected at each crossing (there would be approximately 600 linear feet of road within the buffer at each crossing, or about 0.5 acres). As a result, impacts would range from negligible to moderate and would be short to long term. Indirect effects would be the same as described for SLT in Section 4.7.4.6. The majority of municipal watersheds would be available under NSO and the impacts to these resources would be the same as described for NSO in Section 4.7.4.3. There would be no potential for increasing miles of roads within municipal watersheds (*Measurement Indicator #3*).

Direct disturbance under this alternative (*Measurement Indicator #5*) would be primarily seismic exploration following appropriate NEPA analysis, with up to 60 acres on the Pine Valley Ranger District and 120 acres on the Cedar City, Powell, and Escalante Ranger Districts. In addition, approximately 0.5 acres (600 linear feet) of roads would be constructed at each stream crossing. As the number of possible stream crossings is unknown, a conservative estimate is to assume that disturbance could be up to the maximum estimated for road construction on each ranger district. This would be up to 53.5 acres for the Pine Valley Ranger District, 160.5 acres for Cedar City, and 214.0 acres for the Powell and Escalante Ranger Districts. As a result, total acres disturbed would be 113.5 acres for the Pine Valley Ranger District, 280.5 acres for the Cedar City Ranger District, and 334.0 acres for the Powell and Escalante Ranger Districts. This represents less than one percent of the total acreage of the different resource components on the individual ranger districts.

Indirect effects may also occur as a result of oil and gas activity in upland areas. The types and magnitude of indirect effects would generally be the same as for Alternative B; however, the potential for these effects to occur is increased relative to Alternative B due to the lack of an additional buffer. Also, as described under Alternative B, there would be the potential to impact water resources other than those associated with the three identified resource components. However, the types of specific events listed in Section 4.7.4.6 as being assumed that one or more could occur under SLT (hydrochloric acid spills, hydrocarbon spills, magnesium chloride releases, reserve pit overflows, failure of reserve pit liner), are less likely to occur under this alternative and substantially less likely to affect water resources, should they occur. In general, this alternative would have an increased potential for effect to water and watershed resources

relative to Alternative B, but the potential for direct effects would be reduced compared to Alternatives D and E.

4.7.5.4 Alternative D1 (NSO in IRAs)

Under Alternative D1 (NSO in IRAs), NSO would apply to 100 percent of lava fields over sensitive aquifers and CSU would apply to the other water and watershed resource components. Approximately 42 percent (22,268 acres) of municipal watersheds would be CSU, approximately 44 percent (23,548 acres) would have an NSO leasing option, and the remainder (14 percent, 7,589 acres) would be NA. Approximately six percent (23,496 acres) of the 300-foot buffered areas would be within wilderness and not legally available (NA) for leasing, 41 percent (167,052 acres) would be under NSO, 54 percent (220,203 acres) would be under CSU.

When compared with Alternative C, assignment of leasing options under this alternative would provide less protection to lava fields over sensitive aquifers, as directional drilling would be allowed from adjacent areas and seismic activities would be permitted within the boundaries of these areas under NSO following appropriate NEPA analysis.

As described in Section 4.7.4.5, the CSU applied to the 300-foot buffer around all waterbodies is similar to the NSO applied under Alternative C (NSO with Stream Crossings). As a result, the impacts to watershed resources and surface waters (including *Measurement Indicators # 1, 2, 4*, and *5*) would be the same as described for Alternative C. For municipal watersheds, the disturbance allowed would essentially be the same as SLT (*Measurement Indicators #3* and *5*). However, the level of impacts expected to occur from the types of impacts to water quality described in Section 4.7.4.6 would be reduces due to increased oversight and regulation. As a result, impacts due to short-term sediment impacts and temporary impacts from accidental releases of fuels or chemical spills would be negligible to moderate, and short-term (as compared to negligible to major under SLT). However, given the amount of disturbance allowed under CSU, there would still be a greater potential to impact municipal watersheds than under Alternative B and C.

4.7.5.5 Alternative D2 (CSU in IRAs)

Under Alternative D2 (CSU in IRAs), 100 percent of lava fields over sensitive aquifers would be under NSO as under D1. Approximately 14 percent (7,587 acres) of municipal watersheds would be under NA, 75 percent (39,876 acres) would be CSU, and 11 percent (5,940 acres) would be NSO. Approximately six percent (22,940 acres) of the buffered areas would be within Wilderness and not available for leasing (NA), seven percent (27,370 acres) would be under NSO, and 87 percent (360,510 acres) would be under CSU.

The same types of impacts as described for Alternative D1 would have the potential to occur under this alternative, and the impacts (including *Measurement Indicators*) would be the same as described for Alternative D1. The difference between Alternative D2 and Alternative D1 is simply a matter of the amount of acres of streams, lakes, springs, wetlands, floodplains, riparian areas, and municipal watersheds where surface occupancy would be allowed. Under this alternative, a greater number of acres would have a CSU leasing option and thus would be more prone to impact than equivalent areas where NSO would apply.

4.7.5.6 Alternative E1 (NSO in IRAs)

Under this alternative, all of the identified resource components would be available for lease under SLT, with the exception of those that are NA, or are within IRAs, which would be available

under the NSO leasing option. Approximately 32 percent (18,821 acres) of lava field over sensitive aquifers would be within IRAs and under NSO. The remainder (68 percent, 39,765 acres) would be available under SLT. For municipal watersheds, 14 percent (7,589 acres) would be NA, 42 percent (22,594 acres) would be within IRAs and under NSO, and 43 percent (23,222 acres) would be available under SLT. Approximately six percent (22,496 acres) of the buffered areas would be within wilderness and not legally available (NA) for leasing and 36 percent (146,332 acres) would be under NSO. The remaining 59 percent (240,923 acres) would be available under SLT.

As large portions of each resource component are available under SLT, the impacts would generally be the same as described for SLT in Section 4.7.4.6. However, about 35 percent of all water and watershed resource components would be under NA or protected by NSO, and the potential for impacts would be reduced relative to having the entire area available under SLT. Disturbance (*Measurement Indicator #5*) would be the same as described for SLT in Section 4.7.4.6 and shown in Table 4.7-3.

4.7.5.7 Alternative E2 (SLT in IRAs)

Under this alternative, the identified resource components would all be available for lease under SLT, except where they are NA (the same percentages as under Alternatives C, D, and Alternative E1). This means that all of the potential impacts discussed under 4.7.4.6 would have the potential to occur on all of the lava fields over sensitive aquifers, 94 percent of water resource components within the 300-foot buffer, and 86 percent of municipal watersheds. Both direct and indirect impacts as well as disturbance (*Measurement Indicator #5*) would be the same as described for SLT in Section 4.7.4.6. All told, this alternative would have the greatest potential to impact water and watershed resources.

4.8 Soils and Geologic Hazards

4.8.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.8-1 provides an example how these terms would apply to soils and geologic hazards.

Table 4.8-1 Terms used to Describe Effects to Soils and Geologic Hazards

Attribute of Effect		Description relative to Soils and Geologic Hazards
Quality	Beneficial	Soil structure, texture, and fertility are fortified over time, leading to decreased rates of soil erosion and increased plant productivity.
	Adverse	Soil structure, texture, and fertility are lost over time, leading to increased rates of soil erosion and decreased plant productivity.
Magnitude (Intensity)	Negligible	Any change to soil structure, texture, or fertility is so small it cannot be measured effectively using existing methods.
	Minor	Changes to soil structure, texture, or fertility are large enough to be measured using existing methods. However, these changes are small and do not change physical or biological conditions on the affected area or surrounding lands.
	Moderate	Changes to soil structure, texture, or fertility are large enough to be measured using existing methods. Changes may result in increased erosion or sedimentation above background levels, and/or decreased plant cover and production on the affected area or surrounding lands. The land still supports vegetation and soil productivity is maintained at a

Attribute of Effect		Description relative to Soils and Geologic Hazards
		base level.
	Major	Changes to soil structure, texture, or fertility are large enough to be measured using existing methods. Changes include increased erosion or sedimentation above background levels, and/or decreased plant cover and production on the affected area or surrounding lands that result in long-term and visible change to the soil and vegetative resource on the affected area and nearby soils.
Duration	Temporary	A decrease in vegetation and other soil cover and an increase in sediment delivery during construction of a facility (i.e., road, well pad) that is resolved once construction is completed.
	Short-term	A decrease in vegetation and other soil cover and an increase in sediment delivery due to exploration activities (i.e., construction of exploratory well pads or access roads). These changes are limited to the time needed for exploration and reclamation, 10 years or less.
	Long-term	A decrease in vegetation and other soil cover and an increase in sediment delivery due to the construction of production facilities (i.e., a production field and associated roads). The life of the production field and the time needed for reclamation would exceed 10 years.

4.8.2 Measurement Indicators

- *Measurement Indicator #1* ACRES OF DISTURBANCE
- *Measurement Indicator #2* NARRATIVE DESCRIPTION OF POTENTIAL EFFECTS TO SOIL PRODUCTIVITY
- *Measurement Indicator #3* POTENTIAL SOIL LOSS
- *Measurement Indicator #4* MILES OF ROAD AND AREA OF DISTURBANCE (ACRES) ON SENSITIVE LANDFORMS
- *Measurement Indicator #5* POTENTIAL FOR CREATING HAZARDOUS CONDITIONS
- *Measurement Indicator #6* PERCENTAGE OF DISTURBANCE ON SENSITIVE SOIL TYPES

4.8.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E, it is assumed that activities described in the RFDS would occur. Activities described under the RFDS include 60 to 120 acres (depending upon ranger district) of overland travel associated with seismic surveys, 80 to 330 acres (depending upon ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field (per ranger district). The locations of these activities are not yet known.

Seismic exploration effects were noted in a BLM compliance review of a recent 2-D seismic survey conducted in northeastern Utah between 6,000 and 8,000 feet elevation. Truck-mounted drills, buggy-mounted drills, OHVs, and heliportable drills were used. Effects of heliportable drills were limited to footprints by workers in the 3-foot diameter drill area with some subsurface drill cuttings left on the surface. Impacts from truck- and buggy-mounted drill rigs were more noticeable and included up to six passes by some form of vehicle. Effects included localized compaction, decreased infiltration, corresponding increased surface run-off, and decreased ability for seedling establishment and root growth (BLM 2002).

For the Dixie National Forest, seismic work occurring on steep slopes could result in compaction of soil where wheeled vehicles pass. This could lead to the formation of rills and new flow patterns, which, over time, could develop into gullies. Where stream channels were crossed, imprints could be left on channel banks, which would be susceptible to increased erosion or head-cutting. However, in the Utah study, all types of drills and transportation devices were determined to cause "little soil disturbance," which would be "normal in appearance after the next spring's rains" (BLM 2002). With this report in mind, it is likely that effects of seismic surveying on soil resources would be adverse, negligible to minor in intensity, and short term in duration.

Exploratory well development would likely cause the following impacts to soils in all locations:

- An increase in erosion of soil materials from roads and drill pads onto native lands due to run-off events, wind, and traffic. Erosion would be more likely to occur on cut slopes, fill slopes, and/or developments located on steep slopes or areas with high erosion potential. Using BMPs *and Dixie National Forest Operating Standards and Well Site Design Requirements* (see Appendix C), these impacts would most likely be adverse, negligible to minor, and short term in duration.
- An increase in sediment deposition on lands next to roads and drill pads, or in streams near these areas, due to the erosion noted above. Using BMPs, these impacts would most likely be adverse, negligible to minor in intensity, and short term in duration.
- Pollution to soil resources due to hydrocarbon, drilling mud, or other chemical spills occurring on drill pads, some of which may require treatment at a land farm. Using BMPs, these impacts would most likely be adverse, negligible to moderate in intensity, and would generally be short term in duration. However, if a reportable spill were to occur, effects could be adverse, major, and long term.
- Development of any oil and gas related infrastructure on rockfall/unstable areas could result in more frequent landslides and rockfall. This would be hazardous to people, wildlife, livestock, vegetation, and other resources that could be hit and injured, killed, or buried by falling rock. If proper siting of well pads and roads occurred, most incidents would be adverse, negligible to minor in intensity, and short term in duration. Proper siting of well pads and roads would reduce the likelihood of such incidents.

Full-field development would likely include the same effects as described for exploration above.

Table 4.8-2 lists the leasing option assigned to each sensitive soil/geologic hazard by alternative. Descriptions of leasing options (and associated impacts on soils) are described in Section 4.8.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) wherever the applicable resource component occurs on the Dixie National Forest.

Table 4.8-2 Leasing Options Assigned to Areas with Sensitive Soil/Geologic Hazards under each Alternative

Resource Component	Alternative				
	A	B	C	D	E
Active rockfall and landslide areas	NL	NSO-22	NSO-22	NSO-22	SLT
Slopes > 35 percent	NL	NSO-23	NSO-23	CSU-24	SLT

Areas of high erosion potential	NL	NSO-23	NSO-23	CSU-24	SLT
Marginally unstable slopes	NL	CSU-25	CSU-25	SLT	SLT
Cave resources	NL	CSU-26	CSU-26	CSU-26	SLT

4.8.4 Impacts of Connected Actions by Leasing Option

Leasing options would dictate the conditions under which impacts from connected actions (described under the RFDS) may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to soil resources, considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.8.5 (Impacts by Alternative). Under all leasing options and alternatives, oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C) and the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

4.8.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing would occur in these areas and no disturbance to soils in these areas would occur.

4.8.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing and no disturbance to soils or geologic hazards would occur under NL. Under Alternative A, NL would apply to all soils and geologic resource components listed in Table 4.8-2. No oil and gas leasing would occur in these areas; thus no disturbance to soils would occur in these areas.

4.8.4.3 No Surface Occupancy (NSO)

With the exception of seismic activities, NSO would prohibit occupancy or use of the land for oil and gas activities (e.g., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). Under Alternatives B and C, NSO would apply to rockfall/unstable areas, steep slopes, and areas of high erosion potential. Under Alternative D, NSO would apply only in rockfall/unstable areas.

Measurement Indicators

- *Measurement Indicator #1* ACRES OF DISTURBANCE

Under NSO, seismic activities could occur following appropriate NEPA analysis and could affect 60 to 120 acres. These disturbances could be located in rockfall/unstable areas, steep slopes, or areas with high erosion potential. Potential effects would vary depending on the soil affected and are described more fully under the measurement indicators below. Compared to the total acreage of sensitive soils, these effects would be negligible and short term in duration.

- *Measurement Indicator #2* POTENTIAL EFFECTS TO SOIL PRODUCTIVITY

Under NSO, seismic exploration activities could occur following appropriate NEPA analysis and could be located in rockfall/unstable areas, on steep slopes, and on areas with high erosion potential. Potential effects include a loss of soil productivity due to breaking down of the soil

structure on travelways of seismic trucks and buggies, especially in areas with minimal vegetation coverage. Some downhill or downstream sedimentation would be expected if disturbed soil was eroded. If seismic work is conducted using trucks on roads, and helicopters and/or specially designed buggies, impacts to sensitive soils/geologic hazards would be negligible and short term in duration.

- *Measurement Indicator #3* POTENTIAL SOIL LOSS

Under NSO, seismic exploration activities could occur following appropriate NEPA analysis and could be located in rockfall/unstable areas, on steep slopes, and on areas with high erosion potential. Potential effects include erosion of soil due to wind and water, particularly if seismic lines went straight up and down hills.

Soil loss would be minimal on areas with high rockfall potential since these areas have little soil and are often barren of vegetation (e.g., boulder field, lava flow field). Effects of soil loss due to seismic activity in rockfall areas and cave resources would be negligible and short term.

Soil loss would tend to be more severe on steep slopes/unstable areas especially if landslides are caused by activities (slopes mostly greater than 35 percent) because there is often a substantial soil resource in these areas that is being pulled downward by the force of gravity and may be poorly adhered to the underlying parent material. Activities that involve steep cuts and fills (roads and pads) could change slope support dynamics and result in greater soil water retention, which could cause the soils to move or fail. Areas with thicker vegetation cover are often less likely to erode because of the anchoring effects of root systems and plant transpiration which removes water from the soils. Effects of soil loss due to seismic activity on steep slopes could cause adverse, minor impacts of long-term duration.

Soil loss on highly erosive soils would be most severe due to the inherent erodibility of these soils. Effects of soil loss due to seismic activity on highly erosive soils could cause adverse, minor impacts of long-term duration.

- *Measurement Indicator # 4* MILES OF ROAD AND AREA OF DISTURBANCE ON SENSITIVE LANDFORMS

Under NSO, no roads would be constructed. However, as explained in Section 2.2.3, approximately 100 miles of seismic lines could occur on the Pine Valley Ranger District, and 200 miles could occur on each of the other ranger districts in the next 15 years, with approximately 50 to 100 linear miles per ranger district per year. This is equivalent to 60 to120 acres of total disturbance per ranger district over 15 years. Physical impacts of seismic surveying on sensitive soils/geologic hazards are described in Section 4.8.3. The effect of running 100 to 200 miles, or 60 to120 acres, of seismic line across rockfall areas, areas with slopes over 35 percent, and/or areas high erosion potential in each ranger district would be an adverse, negligible to minor impact of short-term duration.

- *Measurement Indicator # 5* POTENTIAL FOR CREATING HAZARDOUS CONDITIONS

Under NSO, seismic activities taking place in rockfall/unstable areas, steep slopes, or areas with high erosion potential could create hazardous conditions if drill sites and travelways were not selected to avoid potential rockfall areas, or areas or conditions prone to cause landslide. Rockfall may occur any time, but is more frequent during freeze-thaw periods. Landslides tend to occur during very wet periods, on very steep, unconsolidated slopes, or on cut banks

adjoining drainages. Because of the nature of these landscapes, areas affected by rockfall or landslides would be altered permanently, effects of seismic activities conducted in hazardous areas could be adverse and minor to moderate in intensity depending on the size of any resulting landslide or rockfall area, and long term in duration.

- *Measurement Indicator # 6* PERCENTAGE OF DISTURBANCE ON SENSITIVE SOIL/GEOLOGIC HAZARDS

Percent disturbance on sensitive soils/geologic hazards would be up to 0.8 percent of the total if all disturbance through production wells occurred on sensitive soils/geologic hazards, which is highly unlikely. For all sensitive soils/geologic hazards, this would be a negligible, short-term impact.

4.8.4.4 Timing Limitation (TL)

No Timing Limitation stipulations were developed for protection of Soils and Geologic Hazards.

4.8.4.5 Controlled Surface Use (CSU)

The CSU leasing option allows surface use on all or portions of a lease with special operational constraints that may otherwise exceed the mitigation provided by SLT, regulations, and operating orders. A CSU leasing option would not prevent disturbance to sensitive soils/geologic hazards. A CSU leasing option would apply to marginally unstable slopes under Alternatives B and C and to slopes over 35 percent and areas of high erosion potential under Alternative D. Impacts to soils resources under CSU with regard to applicable measurement indicators are described below.

- *Measurement Indicator #1* ACRES OF DISTURBANCE

Under CSU, marginally unstable slopes and cave resources would be open to exploration and production under Alternatives B and C. Steep slopes and areas of high erosion potential would be open to these disturbances under Alternative D. Effects from seismic activities would be the same as those listed in Section 4.8.3 and for NSO (Section 4.8.4.3), which were identified as negligible and short term in duration.

Under CSU, up to 330 acres of disturbance for exploration and 254 acres of disturbance for full-field development could occur on marginally unstable slopes and cave resource areas under Alternatives B or C, and to steep slopes and areas of high erosion potential under Alternative D. This is the same amount of possible disturbance as under SLT (Section 4.8.4.6). However, impacts to sensitive soils would not be as likely because the CSU stipulation states that wells will be sited to avoid these areas. Considering likely avoidance in addition to the small relative amount of sensitive soil disturbance that is possible if all activities did occur in these areas (Table 4.8-3), impacts would be negligible.

- *Measurement Indicator #2* POTENTIAL EFFECTS TO SOIL PRODUCTIVITY

Under CSU, marginally unstable slopes and cave resources would be open to seismic exploration under Alternatives B and C. Steep slopes and areas of high erosion potential would be open to seismic exploration under Alternative D. Between 60 and 120 acres would be disturbed by seismic exploration. Effects would be similar to those listed under Section 4.8.3, Impacts Common to all Action Alternatives. Compared to the total acreage of these sensitive soils (Table 3.8-1), these effects would be negligible and short term in duration.

Under CSU, exploration or full-field development on marginally unstable slopes or cave resources areas under Alternatives B or C, or slopes over 35 percent or areas with high erosion potential under Alternative D, could result in lost soil productivity if soil resources were polluted due to hydrocarbon, drilling mud, or other chemical spills on drill pads. Under the CSU, these impacts would be the same as SLT (Section 4.8.4.6): most likely adverse, minor in intensity, and of short-term duration. However, if a spill were large enough to be reportable, effects could be adverse, major, and long term, as under SLT (Section 4.8.4.6).

- *Measurement Indicator # 3* POTENTIAL SOIL LOSS

Under CSU, marginally unstable slopes and cave resources would be open to seismic exploration under Alternatives B and C. Steep slopes and areas of high erosion potential would be open to seismic exploration under Alternative D. Effects would be similar to those listed under Section 4.8.3 and for NSO (Section 4.8.4.3). Compared to the total acreage of these sensitive soils (Table 3.8-1), these effects would be negligible and short term in duration.

Under CSU, exploration or full-field development could result in soil loss on marginally unstable slopes or cave resource areas under Alternatives B and C, or steep slopes or areas with high erosion potential under Alternative D if erosion from roads and drilling pads were not controlled adequately, as under SLT (Section 4.8.4.6).

Erosion would be most likely to occur if the surface of roads and drill pads were not adequately watered or was fine-textured. Erosion is also more likely to occur on cut slopes, fill slopes, and/or travelways. Erosion can increase sediment load in streams located near existing and newly developed roads and drill pads. The erosional force of water is more pronounced on steep slopes. Soil takes many years to re-develop once it is lost. Under the CSU, however, impacts from soil loss on erodible soils, marginally unstable slopes, and steep slopes should be adverse and minor, but long term in duration.

- *Measurement Indicator # 4* MILES OF ROAD AND AREA OF DISTURBANCE ON SENSITIVE LANDFORMS

Under CSU, seismic disturbance could take place. Effects would be similar to those listed under Section 4.8.3 and for NSO (Section 4.8.4.3), which were identified as negligible and short term in duration.

As under SLT (Section 4.8.4.6), if all roads were constructed in sensitive soil areas, the proportion of road mileage on sensitive soils/geologic hazard areas would increase by 26 percent. Under Alternative B & C, this disturbance could occur on marginally unstable slopes or cave resource areas. Under Alternative D, this could occur on steep slopes or areas with high erosion potential and cave resources. Assuming that roads are constructed to standards outlined in BLM and USFS (2007) and the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* (Appendix C), effects of this increased road mileage on sensitive soils/geologic hazards would be an adverse, moderate impact of long-term duration. These would be the same impacts as under SLT because the CSU has no specific stipulations regarding road building over sensitive soils.

- *Measurement Indicator # 5* POTENTIAL FOR CREATING HAZARDOUS CONDITIONS

Effects of seismic activities conducted in hazardous areas would be adverse and minor to moderate in intensity depending on the size of any resulting landslide or rockfall area, and long term in duration as analyzed in section 4.8.3 and 4.8.4.3 for NSO.

Under CSU, exploration drilling or full-field development could create unstable conditions on marginally unstable slopes under Alternatives B and C, and steep slopes or highly erosive areas under Alternative D if oil and gas facilities are not properly planned and constructed. However, CSU stipulations contain provisions for avoiding such conditions and as a result adverse impacts would be less likely under the CSU than under SLT (Section 4.8.4.6). Effects of unstable conditions on marginally unstable slopes under Alternatives B and C, or steep slopes and areas of high erosion potential under Alternative D, if not properly controlled, would be adverse, minor to moderate, and long term in duration.

Impacts to caves are also likely to be less adverse than under SLT due to CSU stipulations designed to protect lava tube cave resources. Long-term impacts to cave could be moderate under CSU.

- *Measurement Indicator # 6* PERCENTAGE OF DISTURBANCE ON SENSITIVE SOIL/GEOLOGIC HAZARDS

Percent disturbance on sensitive soils could be to 0.8 percent if all disturbances through production wells occurred on sensitive soils/geologic hazards, which is highly unlikely. Depending on the type of disturbance, duration could be short or long term. Thus, for all sensitive soils/geologic hazards, this would be a negligible, short-term impact.

4.8.4.6 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT) and the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

Under Alternative E, SLT would apply directly to all identified soil and geologic hazard areas, including within IRAs if the 2001 Roadless Area Conservation Rule was not in effect.

Measurement Indicators

- *Measurement Indicator #1* ACRES OF DISTURBANCE

Under SLT, all acres of sensitive soils and geologic resources would be open to seismic survey. Between 60 and 120 acres could be affected. Effects would be the same as those listed under Section 4.8.3, which were identified as negligible (with regard to the entire area of sensitive soils) and short term in duration.

Under SLT, between 397 and 706 acres of disturbance could occur on each ranger district, or up to 1,672 acres on the Dixie National Forest as a whole, over the next 15 years. The locations of future oil and gas activity disturbance are unknown at this point. However, if full development were to occur as described in the RFDS (Section 2.2.1), and if all disturbances took place on sensitive soils/geologic hazards, less than one percent of these sensitive areas would be disturbed in each ranger district. The Pine Valley Ranger District would have the least disturbance and the Powell and Escalante Ranger Districts would have the most (see Table 4.8-3 below). These effects would be negligible. Duration would be short term if disturbance was related to exploratory activities and long term if associated with production activities.

Table 4.8-3 Maximum Acres of Disturbance to Sensitive Soils/Geologic Hazards and the Percent of Total Acreage

Ranger District	Acres			Percent of Acres in District	
	Seismic Disturbance	Full field development (includes seismic disturbance)	Sensitive Soils/Geologic Hazards in District[2]	Seismic Disturbance	Full Field Developme nt
Pine Valley[1]	60	397	144,023	0.04%	0.28%
Cedar City[1]	120	623	79,201	0.15%	0.79%
Escalante[1]	120	706	112,193	0.11%	0.63%
Powell[1]	120	706	126,415	0.09%	0.56%

[1] Assumes the greatest amount of disturbance predicted in a ranger district occurred within each area. Cave resources are not included in the acreage estimates.
[2] There are more than 706 acres of each of the sensitive soils/geologic hazards on each ranger district, except Pine Valley, which has no acres of unstable soils. The figures in this table represent potential development acreage on each type of sensitive soil. The sensitive soil acreage is not split out within a ranger district, as it would be redundant.

- *Measurement Indicator #2* POTENTIAL EFFECTS TO SOIL PRODUCTIVITY

Under SLT, all acres of sensitive soils/geologic hazards would be open to seismic surveys. Up to about 120 acres could be affected. Effects would be similar to those listed under Section 4.8.3 and for NSO (Section 4.8.4.3), which were identified as negligible and short term in duration.

Soil productivity and slope stability is generally adversely affected by oil and gas development due to compaction or disturbance by salvaging of soils on road and pad locations. Compaction inhibits water movement and root penetration within the soil matrix, and results in less water infiltration and higher overland flow. Soil physical structure is lost when soil is excavated and stockpiled for future use during reclamation of disturbed areas. Some silty or gypsum-rich soils become powdery when excavated, creating poor contact between soil and seed or soil and root, which results in poor plant growth. Powdery soil is also prone to wind and water erosion, which results in nutrient-rich topsoil loss. Effects of compaction or excavation on soil resources would be adverse, minor to moderate, and long term in duration.

- *Measurement Indicator # 3* POTENTIAL SOIL LOSS

Under SLT, all acres of sensitive soils/geologic hazards would be open to seismic survey. Up to about 120 acres could be affected. Effects would be similar to those listed under Section 4.8.3 and for NSO (Section 4.8.4.3), which were identified as negligible and short term in duration.

Under SLT, high-erosion areas, steep slopes, and marginally unstable areas could be exposed to severe soil loss if proper road and pad siting were not completed, and/or if proper design features specific to the proposed development site were not employed. Areas of high erosion potential, steep slopes, and marginally unstable areas, would not be adequately protected using standard BMPs designed to prevent erosion and sedimentation. Effects of soil loss to areas of high erosion potential, steep slopes, and marginally unstable areas would be adverse, minor to major, and long term in duration.

Under SLT, exploratory or full-field development in rockfall areas or cave resources would have little effect on soil loss as there is very little soil in either of these areas. Effects would be adverse, negligible, and short term.

- *Measurement Indicator # 4* MILES OF ROAD AND AREA OF DISTURBANCE ON SENSITIVE LANDFORMS

Under SLT, all acres of sensitive soils/geologic resources would be open to seismic survey, exploration, and full field development. Up to 293 miles of road disturbance could occur on the Dixie National Forest due to exploration activities, with a total of 996 acres (including roads and all other disturbance) disturbed for this purpose. One production field on the Forest would result in approximately 15 miles of new road and 254 acres of disturbance (it is assumed the production well could occur on any ranger district and so is included in the potential disturbance for each district). Total gross Forest-wide disturbance associated with oil and gas activity through construction of a production well would be approximately 1,673 acres. All but 220 acres of this (the production field disturbance) would be reclaimed. There are 3,031 miles of authorized Forest roads on the Dixie National Forest (see Section 3.10). Approximately 1,188 miles of these are in areas that present risks to soil resources (USFS 2003c). Exploration and production activities would increase overall Forest road mileage by 308 miles of new and reconstructed roads (10 percent). Although unlikely, if all roads were constructed in sensitive soil areas, the proportion of road mileage on sensitive soils/geologic hazard areas would increase by 26 percent.

- *Measurement Indicator # 5* POTENTIAL FOR CREATING HAZARDOUS CONDITIONS

Under SLT, all acres of sensitive soils/geologic hazards would be open to seismic survey. Up to about 120 acres could be affected. Effects would be the same as those described Section 4.8.3 and Section 4.8.4.5, which were identified as adverse, minor to major, and short-term in duration. Depending on the underlying geology, significant effort may be required to “anchor” facilities to the hill, or allow subsurface water to safely flow under, over, or around a road or drill pad. Under some conditions, it may be necessary to provide both surface and subsurface drainage, such as horizontal drains, drainage trenches, French drains, gabions, or drainage blankets to prevent groundwater from entering embankments, which can lead to moisture saturation and subsequent slope failure.

Hazardous effects to cave resources from oil and gas activities have been given more attention recently because of increased development in karst and lava tube areas. BLM (2006c) provides information on potential and inherent impacts of oil and gas development on caves and cave resources. These include:

- Areas with sensitive bat colonies or other animals could collapse, be buried, or destroyed for the very long term if no specific leasing options or limitations are in place to protect these resources. Such effects would be adverse, major, and of long term duration.
- Most caves are not completely mapped. Exploratory drilling activities may “punch through” an unknown subterranean passage and fill or partially fill a cave cavity with drilling mud, water, hydrocarbons, and/or drill cuttings.
- Unknown voids located close to the surface can collapse when heavy trucks or drilling equipment drives or parks over the void. This occurred at the Exxon Fed. #4 location in New Mexico. The ceiling of the cavern stooped to the surface producing a 15-foot

diameter hole under the drilling rig. This could result in injury or death to humans or animals, damage or destroy personal property, and/or could damage or destroy sensitive cave ecosystems (James Goodbar, BLM, personal communication). These effects would be adverse, moderate to major in intensity, and long term in duration because of the difficulty of accessing cave reaches to mitigate effects.

- If any part of a well casing fails during drilling or testing, brine, gas, hydrogen sulfide gas, or drilling fluid could enter the cave system. Some caves are water sources for culinary water or stream water supplies. All springs on Forest Service land are considered Class 1 waters in Utah. Pollution of cave waters could pollute Class 1 and culinary water supplies for the short term or indefinitely (BLM 2006b).
- During completion of a well, the casing is set to the desired depth and a mixture of cement and additives are pumped down the casing and back up outside to form a protective sheath of cement between the casing and well bore. If voids have been encountered, the cement mixture would enter the void and remain there permanently. This volume could amount to several hundred to several thousand cubic feet of cement, the total volume of the annulus (BLM 2006b). Effects would be adverse, minor to major in intensity depending on the material and volume lost to the cave system, and long term in duration because of the difficulty of accessing cave reaches to mitigate effects.
- The opening of new entrances to the earth's surface could influence or alter normal cave temperatures and change the flow of air, water, and humidity through the cave, thus changing the cave's microclimate. This change in the constant microclimate could affect cave flora, fauna, and development and growth of cave formations (i.e., speleogens and speleothems). Some cave formations could be destroyed by changes in air pressure (BLM 2006b).
- The use of lined mud pits (versus self-contained mud pits) could cause contamination of cave environments by leaching of chemicals into the ground and groundwater systems after pits are broken and allowed to dry. Soluble chemical constituents in the mud could percolate down through natural fractures in the rock, carried by the rainwater, and enter caves and cave water systems. It is this same percolation of rainwater that provides water for the development of speleothems. Leaching of chemicals could also occur due to leaking flow lines, gas dehydrators, and tanks. The chemicals and other constituents could change the chemical composition of the minerals forming speleothems and adversely alter the cave atmosphere. This chemically-altered atmosphere could cause the deterioration of existing speleothems and/or prevent their natural growth (BLM 2006b).
- The presence of hydrogen sulfide and methane gas, even in small amounts, could change the delicate balance of the cave atmosphere, causing the rapid deterioration of cave formations and the disruption or death of cave life. These gasses could also explode, causing damage to existing formations from the shockwave (BLM 2006b). Effects would be adverse, negligible to major in intensity, depending on the concentration of gasses (effects may be unknown for many years), and long term in duration because of the difficulty of accessing cave reaches to mitigate effects.
- After a well was depleted, plugged, and abandoned, impacts to cave values could still occur. The steel casing could deteriorate over time because of interactions of the casing with hydrogen sulfide gas and weak acids in percolating water, causing leaks and the problems noted in the bullet above (BLM 2006b).

- Although unlikely, natural gas could settle in the bottom of sinkholes and migrate into caves or fractures leading to caves and contaminate them. If natural gas were to flow through an open hole or through casing/cement that either failed or was inadvertently perforated, the gas would follow passages or other routes – some known, some unknown – such as small fractures or faults, and eventually contaminate a cave or cave system. The risk to humans and all other cave fauna from the migration of hydrogen sulfide and/or methane gas could be substantial. Explosions could result when the gas and oxygen in the cave mix and are ignited by carbide lights often used by cavers. The replacement of oxygen by the other gases endangers humans and other fauna by asphyxiation (BLM 2006b).

Because of the difficulty of accessing cave reaches to mitigate impacts, effects of these changes to cave resources would be adverse, negligible to major in intensity, depending on the extent of contamination (effects may be unknown for many years), and long term in duration.

Under SLT, all acres of sensitive soils/geologic hazards would be open to exploration and full-field development. Potential effects of this development on sensitive soils/geologic hazards would vary, depending on the specific location of development. Impacts would be adverse, long term in duration, and could range from minor to major, and would be similar to those outlined in Section 4.8.3 and *Measurement Indicator #3*, above. Effects of hazardous conditions on sensitive soils/geologic hazards, if not properly controlled, would be adverse, minor to major, and long term in duration.

- *Measurement Indicator # 6* PERCENTAGE OF DISTURBANCE ON SENSITIVE SOIL/GEOLOGIC HAZARDS

Percent disturbance on sensitive soils could range from 0.0 percent if no sensitive soils/geologic hazards were disturbed, to 0.8 percent if all disturbance through production wells occurred on sensitive soils/geologic hazards, which is highly unlikely. Depending on the type of disturbance, duration could be short or long term. Thus, for all sensitive soils/geologic hazards, this would be a negligible, short-term impact.

4.8.5 Impacts by Alternative

The degree to which the connected action impacts would differ by alternative are discussed in this section. Each alternative involves a unique set of leasing options for each resource component, which would restrict the locations and the nature of oil and gas activities that are allowed wherever these resources occur.

Table 4.8-4 shows the acres of each resource component for soils/geologic hazards under each leasing option, by alternative. Table 4.8-4 incorporates the amount of overlap with more restrictive leasing options (assigned to other resources) in addition to the leasing option assigned directly to each resource component. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option. A more detailed table that separates the acreage by resource component and ranger district is available in Appendix B. The percent of the resource components discussed (with the exception of cave resources, which have not been quantified) in this section that fall within IRAs is as follows: Pine Valley Ranger District (59 percent), Cedar City Ranger District (12 percent), Powell Ranger District (68 percent), and Escalante Ranger District (46 percent).

In this section, impacts are generally discussed at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives. However, any pronounced differences in the impacts to a resource component between ranger districts are highlighted.

Impacts by alternative are summarized in Table 4.8-4 below and differences between alternatives regarding soil resources are outlined in the text below. *Measurement Indicator #1* is not discussed in this section or in Table 4.8-4 because the impacts in terms of acres disturbed would be the same under all alternatives that allow leasing. The percentage of sensitive soils disturbed by development (*Measurement Indicator #6*) is relatively small for each alternative (0.0 to 0.8 percent). Relative to these measurement indicators, impacts would be negligible and short to long term. Under Alternative A, no new leasing would be allowed and there would be no impacts relative to *Measurement Indicators #1* and *#6*.

Table 4.8-4 Acreage of Resource Components under each Leasing Option, by Alternative

Resource Component[3]	Leasing Option[4]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
Active rockfall and landslide areas Rockfall/ unstable	NA	9,340	9,340	9,340	9,340	9,340	9,340	9,340
	NL	7,813	6,097	190				
	NSO		1,716	7,623	7,813	7,813	4,400	
	CSU							
	SLT						3,413	7,813
Slopes >35%	NA	64,759	64,759	64,759	64,759	64,759	64,759	64,759
	NL	317,718	245,189	3,256				
	NSO		72,529	314,462	176,851	17,261	169,821	
	CSU				140,868	300,458		
	SLT						147,897	317,718
Areas of High Erosion Potential	NA	12,260	12,260	12,260	12,260	12,260	12,260	12,260
	NL	83,704	58,559	1,628				
	NSO		25,145	82,076	39,734	5,590	37,696	
	CSU				43,971	78,114		
	SLT						46,008	83,704
Marginally Unstable Soils	NA	772	772	772	772	772	772	772
	NL	43,216	33,423	577				
	NSO		9,371	40,785	21,086	2,300	19,972	
	CSU		422	1,855	22,130	40,916		
	SLT						23,244	43,216

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Note that there is some overlap of resource components (e.g. soils can be both steep and rocky). Thus, the total acreage by resource component is more than the total acres of sensitive soils by approximately 11 percent.
[4] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.

4.8.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases not in production will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. Under Alternative A, there would be no impacts to sensitive soil and geologic hazards from oil and gas leasing because no new leases would be approved.

4.8.5.2 Alternative B

Section 2.5.2 describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative B (*Measurement Indicator #1*; see Table 2.5-2). Under all alternatives, 6 percent of the Forest is not legally available for leasing (NA) and approximately 70 percent would not be leased (NL) under Alternative B. Of the remainder, 20 percent would be NSO and 4 percent would be CSU. Due to overlapping leasing options with other resource values, leasing options under Alternative B include NA and NL, as well as NSO in rockfall/unstable areas, steep slopes, and in areas with high erosion potential. Marginally unstable slopes include NA, NL, and NSO as well as some CSU. The area and locations of cave resources is unknown at this time, but would be covered by CSU if a more restrictive leasing option did not overlap. There would be no lease (NL) stipulation on cave and karst resources that overlap with lava fields over sensitive aquifers.

Effects under Alternative B would be the same as described under Sections 4.8.4.3 (for rockfall/unstable areas, steep slopes, and areas of high erosion potential) and 4.8.4.5 (marginally unstable slopes and cave resources). For rockfall/unstable areas, steep slopes, and areas of erosion potential, the main possibility of impacts under Alternative B (NSO for these resources) is with regard to *Measurement Indicator #5* (hazardous conditions) due to the possibility (although remote) of a catastrophic event resulting from seismic activities on these areas. Impacts to unstable slopes could be minor with an additional regard to soil productivity (*Measurement Indicator #2*) and hazardous conditions (*Measurement Indicator #5*), and moderate with regard to disturbance of sensitive landforms (*Measurement Indicator #4*), because any oil and gas activity may be allowed in these areas under Alternative B (CSU for this resource).

The possibility of a catastrophic event that would affect caves (locations unknown), although unlikely, would be similar under Alternatives B, C, D, and E,(see *Measurement Indicators #2* and *#5*), which could have moderate or major impacts regardless of leasing options. Impacts with regard to *Measurement Indicator #4* (acres disturbance on sensitive landforms) could be moderate under Alternatives B, C, D, and E (refer to Section 4.8.4.5 - CSU). However, impacts to caves under Alternative B (and C) would actually be less adverse than as described in Section 4.8.4.5 (CSU) because there is a relatively high likelihood that caves occur within lava fields over sensitive aquifers, which are NL under Alternative B (and C). Due to this likely overlap, impacts to cave resources under Alternative B would actually be minor.

4.8.5.3 Alternative C

Section 2.5.2 describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative C with NSO in IRAs. All sensitive soils/geologic hazard areas outside IRAs are covered either by areas of NA, NL, or by CSU. Some areas of CSU have an additional TL for wildlife protection: this designation does not change the effects of oil and gas exploration or development.

Impacts to cave resources under Alternative C would be as described under Alternative B due to the likely overlap with lava fields over sensitive aquifers. Impacts to rockfall/unstable areas, steep slopes, unstable slopes, and areas of erosion potential would be very similar to Alternative B because leasing options are the same between alternatives.

4.8.5.4 Alternative D1 (NSO in IRAs)

For sensitive soils/geologic hazards, Alternative D1 (NSO in IRAs) is more restrictive than Alternative D2 (CSU in IRAs). However, this alternative applies a CSU leasing option to slopes greater than 35 percent and areas of high erosion potential and, therefore, is technically less restrictive than Alternatives A, B, and C. NSO applies to all rockfall/unstable areas under this alternative and because of leasing option overlaps, steep slopes would also be under NSO (despite having a CSU leasing option applied). Leasing options under this alternative include NSO in all IRAs, rockfall/unstable areas, and steep slopes because of overlapping resource components. Areas with high erosion potential, and cave resource areas are open to leasing with the CSU option unless they are located within an IRA or within a lava field (over sensitive aquifers).

Effects of Alternative D1 would be limited to seismic activities, and would be the same as described under Section 4.8.4.3 (for all sensitive soils), and Section 4.8.4.5 (for areas of high erosion potential, marginally unstable slopes). Due to likely overlap with lava fields over sensitive aquifers, impacts to cave resources would be limited to seismic activities and directional drilling. These impacts would be minor to moderate and long term. Impacts to rockfall areas and unstable slopes would be as described under Alternative C because leasing options between alternatives are similar. Impacts to steep slopes and areas of erosion potential would be more adverse under Alternative D, relative to Alternative C, because leasing options for these resources would be CSU, thus allowing all oil and gas activities to potentially take place in these areas. Impacts to areas of high erosion potential could be major with regard to soil productivity (*Measurement Indicator #2*) and moderate with regard to sensitive landforms (*Measurement Indicator #4*), which are substantially more adverse than Alternative C. Impacts to steep slopes with regard to soil productivity (*Measurement Indicator #2*) could potentially be major in areas covered by CSU.

4.8.5.5 Alternative D2 (CSU in IRAs)

Under Alternative D2 (CSU in IRAs), nine percent of the Dixie National Forest would be NSO, 85 percent would be CSU, and six percent would be NA. This alternative would include, in addition to a CSU leasing option in IRAs, NSO leasing options in those areas where leasing can still occur, but other, more restrictive resources values overlap. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative D2 and where those acres are located. Impacts to all soil resources under this alternative would be similar to those described under Alternative D1.

4.8.5.6 Alternative E1 (NSO in IRAs)

Under Alternative E1, all areas of sensitive soils/geologic hazards are open to leasing under SLT except for those sensitive soils/geologic areas located within IRAs, which are covered by NSO. Relative to other alternatives, impacts under Alternative E1 would be most severe with regard to rockfall/unstable areas because they are protected by NSO under other alternatives, and not protected (they would be under SLT) under Alternative E1 (and E2). This would allow any oil and gas activity to take place on a rockfall/unstable area with only the minimum requirements in place for resource protection that are contained in all leases. Impacts could be major if a catastrophic event occurred on these areas, although such events are unlikely (see Section 4.8.4.6). Impacts to other soil resources could potentially be major also, but impacts are not dissimilar to those described under Alternative D, under which most resources are protected by CSU leasing options under which most oil and gas activities would still be allowed. Impacts to cave resources would be potentially major as described in Section 4.8.4.6.

4.8.5.7 Alternative E2 (SLT in IRAs)

Alternative E2 (SLT in IRAs) would allow leasing under the SLT leasing option on all lands, regardless of their designation as having sensitive soils, geologic hazards, or other resource values such as designated wilderness or sensitive plant populations. The potential impacts of this option are discussed for SLT in Section 4.8.4.6.

Table 4.8-5 Impacts with respect to Measurement Indicators #2 through #5

Resource	*Measurement Indicator (MI)*	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Active Rockfall and Landslide Areas	*MI #2*	Neg ST	Neg ST	Neg ST	Neg ST	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT
	MI #3	Neg ST	Neg ST	Neg ST	Neg ST	Neg ST	Neg ST
	MI #4	Neg ST	Neg-min ST	Neg-min ST	Neg-min ST	Moderate LT	Moderate LT
	MI #5	Minor-moderate LT	Minor-moderate LT	Minor-moderate LT	Minor-moderate LT	Minor-major LT	Minor-major LT
	MI # 6	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]
Slopes >35%	*MI #2*	Neg ST	Neg ST	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT
	MI #3	Neg ST	Minor ST	Minor ST	Minor ST	Minor ST	Minor ST
	MI #4	Neg ST	Neg ST	Neg ST	Neg ST	Moderate LT	Moderate LT
	MI #5	Minor-moderate LT	Minor-moderate LT	Minor-moderate LT	Minor-moderate LT	Minor-major LT	Minor-major LT
	MI # 6	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]
Areas of High Erosion Potential	*MI #2*	Neg ST	Neg ST	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT
	MI #3	Minor LT	Minor LT	Minor ST	Minor ST	Minor ST	Minor ST
	MI #4	Neg ST	Neg ST	Moderate LT	Moderate LT	Moderate LT	Moderate LT
	MI #5	Minor-moderate LT	Minor-moderate LT	Minor-major LT	Minor-major LT	Minor-major LT	Minor-major LT
	MI # 6	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]
Marginally Unstable Slopes	*MI #2*	Minor[b] ST-LT	Minor[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT	Minor-Major[b] ST-LT
	MI #3	Neg ST	Neg ST	Minor ST	Minor ST	Minor ST	Minor ST

Resource	*Measurement Indicator (MI)*	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
	MI #4	Moderate LT	Moderate LT	Moderate LT	Moderate LT	Moderate LT	Moderate LT
	MI #5	Minor LT	Minor LT	Minor-mod LT	Minor-mod LT	Minor-major LT	Minor-major LT
	MI # 6	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]
Cave Resources[a]	*MI #2*	Minor ST-LT	Minor ST-LT	Minor-mod [a] ST-LT	Minor-mod[a] ST-LT	Minor-Major [a] ST-LT	Minor-Major [a] ST-LT
	MI #3	Neg ST	Neg ST	Neg ST	Neg ST	Neg ST	Neg ST
	MI #4	Minor LT	Minor LT	Minor LT	Minor LT	Moderate LT	Moderate LT
	MI #5	Minor LT	Minor- LT	Minor- mod LT	Minor- mod LT	Minor-major LT	Minor-major LT
	MI # 6	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]	Neg ST[c]

LT = long term; ST = short term; neg = negligible; mod = moderate
a Impacts to cave resources could be major if a road, production well or field was located over a cave void or passage.
b Impacts would generally be minor and short-term. However, if a reportable hydrocarbon spill occurred, impacts could be major and long-term.
c Impacts would be negligible but could persist for a long term depending on the type of activity occurring (exploration vs. development).

4.9 Vegetation

4.9.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.9-1 provides an example how these terms would apply to vegetation.

Table 4.9-1 Terms used to Describe Effects to Vegetation

Attribute of Effect		Description relative to Vegetation
Quality	Beneficial	An increase in the amount or quality of a native vegetation community.
	Adverse	A decrease in the amount or quality of a native vegetation community.
Magnitude (Intensity)	Negligible	A modification in the amount or quality of a native vegetation community that is not perceptible on a Forest-wide scale. *Example: Loss of <5% of a major vegetation community.*
	Minor	A modification in the amount or quality of a native vegetation community that would only affect individual plants and not affect the overall character of the community. *Example: Loss of part (e.g., 10-15%) of a short-lived and major vegetation community that is locally abundant and could be restored.*
	Moderate	A modification in the amount or quality of a native vegetation community that would affect the overall character of the community. *Example: Uncontrolled increase in invasive plants within a community that would modify the relative abundance of species over time.* *Example: Modification of a special or unique vegetation area that degrades its 'special' or 'unique' characteristics.* *Example: Loss of mature forest that may or may not be restored to its original condition.*
	Major	A modification in the amount or quality of a vegetation community that would completely change the overall character of the community. *Example: Complete removal of native forest or long-lived shrub community without re-vegetation (i.e., conversion).* *Example: Irretrievable loss of a special or unique vegetation area, or a major vegetation community that is limited in the area.*
Duration	Temporary	A vegetation modification that only occurs during construction of a facility (i.e., road, well pad). Original condition is immediately restored once construction is completed. *Example: Seismic activities that occupy an area without disturbing the vegetation.*
	Short-term	A vegetation modification that occurs during exploration activities (i.e., construction of exploratory well pads or access roads) or only affects short-lived species such as grasses or shrubs. The vegetation modification lasts 10 years or less. Original condition would likely be restored within this time frame. *Example: Removal or modification of grass or shrub community that is eventually re-vegetated.*
	Long-term	A vegetation modification that occurs during extended exploration activities or during production activities, or affects long-lived species such as forest or long-lived shrubs (e.g., some sagebrush). The vegetation modification lasts more than 10 years and original condition may or may not be restored. *Example: Removal or modification of forest community.*

4.9.2 Measurement Indicators

- *Measurement Indicator #1* ACRES OF DISTURBANCE
- *Measurement Indicator #2* LOCATION OF SURFACE DISTURBANCE
- *Measurement Indicator #3* COMPLIANCE WITH ESTABLISHMENT RECORDS (RESEARCH NATURAL AREAS)
- *Measurement Indicator #4* NARRATIVE DESCRIPTION OF THE EFFECTS AND DURATION OF EFFECTS THAT WOULD OCCUR TO THE LIMITING ATTRIBUTES OF THE AREAS, WHICH LED TO DESIGNATION (SPECIAL AREAS/RESEARCH NATURAL AREAS)
- *Measurement Indicator #5* COMPLIANCE WITH MANAGEMENT OBJECTIVES (SPECIAL AREAS/RESEARCH NATURAL AREAS)
- *Measurement Indicator #6* INCREASES IN INVASIVE PLANTS

4.9.3 Impacts Common to All Action Alternatives

Under Alternatives B, C, D, and E it is assumed that activities described under the RFDS would occur. These activities include 60 to 120 acres (per ranger district) of overland travel associated with seismic surveys, 83 to 332 acres (per ranger district) of land clearing surface disturbance associated with road and pad building for exploration wells, and 254 acres of land clearing surface disturbance for a production field. The locations of activities are not yet known. The main impact to vegetation associated with land clearing is complete vegetation removal. Vegetation would be removed within the footprints of the well pads, associated facilities, and roads, for as long as the activities were conducted plus the time needed for reclamation and successful reestablishment of vegetation. Impacts of vegetation removal are a loss of vegetation in at least the short term (for grasses, forbs, and most shrubs) and in many cases the long term (forested and some non-forested areas), a temporary loss of soil stability (see Section 4.8), alteration of vegetation communities after reclamation (species may differ from what was disturbed), and alteration of adjacent (undisturbed) vegetation communities due to changes in relative species abundance. Species used for reclamation would be chosen based on the need to establish vegetation for a variety of uses (e.g., erosion control, wildlife and livestock forage, achieving management objectives for diversity, etc.). Vegetation would be expected to reach the required percentage of ground cover after two to three years, but may or may not eventually reach the same productivity as pre-disturbance conditions.

Seismic exploration effects were noted in a BLM compliance review of a recent 2-D seismic survey conducted in northeastern Utah between 6,000 and 8,000 feet elevation. Truck-mounted drills, buggy-mounted drills, OHVs, and heliportable drills were used. Effects of heliportable drills were limited to footprints by workers in the 3-foot diameter drill area with some subsurface drill cuttings left on the surface. Impacts from truck- and buggy-mounted drill rigs were more noticeable and included up to six passes by some form of vehicle. Effects included localized soil compaction, decreased infiltration, corresponding increased surface run-off, and decreased ability for seedling establishment and root growth (BLM 2002). However, in the Utah study, all types of drills and transportation devices were determined to cause “little soil disturbance,” which would be “normal in appearance after the next spring’s rains” (BLM 2002). With this report in mind, it is likely that effects of seismic surveying on soil resources would be adverse, negligible to minor in intensity, and short term in duration.

Impacts associated with overland travel (seismic activities) include the crushing of grasses, forbs, bushes, and other low growing species. Generally, impacts of crushing vegetation are negligible as the roots remain intact and plants would recover or resprout the following year. Biological soil crusts would be disturbed for the long term by overland travel because they take many years to regenerate. Because seismic activities cover long distances (either by ground or helicopter), soils and seed from other sites could be introduced that would alter soil conditions or plant community composition, e.g., by spreading invasive plants (see *Measurement Indicator #6*). The amount of direct removal of or damage to vegetation would be greater for exploration well construction, which would include footprints for roads, well pads, and other structures. Indirect adverse impacts to vegetation may also occur in the vicinity of exploration wells if soils and seed are introduced, via construction vehicles and other traffic, to undisturbed vegetation around the sites. Organic materials from other locations may alter the composition and succession of these vegetation communities following reclamation. Direct adverse impacts from exploration activities that do not result in development would be minor and short term (less than 10 years); direct impacts would typically last five years (1 year drilling, 1 year reclamation, and 3 years for revegetation). In the event that production occurs on a well, adverse impacts from disturbance at that location would be long term and moderate due to the larger amount of vegetation removed or damaged and the extended length of well field operations. On production wells, the portion of each pad not needed for production would be reclaimed and revegetated after the well is drilled. Any indirect adverse impacts to vegetation from the spread of invasive plants would be long term and minor to moderate, depending on the extent.

Table 4.9-2 lists the leasing options assigned to each vegetation resource component under each alternative. Descriptions of leasing options (and associated impacts on vegetation resources) are described in Section 4.9.4. Each assigned leasing option would either allow or restrict certain oil and gas activities (described under the RFDS) wherever the applicable resource component occurs on the Dixie National Forest.

Table 4.9-2 Leasing Options assigned under each Alternative for Vegetation Resources

Resource Component	Alternative				
	A	B	C	D	E
Botanical and Geological Areas (i.e., Red Canyon Botanical Area; 203 acres)	NL	NSO-25	NSO-25	NSO-25	SLT
Side Hollow Ponderosa Pine Provenance Study Area (4.5 acres)	NL	NSO-26	NSO-26	NSO-26	SLT
Research Natural Areas (4,796 acres)	NL	NL	NL	NSO-24	SLT[1]

[1] SLT in Research Natural Areas would not be in compliance with the 1986 Land and Resource Management Plan, which requires NSO in these areas (see Section 4.18.

4.9.4 Impacts of Connected Actions by Leasing Option

Leasing options would dictate the conditions under which connected actions (described under the RFDS) would be allowed, and under which impacts may occur. Impacts from connected actions under each leasing option are discussed in this section. Impacts to vegetation resources considering leasing option overlaps (i.e., overlaps with more restrictive leasing options assigned to other resources) are discussed in Section 4.9.5 (Impacts by Alternative).

4.9.4.1 Not Legally Available (NA)

NA applies to lands that are not legally available for leasing, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984. No oil and gas leasing would occur in these areas and no disturbance to vegetation resources in these areas would occur. NA does not apply to any of the vegetation resource components under any alternative.

4.9.4.2 No Lease (NL)

NL applies to lands where no new leases would be authorized. These lands would not be administratively available for leasing and no oil and gas leasing or disturbance would occur on lands with a NL leasing option. Under Alternative A, NL would apply to the Red Canyon Botanical Area and Side Hollow Study Area (Special Areas) and all five Research Natural Areas. NL would also apply to all Research Natural Areas under Alternatives B and C. Because no new leases would be authorized on lands within Special Areas or Research Natural Areas under NL, there would be no surface disturbance related to oil and gas activities within these boundaries and no direct or indirect impacts to these resources.

4.9.4.3 No Surface Occupancy (NSO)

With the exception of seismic activities, NSO would prohibit occupancy or use of the land for oil and gas activities (e.g., construction of well pads, central tank batteries, access roads, pipelines, power lines, and other linear structures). Under NSO, adverse impacts to vegetation would be limited to crushing plants, breaking of branches and stems, and a loss of live plant material as a result of seismic activities.

Under Alternatives B, C, and D, NSO would apply to the Red Canyon Botanical Area and Side Hollow Study Area. Under Alternative D, NSO would apply to these resources in addition to all five Research Natural Areas. Impacts to these resource components under NSO with regard to applicable measurement indicators are described below.

Measurement Indicators

- *Measurement Indicator #3* COMPLIANCE WITH ESTABLISHMENT RECORDS

The establishment records for Research Natural Areas generally do not explicitly allow surface disturbing activities unrelated to research or educational uses. Oil and gas reserves located under a Research Natural Area could potentially still be accessed by drilling from outside the boundary of the Research Natural Area. Compliance with prescriptions in the RNA establishment records for oil and gas leasing specifically within RNAs are discussed here. Impacts as a result of connected actions to leasing are discussed under *Measurement Indicator #5* (Compliance with Management Objectives).

Regarding specific prescriptions for oil and gas leasing, establishment records for Research Natural Areas either: 1) do not specify special protection measures for oil and gas activities (Table Cliff); 2) honor oil and gas activities (Browse and Upper Sand Creek), 3) specify that the area be withdrawn from mineral entry (Timbered Cinder Cone), or 4) lease with appropriate protective stipulations (Red Canyon). Seismic activities that are allowed under NSO would comply with the establishment record for each Research Natural Area either: 1) by default, because no direction is specified (Table Cliff); 2) by prescription, because oil and gas leasing is allowed on existing leases until expiration (Browse and Upper Sand Creek); 3) because seismic activities are not considered mineral entry (Timbered Cinder Cone), or 4) because NSO would

provide sufficient protective stipulations to features of the RNA (Red Canyon). Therefore, adverse impacts with regard to *Measurement Indicator #3* within all Research Natural Areas would be negligible under NSO.

- *Measurement Indicator #4* EFFECTS AND DURATION OF EFFECTS IN LIMITING ATTRIBUTES OF SPECIAL AREAS

Under NSO, adverse impacts to sensitive plants (i.e., the limiting attribute) in the Red Canyon Botanical Area could occur as a result of overland travel and foot traffic associated with seismic activities. Individual sensitive plants may be trampled or removed by overland travel or foot traffic. The soil would also be altered during seismic surveys in a way that would make it less likely for sensitive plants to establish in the future. In the Red Canyon Botanical Area, the probability of most sensitive plant species establishing is determined by levels of erosion and soil stability, which are both natural and human-caused. Approximately 50 percent (115 acres) of the area is classified as having a high erosion potential. Seismic activities may involve minor amounts of human-caused erosion to the Claron Formation by foot and buggy traffic or helicopter landings and equipment placement, and the use of trails and roads in the Area to access seismic sites. Human caused erosion may adversely modify growth conditions for sensitive plants by creating compacted or eroded areas that would be less likely to support germination or establishment of these species. These adverse impacts could be long term and major.

Under NSO, adverse impacts to ponderosa pine trees (i.e., a limiting attribute) in the Side Hollow Study Area due to seismic activities would be negligible because individual trees would be avoided. Seismic activities may compromise the scientific integrity of the Side Hollow Study Area (i.e., a limiting attribute) because the process of accessing seismic sites may disturb the soil or vegetation within or adjacent to study plots that are meant to be consistent (and thus comparable) with other areas. Adverse impacts could be major and long term (see *Measurement Indicator #5*).

- *Measurement Indicator #5* COMPLIANCE WITH MANAGEMENT OBJECTIVES

Management objectives for the Red Canyon Botanical Area involve protecting erosive soils and ensuring the persistence of sensitive plants. Soils and sensitive plants could be disturbed directly and indirectly under NSO by seismic activities though trampling and subsequent erosion and disturbed growing conditions (see *Measurement Indicator #4*). Disturbance to soils and sensitive plants within the Red Canyon Botanical Area under NSO would violate management objectives. Adverse impacts could be long term and major.

Management objectives for the Side Hollow Study Area involve protecting ponderosa pine trees and supporting ongoing studies. Studies may be indirectly affected by seismic activities under NSO within the Study Area if soil or other vegetation conditions are altered within study plots by human traffic, buggies, helicopters, or other equipment. Small alterations of soils and vegetation in one area of a study plot may produce detectable impacts by diminishing the comparability of that plot to others, depending on the scale of the study. Adverse impacts from seismic activities under NSO could be major and long term because many studies in the Side Hollow Study Area are more than 10 years old and cannot be replicated.

Management objectives for Research Natural Areas include preserving and maintaining the natural state of these areas; similar to the Side Hollow Study Area, small alterations to vegetation within Research Natural Areas caused by seismic activities would conflict with preservation of the natural vegetation trends essential for research and interpretation. In

general, vegetation disturbance unrelated to scientific or educational uses in Research Natural Areas is not allowed. Although seismic activities under NSO would not have noticeable impacts on the vegetation itself, adverse impacts in terms of compliance with management objectives to preserve the area from disturbance would be detectable. Therefore, adverse impacts to Research Natural Areas under NSO could be long term and major due to seismic activities.

- *Measurement Indicator #6* INCREASES IN INVASIVE PLANTS

Compared to other connected actions, invasive plant proliferation would be relatively likely to occur during seismic activities (with buggies), which are permitted under NSO. Transporting the seismic equipment on the ground requires a wide wheelbase, and equipment is heavy enough to produce ruts if the soil is soft. The combination of a large surface area (the wheel) where weed seeds can attach, and the creation of disturbance (ruts) where seeds could establish creates conditions suitable for the proliferation of invasive plants. In addition, seismic assessments require relatively long, linear distances to be covered between points, thus the potential area of exposure is high. Invasive plant infestations would be less of an issue if helicopters were used for seismic surveys. Adverse impacts of an infestation under NSO could be long term and moderate to major, depending on whether or not the infestation is controllable and reversible.

4.9.4.4 Timing Limitation (TL)

A TL leasing option would not apply to vegetation resources directly under any alternative.

4.9.4.5 Controlled Surface Use (CSU)

A CSU leasing option would not apply to vegetation resources directly under any alternative.

4.9.4.6 Standard Lease Terms (SLT)

Impacts in this section are discussed assuming no restrictions or leasing options other than those listed on BLM Lease Form 3100-11 (SLT) and the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2. As a minimum, all leases are governed by SLT and the impacts described in this section represent the maximum amount of disturbance that could occur as a result of oil and gas activities.

Under Alternative E, SLT would apply to the Red Canyon Botanical Area and Side Hollow Study Area (Special Areas) and all five Research Natural Areas, including within IRAS if the 2001 Roadless Area Conservation Rule is not in effect.

Measurement Indicators

VEGETATION RESOURCES (ALL)

- *Measurement Indicator #1* ACRES OF DISTURBANCE

The amount of disturbance expected from connected actions is presented as Tables 2.2-1 and 2.2-2. In summary, the RFDS predicts between 397 and 706 acres of disturbance on each ranger district over the next 15 years. The Pine Valley Ranger District would have the least disturbance and the Powell and Escalante Ranger Districts would have the most. The adverse impacts on vegetation resources in general from disturbed acres would be short term and minor for exploration activities that did not result in production, and long term and moderate for production activities.

- *Measurement Indicator #2* LOCATION OF DISTURBANCE

The intensities of direct impacts (i.e., removal of vegetation) and indirect impacts (i.e., alteration of community) to vegetation are proportional to the ratio between disturbed and undisturbed vegetation of the same type within the Dixie National Forest or within the area under consideration (i.e., in Special Areas or Research Natural Areas). The amount of undisturbed acreage depends on the location of disturbance (i.e., what vegetation type is being disturbed). Within major vegetation communities (see below), adverse impacts would generally be negligible. In unique vegetation areas, Special Areas, or Research Natural Areas (see below), direct and indirect impacts would be more adverse because these areas are smaller (i.e., more would be lost relative to what is available) and the vegetation is less replaceable than for common types, so impacts would be more long term. The relative amount of vegetation removed also depends on the density of vegetation. The adverse impacts of disturbance location are discussed under each vegetation resource component.

MAJOR VEGETATION COMMUNITIES

Disturbance from connected actions could occur in any of the major vegetation communities on the Dixie National Forest. Pinyon juniper, sage steppe, and aspen/conifer are the most common vegetation types on the Dixie National Forest (56% of all vegetation). These areas are the most likely to be disturbed if there is no correlation between vegetation type and probability that an area will be leased. Disturbance in grassland and some shrub communities from oil and gas activities would be short term (less than 10 years), assuming similar vegetation reestablishes. Disturbance in forest communities would be long term because forests take at least 50 to 100 years to reestablish. Sagebrush communities can also take up to 50 years to reach maturity, thus sagebrush disturbances could also be long term. The proportion of grasses and shrubs would increase in the short term after reclamation regardless of the type disturbed. In some cases a site may be disturbed or altered to the point that reestablishment of native vegetation is not possible. These adverse impacts would be long term.

Assuming that all activities (397 to 706 acres of disturbance, depending on the ranger district) occurred within one vegetation type, less than three percent of any type would be disturbed in most cases (Table 10.5-3). Adverse impacts would be short or long term depending on the vegetation. These impacts would be negligible for common vegetation types because less than five percent would be disturbed in most cases, if all activities occurred within one type. Impacts would be of relatively greater intensity within locally rare types, such as desert scrub on the Escalante Ranger District or grass meadow within the Pine Valley Ranger District (see Table 4.9-3). Considering the spatial extent and concentration of oil and gas activities, however, it is not likely that activities would remove the relatively small amount of grass meadow type on the Pine Valley Ranger District (479 acres mapped; maximum predicted disturbance of 397 acres would remove 83%). These occurrences are scattered and most lie within the Pine Mountain Wilderness Area, which is not available for lease (see Figure 3.9-1). Although unlikely, activities could conceivably remove 452 acres of the relatively small amount of desert scrub type (488 acres) within the Escalante Ranger District; this adverse impact would be short term and major for either exploration or exploration and production.

Table 4.9-3 Maximum Percentage of Possible Habitat Disturbance in Major Vegetation Communities Impacted by Oil and Gas Activities

Ranger District (# wells[1])	pinyon juniper[3]	aspen conifer	pine wood	moun-tain brush[3]	sage steppe[3]	spruce fir	grass meadow	desert scrub[3]
Pine Valley[2] (5 + 19)	<1%	1%	10%	<1%	2%	--	83%	4%
Cedar City[2] (15 + 19)	2%	1%	1%	2%	1%	2%	5%	--
Powell[2] (20 + 19)	1%	1%	3%	--	1%	2%	3%	--
Escalante[2] (20 + 19)	1%	1%	1%	13%	1%	1%	6%	93%

[1] (Exploratory wells + production wells); exploratory wells include acres disturbed by seismic exploration.
[2] Assumes the greatest amount of disturbance predicted in a ranger district occurred within each area
[3] Any activities within pinyon juniper, mountain brush, sage steppe, or desert scrub have the potential to adversely impact biological soil crusts.

UNIQUE VEGETATION AREAS

Direct disturbance of physical soil crusts would destabilize the soil temporarily, and after reclamation, soil conditions would be improved. Without reseeding, physical crusts will tend to reform during the first rainstorm after disturbance (USFS 2001) and pre-disturbance conditions would return quickly.

Direct disturbance of biological soil crusts would physically destabilize the soil, reduce soil fertility (by removing photosynthetic and nitrogen-fixing organisms and other nutrients contained in the crust), decrease the ability of the soil to retain water, and increase the potential for noxious weed invasion (NSTC 2001). Recovery of biological crusts may take decades to hundreds of years. Recovery and establishment can be impeded by invasive plants, such as cheatgrass, that invade following disturbance. Biological crusts that are in areas of low rainfall, are on coarse-textured soils with low stability, and are in areas with a large amount of bare ground have the longest recovery times (USFS 2001). Direct disturbance of gypsum soils would reduce the amount of area where biological soil crusts are likely to establish. Adverse impacts to biological soil crusts, if they occurred, would be long term and minor.

SPECIAL AREAS AND RNAS

Each Special Area or Research Natural Area measures less than 2,000 acres. Thus, disturbances associated with multiple exploration wells (16.6 acres each) or a production field (254 acres; Table 2.2-1) would constitute long term and major adverse impacts to vegetation resources considering the amount of this type of vegetation available. Seismic exploration would have major adverse impacts to Special or Research Natural Areas, and the risk of invasive plant infestation would be high. Invasive plant impacts, if they occurred, would be adverse, long term and moderate to major (see *Measurement Indicator #6*).

Disturbance within Research Natural Areas or a Special Area would generally be long term due to the uniqueness of this vegetation. In Special Areas, features are by definition unique and are not easily restored. Regarding Research Natural Areas, although they contain the same major vegetation types as the rest of the Dixie National Forest, vegetation in these areas is considered to be of the highest quality and is not easily replaceable. Research Natural Areas are designated as good examples of common or important vegetation, thus the "available"

exemplary vegetation is restricted to the Research Natural Area itself (see *Measurement Indicator #4*).

Drilling that occurs outside the boundaries of a Research Natural Area or Special Area but that accesses oil or gas beneath the Research Natural Area or Special Area would have no adverse impacts on the vegetation within these areas.

- *Measurement Indicator #3* COMPLIANCE WITH ESTABLISHMENT RECORDS

Establishment Records for Research Natural Areas discuss possible conflicts between the intent in establishing the area as a Research Natural Area and the use of the area for oil and gas leasing. Specific direction is put forth in some cases.

Red Canyon: The Establishment Record specified that appropriate protective stipulations be applied to any future leasing, thus oil and gas leasing and activities under SLT within the Red Canyon Research Natural Area would not comply with the Establishment Record for this area. Oil and gas leasing under SLT would also violate objectives in the Establishment Record to preserve and maintain the 'natural' state of the area (see *Measurement Indicator #5*). Adverse impacts in terms of compliance under SLT would be long term and major.

Timbered Cinder Cone: Timbered Cinder Cone Research Natural Area was to be withdrawn from mineral entry after establishment record approval; however, withdrawal has not been initiated. Regarding connected actions, any oil and gas activities involving drilling in the Research Natural Area would not be in compliance. Oil and gas leasing under SLT would also violate objectives in the Establishment Record to preserve and maintain the 'natural' state of the area (see *Measurement Indicator #5*). Seismic activities are not considered mineral entry and therefore would be in compliance (see NSO). Adverse impacts from drilling activities under SLT would be long term and major.

Table Cliff: No special protection measures were put forth in the establishment record for oil and gas leasing; however, leasing within the Table Cliff Research Natural Area would violate the Establishment Record in its objective to preserve and maintain the 'natural' state of the area (see *Measurement Indicator #5*). Adverse impacts in terms of compliance under SLT would be long term and major.

Browse: Oil and gas existing leases and authorized exploration would be honored within the Browse Research Natural Area, thus any oil and gas leasing that followed current statutes and Standard Lease Terms on a current lease would be in compliance with the Browse Research Natural Area Establishment Record. However, Leasing within the Browse Research Natural Area would violate the Establishment Record in its objective to preserve and maintain the 'natural' state of the area (see *Measurement Indicator #5*). Adverse impacts in terms of compliance under SLT would be long term and major.

Upper Sand Creek: Existing Oil and gas existing leases and authorized exploration were honored within the Upper Sand Creek Research Natural Area, thus any oil and gas leasing that followed current statutes and Standard Lease Terms on a current lease would be in compliance with the Upper Sand Creek Research Natural Area Establishment Record. Any additional leasing is not in compliance with the Establishment Record because all parts of the Upper Sand Creek Research Natural Area outside the Box-Death Hollow Wilderness Area are within Management Area 8A2, which states that all lands are withdrawn from all forms of appropriation under the mining laws (with the exception of $C0_2$ leasing until the leases expired).

- *Measurement Indicator #4* EFFECTS AND DURATION OF EFFECTS IN LIMITING ATTRIBUTES OF SPECIAL AREAS

Red Canyon Botanical Area: Disturbance from oil and gas activities to the Claron Limestone and associated rare plant species within the Red Canyon Botanical Area would be a major adverse impact to vegetation resources. Adverse impacts would be long term (greater than 10 years) if any exploratory, development, or production activities took place within the Red Canyon Botanical Area. The endemic and rare plant species that grow on the highly erosive soils of the Claron Formation in the area are vulnerable to disturbance because these areas are naturally unstable (see Soils and Geologic Hazards, Section 4.8). Approximately 50 percent of the area is classified as having a high erosion potential. It is therefore likely that if these areas are disturbed by oil and gas activities, restoration would be impossible in many areas and impacts would be long term.

Indirect adverse impacts to the undisturbed individuals of endemic and rare plant populations in the Red Canyon Botanical Area (including four sensitive species; Section 4.6) are possible if segments of rare plant populations are disturbed or removed by oil and gas activities. In general, the loss of individuals within a small population reduces the number of individuals for reproduction and the amount of gene flow within and between populations. These effects would be more adverse if the vegetation disturbed is locally rare (i.e., sensitive plant population). Indirect adverse impacts would be moderate and long term.

Side Hollow Study Area: The Side Hollow Study Area could be avoided under SLT allowances and thus there would be no direct impacts to trees or ongoing studies within the Study Area. A loss of trees or other vegetation outside and in the vicinity of the Study Area may affect conditions in the Side Hollow Study Area, however, such as water and nutrient levels, which could in turn affect the development parameters of Study Area trees. Any trees in the Study Area that were affected by outside conditions would affect the results of studies that require equal competition and would compromise the objectivity of those studies. Adverse indirect impacts to the Side Hollow Study Area under SLT would be long term and moderate.

- *Measurement Indicator #5* COMPLIANCE WITH MANAGEMENT OBJECTIVES

Unique features of Special Areas and the “exemplary” nature of Research Natural Areas need to be protected in order to comply with management objectives.

Oil and gas activities within Red Canyon Botanical Area would be evaluated through a Biological Evaluation process to determine impact to sensitive plants, and any threat to the persistence of sensitive plants would violate management objectives for the Area. Road building within the Area would need to be carefully evaluated to determine impacts to sensitive plants. No specific prescriptions for oil and gas were given at the time of designation. Adverse impacts with regard to compliance with management objectives under SLT would be long term and major, if oil and gas activities posed a threat to the persistence of sensitive plants.

Management objectives within the Side Hollow Study Area involve preserving the ponderosa pine trees and supporting ongoing studies within the boundary. Pine trees within the boundary would be preserved because the area would be avoided under SLT allowances. Any oil and gas activities that did not interfere with tree growth (i.e., change drainage patterns or other conditions outside the Area) would comply with management objectives for preserving studies. Even small modifications to the soil or plant community conditions in an adjacent location could have an adverse impact on studies in the area that depend on natural conditions to be

consistent across study plots (i.e., equal competition). Adverse indirect impacts to conditions in the Side Hollow Study Area from oil and gas activities under SLT could be long term and moderate if adjacent areas were disturbed.

In general, disturbance within Research Natural Areas from oil and gas exploration would compromise management objectives. Management objectives for Research Natural Areas are to preserve and maintain the 'natural' state of an area, and removing any vegetation within such an area would constitute an unnecessary human intrusion and conflict with preservation of the natural vegetation trends essential for research and interpretation. Research Natural Areas are protected at the level of the entire Area and not just the features of that Area. Additional management objectives for Research Natural Areas involve using Areas for educational or research purposes. Regarding oil and gas activities, mineral lease applications are to be reviewed in a timely fashion and NSO leasing options are recommended (USFS 1986:4-155). Adverse impacts from the alteration of vegetation within Research Natural Areas under SLT would be long term and major.

INVASIVE PLANTS

- *Measurement Indicator #6* INCREASES IN INVASIVE PLANTS

Establishment of or increases in invasive plants, including noxious weeds, would cause indirect adverse impacts to native vegetation. Impacts would be more adverse if infestations occurred in a unique vegetation area, Special Area, or Research Natural Area. Invasive plants cause adverse impacts to the vegetation resources by reducing biodiversity, amount of forage, habitat, soil productivity, and the likelihood that a site can be reclaimed to a 'natural' or historic state. The likelihood of invasive plant proliferation would be most likely during seismic activities (with buggies; see discussion under NSO), but could also occur as a result of pad and road construction, pad development, discharge waters, and secondary disturbances (Bergquist et al. 2007). Road construction may pose the most likely mode of invasive plant proliferation outside of seismic activities under SLT, as roads cover longer linear distances than other construction activities and have a constant and direct contact with vehicles that may transport seeds.

Standard operating procedures include measures to prevent invasive plant occurrences from spreading or establishing during operations and after reclamation. These prescriptions are contained in the *BLM Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development*, *Forest Service Region 4 Oil and Gas Roading Guidelines*, *Dixie National Forest Oil and Gas Construction and Operating Standards* (Appendix C), and other regulating documents. Surface operating standards (BLM and USFS 2007) state that revegetation and maintenance activities on all leases (regardless of leasing option) must ensure that a reclaimed site is free of state- and county-listed noxious weeds. Regarding road construction and reclamation, all roads used to access oil and gas locations exist only as long as necessary to complete exploration and production operations, and are reclaimed after use with native topsoil (where available). Reclaimed areas are seeded with native species, as the long-term objective of final reclamation is to set the course for eventual ecosystem restoration of the natural vegetation community. At the time of reclamation, the operator must achieve at least short-term stability, visual, hydrological, and productivity objectives and take the steps necessary to ensure that long-term objectives will be reached via natural processes (BLM and USFS 2007). These objectives include rapidly controlling and eradicating invasive plants, including noxious weeds, early after they appear on site.

If invasive plants were to increase on the Dixie National Forest, adverse impacts would generally be long term and moderate but would depend on the species introduced. An increase

in invasive plants could result in relative abundance thresholds being crossed that will be difficult or impossible to recover from; in this case, impacts would be major. Further spread of salt cedar or Russian olive may remove the remaining riparian cottonwood communities; these adverse impacts would be moderate to major and long term. Introduction of knapweeds would change species composition, ecological processes, and native plant reproduction due to allelopathic effects; these impacts would be adverse, long term, and moderate.

4.9.5 Impacts by Alternative

The degree to which the connected action impacts (Section 4.9.4) would differ by alternative is discussed in this section. Each alternative involves a unique set of leasing options for each resource component, which would restrict the locations and the nature of oil and gas activities that are allowed wherever these resources occur.

Table 4.9-4 shows the acres of each resource component for vegetation under each leasing option, by alternative. Table 4.9-4 incorporates the amount of overlap with more restrictive leasing options (assigned to other resources) in addition to the leasing option assigned directly to each vegetation resource component. Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B. The Side Hollow Study Area and portions of several Research Natural Areas are within IRAs.

Table 4.9-4 Acreage of Resource Components for Vegetation under each Leasing Option, by Alternative

Resource Component	Leasing Option[3]	Alternative[1,2]						
		A	B	C	D1	D2	E1	E2
Red Canyon Botanical Area (0 acres in IRAs)	NA							
	NL	203	79					
	NSO		124	203	203	203		
	CSU							
	SLT						203	203
Side Hollow Ponderosa Pine Provenance Study Area (4.5 acres in IRAs)	NA							
	NL	4.5	4.5					
	NSO			4.5	4.5	4.5	4.5	
	CSU							
	SLT							4.5
Research Natural Areas (3,219 acres in IRAs)	NA	542	542	542	542	542	542	542
	NL	4,253	4,253	4,253				
	NSO				4,253	4,253	3,219	
	CSU							
	SLT						1,034	4,253

[1] Small discrepancies in the acreage presented for each alternative are due to the fact that the GIS database has limitations when applied over an extremely large area that result in an inability to calculate acreages that match exactly between alternatives. A more detailed table that separates the acreage by resource component and ranger district will be available in Appendix B.
[2] Alternatives D1, D2, E1, and E2 represent the dual analysis of Alternatives D and E. D1 and E1 represent the acres available with NSO in all IRAs. D2 and E2 represent the acres with leasing allowed in IRAs under a less restrictive leasing option.
[3] Areas not legally available (NA) for leasing (see Section 1.5.2) are included in the Table to provide context to the analysis.

In this section, impacts are discussed mainly at the Forest-wide level and not by ranger district. This is done to avoid repetition and facilitate the comparison of impacts across alternatives.

Differences among ranger districts are highlighted in this section if there are pronounced differences among ranger districts.

Impacts by *Measurement Indicators* are summarized in Table 4.9-5 and differences between alternatives regarding vegetation resources are outlined in the text below. *Measurement Indicator #1* is not discussed in this section or in Table 4.9-5 because the impacts in terms of acres disturbed would be the same under all alternatives that allow leasing (Alternatives B, C, D, and E; see Section 4.9.4.6). Under Alternative A, no leasing would be allowed and there would be no impacts relative to *Measurement Indicator #1*.

Under all alternatives, five percent of the Dixie National Forest would be NA, or legally unavailable for lease, including Brian Head Ski Permit Area, wilderness areas, and areas surrounding the Box-Death Hollow Wilderness Area that were withdrawn from leasing by the Utah Wilderness Act of 1984 (see Section 1.5.2).

4.9.5.1 Alternative A

There would be no oil and gas activities on the Dixie National Forest within areas not currently leased. Alternative A would continue present management activities as pertaining to oil and gas leasing. The Forest Supervisor under this alternative would not make any new leasing decisions and no new oil and gas leasing would be allowed on the Dixie National Forest. Current operations, including the Upper Valley oil field on the Escalante Ranger District (19 wells, including nine water-injector wells) would continue. In total, there are 13,454 acres of existing leases on the Dixie National Forest. Existing leases will expire and the potential number of wells that could be drilled on the Dixie National Forest would decrease over time. Under Alternative A, there would be no adverse impacts to vegetation resources, including major vegetation communities, biological soil crusts and gypsum soils, Special Areas, Research Natural Areas, or invasive plants.

4.9.5.2 Alternative B

Chapter 2 of the EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative B (*Measurement Indicator #1*; see Table 2.5-2) and where those acres are located (*Measurement Indicator #2*; Figure 2.5-2 (a-d)). Under all alternatives, six percent of the Dixie National Forest is not legally available for leasing (NA).

Approximately 70 percent of the Dixie National Forest would not be leased (NL) under Alternative B; of the remainder, 20 percent would be NSO and 4 percent would be CSU. All Special Areas and Research Natural Areas would be assigned a leasing option of NSO; however, all or large parts of these areas would be NL due to overlapping leasing options with other resources. Approximately 39 percent of the Red Canyon Botanical Area, all of the Side Hollow Study Area, and all Research Natural Areas would not be available for lease (NL) under Alternative B. Therefore, there would be no effects to the Side Hollow Study Area or Research Natural Areas under this alternative.

For vegetation resources without an assigned leasing option (major vegetation types, biological soil crusts, and weed infestations), under Alternative B the least amount of land would be available for leasing relative to other alternatives (i.e., C, D, and E). The density of oil and gas disturbances predicted under the RFDS (397 to 706 acres) could be higher because only 5 percent of the lands on the Dixie National Forest would be available (i.e., CSU) for the same amount of oil and gas exploration and development. However, since five percent of the Dixie National Forest is equal to about 100,000 acres, oil and gas density would likely be about the

same as if the entire Forest were available for leasing. The 100,000 acres that are available under Alternative B appear to be a mix of major vegetation types similar to that across the entire Forest. No locally rare vegetation (i.e., desert scrub in the Escalante Ranger District) would be available for lease under Alternative B, thus adverse impacts to major vegetation types would be minor and short term (exploration disturbance) to moderate and long term (production disturbance). Adverse impacts to major vegetation communities from seismic activities alone would be negligible.

Adverse impacts to biological soil crusts and invasive plants would be the same under Alternatives B, C, D (both alternatives), and E (both alternatives) because the same amount of disturbance is predicted. Suitable vegetation areas for soil crusts, including desert scrub, pinyon-juniper, sagebrush, are generally available under all alternatives that allow leasing. Likewise, invasive plants may invade any vegetation type, including all areas open to leasing under Alternative B. With NL leasing options in IRAs, the majority of the Pine Valley Ranger District (where crusts are most likely to occur and the greatest numbers of weed infestations are located) would be NL due to the prevalence of IRAs. However, the risk of weed invasion during seismic activities would still be allowed under NSO, which covers 20 percent of the Forest. Adverse impacts with regard to weeds are similar to (or greater than) that from drilling, road building, or any other connected action. Thus, impacts in terms of crust disturbance and weed invasion would not be measurably lower under NSO leasing options, which characterize most available lands under Alternative B, relative to SLT. Adverse impacts to crusts, if they occurred, would be long term and minor, and would be further prevented from recovering by a spread of invasive plants. Adverse impacts related to invasive plants, if they occurred, would be long term and moderate.

4.9.5.3 Alternative C

Alternative C has less restrictive leasing options than Alternative B and more restrictive options than Alternative D. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative C (*Measurement Indicator #1*; see Table 2.5-3) and where those acres are located (*Measurement Indicator #2*; Figure 2.5-3 (a-d)).

Under Alternative C, 76 percent of vegetation on the Dixie National Forest would be NSO. Six percent would be NA. All approved leasing within Special Areas and Research Natural Areas would be NSO.

The same amount of disturbances may occur under Alternative C as under Alternatives B, D, and E. Adverse impacts to major vegetation communities would be minor and short term (exploration) to moderate and long term (production), as described under Alternative B. Under Alternative C, adverse impacts to desert scrub could be major if a production field occurred within this vegetation type on the Escalante Ranger District.

Adverse impacts to biological soil crusts and invasive plants under Alternative C would be the same as under Alternative B because the same amount of disturbance may occur. Regarding Special Areas, 100 percent of the land within these boundaries would be NSO under Alternative C, which is a larger amount of NSO than under Alternative B, under which some areas (i.e., Side Hollow) would not be leased (NL) due to overlaps with other resources. Under Alternative C, seismic activities could occur anywhere within Special Areas due to NSO leasing options throughout. Adverse impacts to Special Areas under Alternative C would be of greater intensity than under Alternative B and are described in 4.9.4.3 (NSO); these impacts could be long term

and minor, if they occurred. There would be no adverse impacts to Research Natural Areas under Alternative C due to NL leasing options.

4.9.5.4 Alternative D1 (NSO in IRAs)

Alternative D has less restrictive leasing options than Alternative C and more restrictive options than Alternative E. Chapter 2 of this EIS describes how many acres of the Dixie National Forest would fall under each leasing option under Alternative D1 (NSO in IRAs) (*Measurement Indicator #1*; see Table 2.5-4) and where those acres are located (*Measurement Indicator #2*; Figures 2.5-4 (a-d)).

Under Alternative D1, 41 percent of the Dixie National Forest would be NSO. Six percent would be NA. As under Alternatives B and C, all approved leasing within Special Areas and Research Natural Areas would be NSO.

Adverse impacts to major vegetation communities, biological soil crusts and invasive plants (*Measurement Indicator #6*), would be the same as under Alternatives B and C because the same amount of disturbance may occur in an unknown location. Adverse impacts to Special Areas (*Measurement Indicators #4 and #5*) would be the same as described for Special Areas under Alternative C because the entirety of these areas would be covered by NSO, under which impacts could be long term and minor. Any impact to Research Natural Areas would be major, as described under NSO (*Measurement Indicators #3* and *#5*; Section 4.9.4.3).

4.9.5.5 Alternative D2 (CSU in IRAs)

Under Alternative D2 (CSU in IRAs), 9 percent of the Dixie National Forest would be NSO. Six percent would be NA. As under Alternative D1, all approved leasing within Special Areas and Research Natural Areas would be under NSO, which would allow seismic activities.

Adverse impacts to vegetation resources (*Measurement Indicators #3, #4, #5,* and *#6*), including major vegetation communities, biological soil crusts, and invasive plants, would be the same as under Alternative E2 (SLT in IRAs). This is because a CSU leasing option (covering the majority of the Forest under this alternative) would not prevent disturbance to vegetation resources and the same impacts may occur as under SLT. Adverse impacts to Special Areas and Research Natural Areas would be the same as under Alternative D1 because leasing options on these lands would still be 100 percent NSO.

4.9.5.6 Alternative E1 (NSO in IRAs)

Alternative E has the least restrictive leasing options. All lands on the Dixie National Forest, with the exception of IRAs, would be under SLT. Chapter 2 of this EIS describes how many acres of forest would fall under each leasing option under Alternative E1 (with NSO in IRAs) (*Measurement Indicator #1*; see Table 2.5-5) and where those acres are located (*Measurement Indicator #2*; Figures 2.5-5 (a-d)).

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Under Alternative E1, leasing would be allowed under NSO on 35 percent of the Dixie National Forest and under SLT on the remainder, with six percent NA. All Special Areas and Research Natural Areas would be under SLT, with leasing allowed in the Side Hollow Study Area, Timbered Cinder Cone Research Natural Area, and Red Canyon Research Natural Area only under NSO because of its location in an IRA.

Adverse impacts to major vegetation communities, biological soil crusts, and invasive plants (*Measurement Indicator #6*), would be the same as under Alternatives B, C, and D because the same amount of disturbance may occur in an unknown location.

Relative to Alternative E2 (SLT in IRAs) (Section 4.9.4.6), although some Research Natural Areas would fall in IRAs and thus be covered by NSO stipulations, adverse impacts to Research Natural Areas under this alternative would still be major. Regarding Special Areas within IRAs (i.e., Side Hollow Study Area), adverse impacts, if they occurred, would be long term and minor. Impacts within Red Canyon Botanical Area would be the same as SLT (4.9.4.6) because this area is not covered by IRAs. In terms of compliance with Establishment Records of Research Natural Areas (*Measurement Indicator #3*), adverse impacts from oil and gas disturbance under Alternative E with NSO in IRAs would be long term and minor for only Timbered Cinder Cone; all others would be negligible because Establishment Records would not be violated. In terms of compliance with management objectives (*Measurement Indicator #5*), SLT options under Alternative E would violate management objectives for Research Natural Areas which state that NSO leasing options should apply within these areas (the 1986 Land and Resource Management Plan would also be violated; see Section 4.17. SLT would also open a larger possibility for disturbance within Special Areas that would violate management objectives to preserve unique features of these areas. These adverse impacts, if they occurred under SLT, would be long term and major.

4.9.5.7 Alternative E2 (SLT in IRAs)

Leasing would be allowed anywhere on the Dixie National Forest that is legally available (94 percent of the forest; Table 1.5-1) under SLT. Impacts would be as described in Section 4.9.4.6.

Table 4.9-5 Adverse Impacts with Respect to Measurement Indicators #2 - #6

Resource			ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
Major Vegetation Types		*MI #2*	No effect	minor-mod ST-LT	minor-mod[1] ST-LT	minor-mod[1] ST-LT	minor-mod[1] ST-LT	minor-mod[1] ST-LT	minor-mod[1] ST-LT
Biological Crusts		*MI#2*	No effect	minor LT **#**	minor LT **#**	minor LT **#**	minor LT **#**	minor LT **#**	minor LT **#**
Special Areas	Red Canyon Botanical Area	*MI#2*	No effect	neg – minor LT	minor LT	minor LT	minor LT	major LT	major LT
		MI #4	No effect	neg – minor LT	minor LT	minor LT	minor LT	major LT	major LT
		MI #5	No effect	neg – minor LT	minor LT	minor LT	minor LT	major LT	major LT
	Side Hollow Ponderosa Pine Study Area	*MI#2*	No effect	No effect	negligible LT	negligible LT	negligible LT	negligible LT	Major[2] LT
		MI #4	No effect	No effect	minor LT	minor LT	minor LT	minor LT	Major[2] LT
		MI #5	No effect	No effect	minor LT	minor LT	minor LT	minor LT	Major[2] LT
Research Natural Areas	Browse	*MI #2*	No effect	No effect	negligible LT	major LT	major LT	major LT	major LT
		MI#3	No effect	No effect	negligible	negligible	negligible	negligible	negligible
		MI #5	No effect	No effect	negligible LT	major LT	major LT	major LT	major LT
	Red Canyon	*MI #2*	No effect	No effect	negligible LT	Alt D: same as Browse		Alt E: same as Browse	
		MI#3	No effect	No effect	negligible				
		MI #5	No effect	No effect	negligible LT				
	Table Cliff	*MI #2*	No effect	No effect	negligible LT	Alt D: same as Browse		Alt E: same as Browse	
		MI#3	No effect	No effect	negligible				
		MI #5	No effect	No effect	negligible LT				

Resource			ALT A	ALT B	ALT C	ALT D1	ALT D2	ALT E1	ALT E2
	Timbered Cinder Cone	*MI #2*	No effect	No effect	negligible LT	Alt D: same as Browse		Alt E: same as Browse	
		MI#3	No effect	No effect	negligible				
		MI #5	No effect	No effect	negligible LT				
	Upper Sand Creek	*MI #2*	No effect	No effect	negligible	negligible	negligible	negligible	negligible
		MI#3	No effect	No effect	negligible	negligible	negligible	negligible	negligible
		MI #5	No effect	No effect	negligible	negligible	negligible	negligible	negligible
Invasive Plants		*MI#6*	No effect	mod-major LT[3]	mod-major LT[3]	mod-major LT[3]	mod-major LT[3]	mod-major LT[3]	mod-major LT[3]

[1] Impacts within desert scrub in Escalante Ranger District could be major if a production field occurred completely within desert scrub.
[2] Impacts would be long term and major if they occurred; however, due to its small size this area could be avoided.
[3] Impacts most likely within Pine Valley Ranger District.
LT = long term; ST = short term; neg = negligible; mod = moderate.

4.10 Transportation

4.10.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.10-1 provides an example of how these terms would apply to the transportation system.

Table 4.10-1 Terms used to Describe Effects to the Transportation System

Attribute of Effect		Description relative to the Transportation System
Quality	Beneficial	An improvement of an existing road, such as adding or improving drainage, grading, or improving surface condition.
	Adverse	A degradation of an existing road as a result of an increase in the number of large vehicles (e.g., semi trucks, etc.), which can increase maintenance costs and create safety concerns.
Magnitude (Intensity)	Negligible	An increase in traffic volume that is not statistically different than baseline and does not result in an increase in maintenance costs.
	Minor	An increase in traffic volume that is statistically different than baseline, but does not result in an increase in realized maintenance costs.
	Moderate	An increase in traffic volume that is statistically different than baseline and results in a small, but realized increase in maintenance costs.
	Major	An increase in traffic volume that is statistically different than baseline and results in large, realized increase in maintenance costs
Duration	Temporary	An increase in traffic volume that does not continue once construction or exploration is completed.
	Short-term	An increase in traffic volume that occurs during exploration activities (i.e., construction of exploratory well pads or access roads, 10 years or less.
	Long-term	An increase in traffic volume due to the construction of production facilities (i.e., a production field and associated roads), more than 10 years.

4.10.2 Measurement Indicators

- *Measurement Indicator #1* ESTIMATED TRAFFIC INCREASE
- *Measurement Indicator #2* MILES OF ROAD CONSTRUCTION AND RECONSTRUCTION (LONG- AND SHORT-TERM)
- *Measurement Indicator #3* DETERMINE THE POTENTIAL GRAVEL QUANTITIES NEEDED

4.10.3 Impacts Common to All Action Alternatives

No resource components or leasing options were identified specifically for the transportation resource. There is no difference between action alternatives for transportation effects. As a result, the impacts of connected actions under the Reasonably Foreseeable Development Scenario (RFDS) are discussed in this section, assuming no restrictions or leasing options on oil and gas activities other that those listed on BLM form 3100-11. Oil and gas activity would be subject to the Best Management Practices (BMPs) listed in the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in Appendix C and the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007).

Impacts to county and Dixie National Forest roads would primarily include maintenance of new and existing roads, and increased levels of traffic using these roads. Increases in traffic volume, especially related to increases in the number of large vehicles (e.g., semi trucks, etc.), can increase maintenance costs and create additional safety concerns (e.g., large vehicles entering highways). Maintenance of existing, new, and reconstructed roads used for oil and gas activities would be the responsibility of the lessee. Construction of new roads could provide access for inappropriate use of National Park Service Lands; however in specified areas, access roads would be gated and only used for oil and gas related activities. Any new road added to the system (production) would first undergo NEPA analysis and any temporary roads (exploration) would be removed and rehabilitated.

Beneficial impacts could include improvement of existing roads (such as adding or improving drainage, grading, improving surface condition) and overall improvement of the transportation system (i.e., planning road locations and types efficiently to meet access needs) to the road and maintenance standards in the Land and Resource Management Plan. Adverse impacts related to surface disturbance, removal of vegetation, erosion, wildlife collisions, IRAs, changes in air quality and fragmentation of wildlife habitats are discussed in the other sections of Chapter 4.

Measurement Indicators

- *Measurement Indicator #1* ESTIMATED TRAFFIC INCREASE

EXPLORATION DRILLING

For this EIS we are using the Fishlake National Forest's estimated traffic volumes by type that was created in support of their oil and gas leasing EIS. This information, currently in draft form, is provided as Appendix E. Traffic volume is directly correlated to estimated size of drill pads and amount of road construction/reconstruction. Estimated pad size for the Fishlake National Forest is the same (5.9 acres) as for the Dixie National Forest. The amount of new road construction per drill pad estimated on the Fishlake National Forest is 0.09 miles more than on the Dixie National Forest and the amount of reconstruction is 1.32 miles less. Although minor differences exist between the two Forests, these data are the best available and more applicable than UDOT (2006).

In summary, it is estimated that total one-way traffic volume would be up to 1,924 trips per exploration well. The RFDS (BLM 2007a) estimates 60 total exploration wells on the Dixie National Forest over a 15-year period. Total estimated traffic volume for these exploration wells is presented in Table 4.10-2. For the purpose of this analysis, it is estimated that it would take 120 days to complete each exploration well, including initial reclamation (Carter Reed, USFS, personal communication). Average daily traffic per exploration well is estimated to be 16 trips. The RFDS (BLM 2007a) predicts four exploration wells on the Dixie National Forest per year. Average daily traffic volume associated with exploration wells would thus range from 0, when no drilling is occurring, to 64 one-way trips if all four exploration wells were active at the same time. Although unlikely, it is assumed for this analysis that all four exploration wells would be active at the same time each year and that associated traffic would occur on all Highways. Under this extreme scenario, average daily traffic volume would increase from between three percent and 12 percent on the Dixie National Forest as a result of exploration drilling (Table 4.10-2). In terms of public safety, this increase would be short term (120 days) and negligible to minor in intensity. Regarding maintenance costs, the lessee would be responsible for maintenance until operations cease and there would be no effect on maintenance costs. If the oil and gas activity requires upgrading an existing Forest Service road to a higher standard, the Forest Service may agree to assume costs of maintenance at the higher standard after exploration is completed.

Table 4.10-2 Total Estimated Exploration Traffic Volume

Ranger District	One-Way Traffic Volume
Cedar City	28,860
Escalante	38,480
Pine Valley	9,620
Powell	38,480
Total	115,440

Table 4.10-3 Estimated Percent Increase in Average Daily Traffic Volume During Exploration Drilling

Highway	Pine Valley[1]	Cedar City[1]	Powell[1]	Escalante[1]
State Highway 18	4%			
State Highway 14		8%		
State Highway 148		12%		
State Highway 143		8%		
US Highway 89		5%		
State Highway 12 Red Canyon			3%	
State Highway 12 Upper Valley				5%
State Highway 12 Boulder				12%

[1] Assumes that 4 wells would be active at the same time and that associated traffic would occur on all highways.

PRODUCTION FIELD DEVELOPMENT

It is estimated that total one-way traffic volume would be up to 6,884 trips for development of a 20-well production field (Appendix E). For the purpose of this analysis, it is estimated that it would take at least two years (520 working days) to complete field development (Carter Reed, USFS, personal communication). Average daily traffic is thus estimated to be 13 one-way trips during the production field development stage. The RFDS estimates the development of one production field on the Dixie National Forest. For the sake of this analysis, it is assumed that a 20-well production field would be developed in each ranger district. Average daily traffic volume would increase from one percent to two percent on the Dixie National Forest as a result of field development (Table 4.10-4). In terms of maintenance costs and public safety impacts as a result of increased traffic and large vehicles pulling onto highways, this increase would be short term (two to three years) and negligible.

FIELD OPERATIONS

Once a field was developed, estimated average daily one-way traffic volume would be up to 15 trips for field operation (Appendix E). Average daily traffic volume increase would be similar to development (Table 4.10-3). In terms of maintenance costs and public safety, this increase would be long term (30 years) and negligible.

Table 4.10-4 Estimated Percent Increase in Average Daily Traffic Volume during Production Field Development

Highway	Pine Valley[1]	Cedar City[1]	Powell[1]	Escalante[1]
State Highway 18	1%			

Highway	Pine Valley[1]	Cedar City[1]	Powell[1]	Escalante[1]
State Highway 14		2%		
State Highway 148		2%		
State Highway 143		2%		
US Highway 89		1%		
State Highway 12 Red Canyon			1%	
State Highway 12 Upper Valley				1%
State Highway 12 Boulder				2%

[1] Assumes that one field is developed on each ranger district and that associated traffic would occur on all highways.

ABANDONMENT AND RECLAMATION

It is estimated that total one-way traffic volume would be up to 902 trips for field abandonment and reclamation (Appendix E). For the purpose of this analysis, it is estimated that it would take three years (780 working days) to complete abandonment and reclamation activities (Carter Reed, USFS, personal communication). Average daily traffic is thus estimated to be one to two one-way trips during the abandonment and reclamation stage. In terms of maintenance costs and public safety, this increase would be short-term (three years) and negligible.

- *Measurement Indicator #2* MILES OF ROAD CONSTRUCTION AND RECONSTRUCTION

It is estimated that an average of 0.66 miles of new road construction and 3.92 miles of road reconstruction would be needed for each exploration well. It is also estimated that 9.5 miles of new spur roads would be needed for a production field (BLM 2007a). Across the ranger districts, the percent increase in miles of roads over baseline would range from 6.9 percent to 13.5 percent (Table 4.10-5). Actual increases would be somewhat less as roads would be constructed over a 15-year period and in any year following the first exploration well, earlier temporary exploration roads would be reclaimed and removed. Impacts to the existing transportation network would be short to long term depending on location of the road and success of reclamation for exploration roads. For production, impacts would be long term as the roads would be in existence for at least 10 years. The 284.3 miles of new road construction/reconstruction would not greatly augment (8.6 percent) the 3,297 miles of system roads already existing on the Dixie National Forest, or individual ranger districts; impacts would be minor.

Table 4.10-5 Estimated Miles of New Road Construction and Reconstruction over a 15-Year Period by Ranger District

Ranger District	Wells	New Road Construction Exploration Drilling	Road Reconstruction Exploration Drilling	New Spur Road Construction Production Field	Total Road Construction/ Reconstruction	Percent Increase Over Existing
Pine Valley	5	3.3	19.6	9.5	32.4	6.9%
Cedar City	15	9.9	58.8		78.2	7.7%
Powell	20	13.2	78.4		101.1	12.6%
Escalante	20	13.2	78.4		101.1	13.5%
Total	60	39.6	235.2		284.3	9.2%

- *Measurement Indicator #3* POTENTIAL GRAVEL QUANTITIES NEEDED

It is estimated that between 1,662 (four inches of gravel surface course) to 3,739 (eight inches of gravel) cubic yards of gravel would be needed for each mile of road construction/reconstruction. It is further assumed that a 5.9-acre well pad would require 6,887 cubic yards of gravel (Donald Wilcox, USFS, personal communication). In total, estimated maximum gravel needed is 1,476,218 cubic yards (Table 4.10-6). Gravel sources on the Dixie National Forest are limited and it is likely that gravel would have to be imported from off the Forest, such as from adjacent BLM-administered lands or from a private source. If gravel came from existing, permitted pits, impacts would be short term and minor to moderate depending on the amount of source material available. If new gravel pits are required, impacts could be long term if the pit remained active for many years. Impacts associated with new gravel pits on BLM-administered lands would be subject to a project-specific NEPA analysis.

Table 4.10-6 Estimated Amount of Gravel Needed for Road Construction/ Reconstruction and Well Pads over a 15-year Period by Ranger District

Ranger District	Wells	New Road Construction Exploration Drilling (miles)	Road Reconstruction Exploration Drilling (miles)	New Spur Road Construction Production Field (miles)	Total Road Construction/ Reconstruction (miles)	Maximum Gravel Needed (cubic yards)
Pine Valley	5	3.3	19.6	9.5	32.4	155,578.6
Cedar City	15	9.9	58.8		78.2	395,694.8
Powell	20	13.2	78.4		101.1	515,752.9
Escalante	20	13.2	78.4		101.1	515,752.9
Total	60	39.6	235.2		284.3	1,476,218.0

4.10.4 Impacts of Connected Actions by Leasing Option

No resource components or leasing options were identified specifically for the transportation resource. Effects of road building by leasing options assigned to other resources are described in other sections of Chapter 4.

4.10.5 Impacts by Alternative

With the exception of Alternative A, estimated traffic increase (*Measurement Indicator #1*), miles of road construction and reconstruction (*Measurement Indicator #2*), and potential gravel quantities needed (*Measurement Indicator #3*) would be the same under all alternatives. Impacts by alternative are thus the same and as described in Section 4.10.3: short (exploration) to long term (development) and mostly negligible to minor. If gravel for road construction/reconstruction came from existing, permitted pits, impacts would be minor to moderate depending on the amount of source material available.

4.11 Socioeconomic Resources

4.11.1 Introduction

The terms used to describe the context and intensity of effects in this section are discussed in Section 4.1 and Table 4.1-1. Table 4.11-1 provides an example of how these terms would apply to socioeconomic resources.

Table 4.11-1 Terms used to Describe Effects to Socioeconomic Resources

Attribute of Effect		Description relative to Socioeconomic Resources
Quality	Beneficial	A change in social or economic conditions that leads to economic prosperity in the form of increased employment, higher incomes, and an increased tax base, or that positively contributes to community values.
	Adverse	A population change for which a local community cannot accommodate and results in economic hardships as the need for public facilities and services arises, or community values are lost.
Magnitude (Intensity)	Negligible	A change in employment and earnings that does not lead to a statistical change in employment, incomes, or tax base.
	Minor	A change in employment and earnings that leads to a statistical change in employment, income, and tax base that impacts a small proportion (less than approximately 25 percent) of the public.
	Moderate	A change in employment and earnings that leads to a statistical change in employment, income, and tax base which impacts a large proportion (between approximately 25 and 75 percent) of the public.
	Major	A change in employment and earnings that leads to a statistical change in employment, income, and tax base which impacts a majority (greater than 75 percent) of the public.
Duration	Temporary	A change in employment and earnings that does not occur once construction or exploration is completed.
	Short Term	A change in employment and earnings that occurs during exploration activities (i.e., construction of exploratory well pads or access roads, 10 years or less.
	Long Term	A change in employment and earnings due to the construction of production facilities (i.e., a production field and associated roads), more than 10 years.

4.11.2 Measurement Indicators

- *Measurement Indicator #1* POTENTIAL LEASE BIDS, LEASE PAYMENTS, AND ROYALTIES GENERATED
- *Measurement Indicator #2* POTENTIAL AMOUNT OF FEDERAL RECEIPTS TRANSFERRED TO THE STATE OF UTAH AND RESPECTIVE COUNTIES
- *Measurement Indicator #3* POTENTIAL AMOUNT OF PROPERTY TAX LEVIED AGAINST PRODUCING WELLS
- *Measurement Indicator #4* NUMBER OF POTENTIAL JOBS GENERATED
- *Measurement Indicator #5* POTENTIAL LOSS TO GRAZING PERMITTEES
- *Measurement Indicator #6* POTENTIAL OFFSET OF RECREATION IN LEASING

AREAS

- *Measurement Indicator #7* COST PER MILE OF ROAD MAINTENANCE FOR FEDERALLY MANAGED ROADS

4.11.3 Impacts Common to All Action Alternatives

The direct social and economic effects of oil and gas leasing on the Dixie National Forest would be increased employment and earnings in the area surrounding the Forest. The effects would actually occur in cities and towns surrounding Dixie National Forest and not on the Forest lands themselves. Additional spending by the oil companies and employees results in indirect and induced economic impacts in the area.

Energy development can bring with it economic prosperity in the form of increased employment, higher incomes, and an increased tax base. Development can also cause adverse effects if local communities cannot accommodate population increases associated with the development. The influx of workers and their families could cause changes in social structures and life styles and impose economic hardships if the need for public facilities and services arises before adequate local revenue sources are generated within the region. Challenges that communities might face include a shortage in the supply of permanent and rental housing, inadequate infrastructure, and an overburdened to medical facilities, schools, and public services. The intensity of impacts depends on site-specific factors such as local population size and growth rates, population densities in the affected communities and surrounding areas, proximity to regional population centers, availability of service and retail businesses, and institutional capabilities to plan for, manage, and finance necessary infrastructure facilities (U.S. General Accounting Office 1982).

The prosperity and severity associated with energy development is also a function of project scale and duration. Large projects in close proximity to population centers will affect local communities more profoundly than self-contained, small-scale projects located far from local communities. Projects that encourage large-scale movement of people into an area for short time periods may also present serious challenges to local communities.

Under the various leasing options for development of the Dixie National Forest's oil and gas resources, a variety of changes in the human environment of the six-county area (Garfield, Iron, Kane, Piute, Washington, and Wayne) could occur. Direct effects would include changes in employment and income that result from new jobs in the community for local residents during the exploration, development, and/or production phases. Indirect changes could take the form of increased business for local merchants and professionals (which would also increase the demand for labor), and possibly increase the population if development activities induce people to relocate permanently to the area. Increases in personal income could result, as well as changes in demand for housing, schools, and public services.

Of concern is the potential magnitude of these changes. The issue is one of capacity and capability of local communities to absorb and accommodate changes in population and requirements for public and private goods and services and whether the area's communities could accommodate inflows of human and material resources that could result from the leases. Two prime factors should therefore be considered: 1) the magnitude of the development activities (in terms of numbers of people and movements of materials and equipment and the associated flows of money into the local economy) and 2) the economic base of the area (in terms of its degree of development to provide goods and services to its residents and visitors).

In the short term, the latter is relatively fixed; the baseline description of the six counties' socioeconomic characteristics described in Section 3.11 portrays the current status of employment, income, fiscal, and population variables. Although four counties in the six-county area are rural and sparsely populated (Garfield, Kane, Piute, and Wayne Counties), the remaining two counties, Washington and Iron Counties, each have a broad-based economy and a solid and growing population.

Because of the relatively minor amount of oil and gas exploration activity predicted by the RFDS, any impacts on counties in the six-county area are likely to be temporary, short term and minor. The geographic area where exploration would occur is vast and remote; the number of wells that would be drilled averages four per year over a 15-year period, and exploration will be spread throughout this large area. Finally, depending on where exploration occurs on the Dixie National Forest and its proximity to the nearest communities, impacts on those communities would vary from negligible to minor. Exploration in remote portions of the Forest could require crews to live on-site in temporary camps. In these situations, interaction with local communities would be minor and not likely to strain local resources. Exploration that occurs closer to the Forest boundaries could likely result in a higher level of interaction between work crews and the local community as contractors occupy nearby hotels and motels, eat meals, and purchase fuel and other sundry items from local merchants.

Longer-term impacts would occur during the operation/production phase. Under the RFDS, one production field with 20 wells would be developed within 15 years. In this phase, oil and gas workers could move into the area and bring their families with them. Some communities may be better prepared than others to absorb population increases and to deal with the social and economic situations that result.

Of interest to the socioeconomic impact assessment are the money and people aspects of the projected developments. Money flows (i.e., changes in demand for economic resources) and relocation of personnel (and dependents) are the direct causes of socioeconomic impacts. It is necessary, accordingly, to attempt to quantify the economic (material and human) resources associated with mineral exploration, development, and production on the Dixie National Forest.

Measurement Indicators

- *Measurement Indicator #1 –* POTENTIAL LEASE BIDS, LEASE PAYMENTS, AND ROYALTIES GENERATED

Under the Mineral Leasing Act of 1920, royalties are paid to the federal government for oil and gas production from public lands. Royalties are paid at 12.5 percent of production value. It is estimated that annual royalties paid to the federal government under the RFDS would be approximately $3.2 million (see Table 4.11-2).

Based on information collected by the U.S. Department of Interior, Mineral Management Service, the federal government collected $9.04 billion in oil and gas royalties in 2007. Using this amount as a guideline, the effect of $3.2 million in royalties generated by 20 producing wells on the Dixie National Forest is considered negligible for the six-county area. Depending on how this royalty income is eventually distributed to local governments and communities the impact could range from minor to moderate. The impacts would likely be long term depending on the length of time the wells remain productive.

- *Measurement Indicator #2* – POTENTIAL AMOUNT OF FEDERAL RECEIPTS TRANSFERRED TO THE STATE OF UTAH AND RESPECTIVE COUNTIES

Revenues from leasing are shared equally between the federal government and the state. Since the passage of the Mineral Leasing Act in 1920, Utah has received $962,468,000 from mineral revenues on federally-managed public lands in the state (BLM 2007d). Generally, one-half of the royalties paid to the Minerals Management Service are returned to the state of origin. Royalties related to production on Indian lands are returned to the appropriate tribe. The states have full discretion as to the distribution of federal mineral royalties as long as priority is given to areas with economic and/or social impacts from leasing activities.

In Utah, federal mineral royalties are distributed to several different accounts according to state law (Table 4.11-2). The largest recipients of federal mineral royalties in Utah are the Department of Transportation (UDOT) and the Permanent Community Impact Fund (PCIF). The funds distributed to UDOT are then distributed to local governments to fund special service districts in proportion to the amount of mineral lease money generated by each county. The Permanent Community Impact Fund (PCIF) makes loans and grants to state agencies and subdivisions of state government impacted by mineral resource development. Unlike the funds administered by UDOT, which are distributed in proportion to royalties generated in the county, the PCIF is distributed by a state-appointed board in response to proposals submitted by state agencies and local governments. Therefore, the distribution of funds by the PCIF to the various counties may vary from the amount of royalty generated.

The payments in lieu of taxes cited in Table 4.11-2 are not the payments in lieu of taxes made by the federal government for federal land in Utah, but are payments made by the state government to counties for lands controlled by the School and Institutional Trust Lands Administration, Utah Division of Parks and Recreation, and the Utah Division of Wildlife Resources.

Table 4.11-2 Distribution of Federal Mineral Royalties in Utah

	Percent
Permanent Community Impact Fund	32.5
State Board of Education	2.25
Utah Geological Survey	2.25
Water Research Laboratory	2.25
Department of Transportation	40.0
Department of Community and Culture	5.00
Permanent Community Impact Fund	Remainder

[1] The amount paid for Payments in Lieu of Taxes has been adjusted annually since 1994 according to the Consumer Price Index.
Source: Utah State Code, Title 59, Chapter 21.

The average annual production from 20 wells is estimated at 363,000 barrels, or 18,165 barrels per well per year. This is the average annual production per well for Utah from 1957 to 2006, weighted by the number of wells (UGS 2008). The 2008 Annual Energy Outlook released by the Energy Information Administration forecasts the price of crude oil to decline gradually from current levels to $70 per barrel in 2016 before rising to $113 per barrel in 2020 (Energy Information Administration 2007a). (This was before the widely fluctuating oil prices of 2008). Crude oil produced in the Rocky Mountain region is, at the time of this writing, selling for a discount compared to quoted prices for light, sweet crude due to refinery capacity issues. For

purposes of this impact analysis, and in concert with the Energy Information Administration (2007a), it is assumed that crude oil produced from the Dixie National Forest would sell for $70 per barrel (this would vary in the future with changes in actual oil prices). Given these assumptions, the amount of federal mineral royalties returned to the State of Utah is estimated at $1.6 million, while 40 percent of this amount, or $636,000, would be returned to the county of origin by UDOT (Table 4.11-3).

Table 4.11-3 Estimated Federal Mineral Royalties Paid Annually

	Amount
Annual Production, barrels	363,300
Selling Price per barrel	$70
Value of Production	$25,431,000
Federal Royalty Rate	12.5%
Federal Royalty Paid	$3,178,875
Amount Returned to the State	$1,589,738
Amount Returned to County of Origin by UDOT	$635,775

Source: Preparer's calculations

In addition to the funds returned directly to the county of origin by UDOT, there is a possibility that additional funds could be returned to the area through the PCIF. These funds are distributed in response to proposals submitted by local governments and state agencies. In the past, the six-county area has received more in awards from the PCIF than the amount of revenue that was generated by federal mineral royalties in the area.

Based on information collected by the U.S. Department of Interior, Mineral Management Service, Utah received $101 million in oil and gas royalties in 2007. Using this amount as a guideline, the effect of $1.6 million in royalty payments to Utah that would be generated by 20 producing wells on the Dixie National Forest is considered minor. County-specific effects cannot be determined, as it is not known which county or counties in the six-county area would receive royalty payments. The effects of these payments would vary depending on the county receiving them, with the effect being greater for a county with lower baseline economic activity than one with a larger economy. The length of time the wells would remain viable is unknown, but the royalty payments would continue as long as the wells produce, likely long term.

- *Measurement Indicator #3* – POTENTIAL PROPERTY TAXES PAID ON PRODUCTION

In Utah, oil and gas properties are centrally assessed by the Utah State Tax Commission. Property taxes are then levied by local governments. Taxes are assessed on all wells, regardless of surface ownership. During 2006, total oil and gas production was 38,908,985 barrels of oil equivalent, on which $12,895,362 in property taxes was charged. This is a ratio of $0.446 per barrel of oil equivalent produced. Applying this ratio to the estimated annual production of 363,300 barrels on the Dixie National Forest results in estimated property tax payments of $162,107 on a producing field with 20 wells, although the actual taxes assessed would depend on the county where the field would be located.

An increase of $162,107 in property taxes related to oil and gas properties is minor (a small but measurable change). The length of time the wells would remain viable is unknown, the impacts would likely be long term depending on how long the wells continue to produce.

- *Measurement Indicator #4* – NUMBER OF POTENTIAL JOBS GENERATED

Potential jobs generated in the six-county area would result from drilling activities and subsequent production under the RFDS. There are currently no oil and gas drilling companies located in the six-county area. Drilling companies would have to relocate to the area on a temporary basis as needed. Due to the specialized nature of the work and lack of an oil service industry in the area, most of the equipment and supplies necessary for drilling would have to be imported. Similarly, most of the drilling crews would likely be existing employees of the drilling companies.

The economic impact of drilling in the area would be living expenses of the drilling crews and supplies the drilling companies are able to purchase in the area. The majority of the supplies purchased locally would be food, lodging, and fuel. While the oil drilling crews would be located temporarily in the area and may not be reflected in government employment statistics, spending by the drilling companies and their workers would stimulate the economy.

Due to uncertainty regarding the location of the production field, the economic impacts are estimated for the region as a whole. The 20 production wells forecast by the RFDS would require between 10 and 20 permanent workers. This estimate is based on employment at similar sized oil fields in Utah. Wolverine Gas and Oil Corporation has between 10 and 19 employees at the Covenant Field in Sevier County, while Citation Oil and Gas Corporation also has between 10 and 19 employees at the Upper Valley Oil Field in Garfield County (Utah Department of Workforce Services 2008). There are 10 operating wells in the Covenant Field and 19 wells in the Upper Valley Field. Therefore, it is estimated that 15 permanent jobs would be created in the vicinity of the Dixie National Forest should a producing oil field with 20 wells materialize.

The average annual wage for the oil industry in Utah during 2006 was $64,763. Therefore, the 15 estimated permanent jobs would have an annual payroll of approximately $971,445.

In addition to the 15 direct jobs in the area generated by the operations, there would be additional indirect and induced employment that results from company and employee spending in the area. The RIMS II Input-Output model developed by the Bureau of Economic Analysis was used to determine the amount of additional jobs and wages in the area due to indirect and induced impacts.

The direct effect employment multiplier for the oil and gas extraction industry in the six-county area is 2.8839. The direct effect earnings multiplier is 1.3534 (Bureau of Economic Analysis 2008). So, for every new job created in the oil and gas extraction industry in the study region, an additional 1.88 jobs are created or sustained in other sectors of the region's economy. Likewise, for every additional dollar of wages paid by the oil and gas extraction industry in the six-county area, an additional $0.35 is paid in earnings to workers in other sectors.

Applying the employment and earnings multipliers to the estimated direct employment and wages paid to oil production workers under the RFDS, results in 43 total new jobs in the area and $1.3 million in wages (Table 4.11-4). The additional wages would result in an increase in state taxes of $105,969 annually. The increase in local taxes is estimated to be $62,451.

Table 4.11-4 Economic Impact of the Reasonably Foreseeable Development Scenario

	Impacts
Direct employment (jobs)	15
Direct wages	$971,445
Indirect and induced employment (jobs)	28
Indirect and induced wages	$343,309
Total employment (jobs)	43
Total wages	$1,314,754
State government fiscal impact	$105,969
Local government fiscal impact	$62,451

Source: Preparer's calculations.

The state and local tax impacts were calculated with ratios developed by quantifying the relationship between total earnings and selected state and local tax collections for 2003-2004 and 2004-2005, the latest years for which these data were available. The state tax ratio was 8.06 and the local tax ratio was 4.75.

Due to the scope and size of the proposed exploration activities, traditional boom and bust cycles associated with oil and gas exploration do not apply to the RFDS. The effects of adding 43 jobs in an area with a 2006 civilian labor force of 90,206 would be imperceptible. On an individual county level, an additional 43 jobs in Washington or Iron County would be negligible. If the production field is near the rural communities of Garfield, Kane, or Wayne Counties, the effects of the impacts would likely be minor. The effect of the impacts on Piute County would be moderate. Overall, the addition of jobs would likely be a mix of employees from the local areas and employees who move to the area. The impacts would likely be long term depending on the length of time the wells remain productive.

- *Measurement Indicator #5* – POTENTIAL LOSS OF AVAILABLE FORAGE/AUMS FOR GRAZING PERMITTEES.

Development of oil and gas leases could impact available grazing AUMs and affect forage available for grazing permittees. Unless all predicted disturbance happened in one place on the smallest allotments, the impact on permittees as far as a loss of AUMS/allotment would be negligible to any individual permittee. Any effects would be more an inconvenience to the permittees from increased activity, potential gate management, and traffic during exploration and production through allotments. If grazing is displaced to another location within the six-county area, there will be no net change in economic activity associated with grazing in the general area and no economic impact, although reallocation of AUMs could impact individual permittees.

- *Measurement Indicator #6* – POTENTIAL RELOCATION OF RECREATION OUTSIDE/AWAY FROM LEASING AREAS.

Development of oil and gas leases has the potential to impact recreational use in the area. As described in Section 4.4, exploration and oil and gas construction activities in currently undisturbed primitive and semi-primitive settings would likely be followed by a decrease in recreation use in these areas as some users may feel that their recreation experience would be compromised because of intrusive sights and sounds not compatible with the natural setting. Use levels may rebound after wells are in place.

Oil and gas activities under SLT may lead to decreases in the usage and quality of certain developed recreation sites (including developed parks and access roads) because most users

would not expect the visual contrast, noise, or activities associated with oil and gas activities. Developed sites usually serve as destinations or hubs for recreation activities in the immediate area. Viewing oil and gas activities within the natural setting of a developed recreation site may cause users to be dissatisfied with their recreation experience. Under SLT, the impacts on developed recreation sites from noise and increased traffic due to oil and gas activities would be minor. Since traffic levels and noise are relatively high in the vicinity of these areas (many users present at one time and adjacent to roads) the increase in noise and traffic levels would be perceptible but would not likely cause users to abandon the site or be dissatisfied with their experience.

These direct impacts to the recreational values of developed and undeveloped recreation sites can have indirect negative effects on leisure/hospitality (tourism) spending and employment. The magnitude of this impact would depend on the proximity of the oil and gas activity to the recreation site, how noticeable the activity is to the recreational users, and the duration of the oil and gas activity. Due to the uncertainty in the location of the exploration and production activity included in the RFDS, these impacts cannot be determined with any certainty, If recreationists relocate to other locations within the six-county area, then the amount of recreation and associated spending would experience little change. Therefore, there would be little change in economic impact due to visitor spending.

- *Measurement Indicator #7* – COST PER MILE OF ROAD MAINTENANCE FOR FEDERALLY MANAGED ROADS

Additional heavy truck traffic associated with drilling and operating activities has the potential to increase maintenance costs on federally managed roads in the Dixie National Forest. Given that the Reasonably Foreseeable Development Scenario predicts an annual average of four exploration wells, widespread road damage due to exploration activities is unlikely to occur. These impacts are addressed in greater detail in the Transportation Section (4.10).

4.11.4 Impacts of Connected Actions by Leasing Option

No resource components or leasing options were identified specifically for the socioeconomic resource. Effects of oil and gas activities by leasing options assigned to other resources are described in other sections of Chapter 4.

4.11.5 Impacts by Alternative

With the exception of Alternative A, potential lease bids, lease payments, and royalties generated (*Measurement Indicator #1*), potential amount of federal receipts transferred to the State of Utah and respective counties (*Measurement Indicator #2*), potential amount of property tax levied against producing wells (*Measurement Indicator #3*), and number of potential jobs generated (*Measurement Indicator #4*) would be the same under all alternatives. Impacts by alternative in regards to these measurement indicators are thus the same and as described in Section 4.11.3. Impacts related to the potential loss to grazing permittees (*Measurement Indicator #5*) are dependent upon where actual oil and gas activities would occur. The location of land available for lease varies by alternative, but regardless of the alternative, and given the large size of most grazing allotments and the comparably smaller amount of predicted disturbance associated with oil and gas activities, the impact on permittees as far as a loss of AUMs/allotment would be negligible for all alternative. Impacts related to potential offset of recreation in leasing areas (*Measurement Indicator #6*) and cost per mile of road maintenance for federally-managed roads (*Measurement Indicator #7*) are discussed in other section of Chapter 4.

Alternatives A through E range from not allowing leasing on most of the Dixie National Forest to identifying most areas of the Forest available for lease subject to all laws under standard lease terms and conditions (SLT) (Alternative E). Depending on which alternative is selected with the exception of Alternative A, various communities could be affected by oil and gas exploration.. Under each action alternative all of the oil and gas activities predicted in the Reasonably Foreseeable Development Scenario could occur at some location within the Dixie National Forest. Communities next to areas with more restrictive leasing options (i.e., NA, NL, and NSO) may be the least likely to be affected by oil and gas activity, while those located in close proximity to lands assigned less restrictive leasing option (i.e., SLT, TL, and CSU) are most likely to experience impacts, both positive and negative. However, oil and gas activities could occur in areas of the Dixie National Forest that are remote from any community and thus, a community's proximity to an area assigned a less restrictive leasing option would not necessarily result in a community impact if oil and gas activity occurred remotely within that area.

4.12 Air Resources

4.12.1 Introduction

The context and intensity of the potential environmental effects of oil and gas operations on air resources do not require qualitative descriptions such as those discussed in Section 4.1 and Table 4.1-1 (with the exception of climate change). That is because the air quality impact modeling results, which comprise the bulk of the impact assessment for Air Resources, are quantitative estimates that are directly compared to applicable regulatory standards and require no additional qualitative descriptors attached to them. Unlike a regulatory evaluation for permitting a given facility design, when impacts are evaluated for compliance with the ambient air quality standards in the specific vicinity of the facility; the evaluation in this EIS discloses the potential impacts to air quality at different distances from a hypothetical, but representative, oil production facility, which could be located anywhere in the Forest.

Representative, known emission rates for oil exploration and production facilities were selected for air pollutant emissions in this analysis. Selection of these emission values were a collaborative effort of the Dixie and Fishlake National Forests, EPA (Region 8), and UDAQ. Air dispersion models, based on unit emissions, were developed to allow for interpolation of emissions. Air dispersion modeling runs using emissions from a typical operation (exploration or production) were performed to verify the accuracy and conservativeness of the unit emission tables. Further discussion of the analysis process is discussed in the Air Quality Modeling Report contained in Appendix SIR-1. Greenhouse gas emission factors used in the climate change discussion were taken from a variety of sources and are discussed in detail in Appendix SIR-2A.

Measurement Indicators

- *Measurement Indicator #1* CHANGE IN AIR QUALITY ABOVE AMBIENT CONDITIONS
- *Measurement Indicator #2* NAAQS EXCEEDANCES
- *Measurement Indicator #3* CHANGE IN VISIBILITY COMPARED TO NATURAL BACKGROUND CONDITIONS

- *Measurement Indicator #4* INCREASE IN GREENHOUSE GAS EMISSIONS

4.12.2 Impacts Common to All Action Alternatives

A CSU stipulation for Air Resources would be applied within 60 km of all Class I areas (i.e., Bryce Canyon National Park, Capital Reef National Park, Zion National Park, and the Grand Canyon). This CSU (CSU-29 in Appendix D) would cover about 96 percent of the Dixie National Forest and is intended meet or exceed guidance in the Federal Land Managers Air Guidance document (USFS et al. 2008). The CSU lists various design and mitigation measures beyond those in the Standard Lease Terms and Conditions that could be implemented to reduce impacts from connected actions on a lease. This is the only leasing option that applies directly to Air Resources.

In the following sections, the impacts of connected actions under the RFDS are discussed assuming no restriction or stipulations on oil and gas activities relative to air resources other than those listed on BLM Lease Form 3100-11 Standard Lease Terms and Conditions and the environmental protection measures that would be implemented by other laws and regulations as described in Section 1.8.5.2. Although the CSU applies to much of the Dixie National Forest under all alternatives, impacts will be discussed assuming no restrictions other than SLT because the CSU application is project-dependent.

Under any alternative, impacts to air resources would only result if oil field exploration and construction activities, oil field development, operating and maintenance activities, and sustainable production occur. The amount of dust generated by these activities would depend on the soil type, moisture conditions, dust control efforts, and the amount of traffic on dirt or gravel roads. Vehicle exhaust emissions would primarily depend on the amount of traffic. Impacts to air resources would be dependent on the distance from the potential activities and their elevations. Further discussion of the impacts is covered in the Air Quality Modeling Report (Appendix SIR-1).

There is the potential for oil and gas exploration and development activities to encounter hydrogen sulfide gas in the subsurface. Hydrogen sulfide can be a component of petroleum and natural gas in widely varying concentrations and exhibits a range of toxic effects to human health depending on its concentration in the atmosphere. Releases of significant amounts of hydrogen sulfide are minimized through precautions normally taken by industry personnel, but serious accidents can potentially cause significant impacts to human health for several thousand feet from the location of the release. When hydrogen sulfide is known to be present at a facility, warning signs are posted, special vents or incinerators are installed on equipment, contingency plans are prepared, and all workers at the facilities receive special training on dealing with accidental releases of the gas.

Criteria pollutants exist that could be released during oil and gas exploration and development activities that can contribute to acid rain impacts. The criteria pollutants sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are precursors to acid rain, which is a result of chemical changes in the atmosphere. Acid rain could affect the pH of the lakes and the vitality of the vegetation in each of the ranger districts. Also criteria pollutant emissions could have an impact on visibility and regional haze. Regional haze is caused by fine particles in the air (emitted directly or formed as secondary pollutants formed from NO_x and SO_2 emissions) that settle out very slowly. Increased criteria pollutant particulate emissions resulting from well field development could affect the visibility of the entire forest.

Carbon dioxide and methane emissions contribute to the carbon cycle, which may indirectly contribute to the effects of climate change described in Appendix SIR-2. Increases in GHG emissions are described in Section 4.12.2.5.

4.12.2.1 Construction and Exploration

The primary potential emissions resulting from exploratory drilling activities predicted in the RFDS are NO_x, SO_x, and VOCs from engine exhaust, product management, and tank breathing losses. Construction of the well pads will also result in measurable emissions of PM_{10} and $PM_{2.5}$ (see Table 4.12-1). Assuming that connected actions to leasing do occur, exploratory and construction impacts would be localized and short term. Impact analyses for VOCs require regional photochemical modeling. There is no practical technical approach for estimating VOC impacts from an individual project or small series of projects; this must be performed on a regional basis when cumulative regional development activity indicates enough emissions to justify it. For this reason, this analysis focuses on the impacts of criteria air pollutants. However, under the cumulative impacts section of this document an assessment of region VOC and ozone effects has been included utilizing existing regional modeling simulations.

Based on the UDAQ regulations and the Utah SIP, dust emissions cannot exceed 20 percent opacity, as verified by EPA Method 22 observations, at the leased property boundary. Emissions from predicted construction and exploration activities would not be expected to exceed Class I or Class II standards because of construction duration, low emission rates, existing good air quality, and dispersion. Additional BMPs for dust control might be needed when there is regular public access near the drilling site. With any industrial activity, owners and operators must comply with the Clean Air Act and the Utah Air Quality Regulations, which regulate both operations that cause air emissions and air emissions.

Table 4.12-1 Construction Emissions

Source Name	Pollutant	Emission Rate (g/sec)
Natural Gas Exploration Flare	CO	0.053200
	NO_x	0.009800
	$PM_{10}/PM_{2.5}$	0.000890
Well Pad Construction[1]	PM_{10}	4.946E-7
	$PM_{2.5}$	7.574E-8
Road[2]	PM_{10}	0.002380
	$PM_{2.5}$	0.000363

[1] Values include well pad construction, construction traffic, drilling traffic, and test and completion traffic.
[2] Values for roads, from Trinity Consultants (Trinity 2004)

Vehicle traffic volume estimates, which were used to derive road dust emission rates, were prepared consistent with the "Highway Freight Traffic Associated with Development of O&G Wells" document prepared in 2006 by Daniel Kuhn of the Utah Department of Transportation.

The evaluation of air resource impacts from the predicted exploration activities in the RFDS included the following activities:

- Construction of 5.5-acre drilling locations;
- A diesel fuel-fired drill rig engine with emissions based upon the 13.5 tons NO_x per well reported in the WRAP Oil and Gas Emission Inventory prepared in December 2005 by

Environ, and the 2005 Wyoming field survey from which that data was developed, with actual emissions adjusted downward to be compliant with recent tiered engine requirements, and SO_2 emissions consistent with AP-42 assuming the 0.15 percent sulfur content in diesel scheduled to be required during the operational phase;

  - The WRAP study indicated the mean drilling time is approximately 90 days per well continuously around the clock except for maintenance. Therefore, the longer term average impact predictions effectively assume four wells drilled back to back in relatively close proximity;

- Construction of 1.1 miles of new access roads;
- Support traffic to supply, maintain, and staff the drilling effort; and
- A low volume of flaring of natural gas during exploration, equal to 100 million standard cubic feet (Mscf) per year.

Impact analyses, under the assumption that all of the connected actions described in the RFDS would occur, were conducted for distances ranging from 0.25 to 200 km (124.3 miles) from the source and at seven receptor elevations that ranged from 2,500 feet above to 2,500 feet below the source. The highest receptor impacts occurred when the model receptors were at or near the same elevation as the source. Table 4.12-2 documents the maximum predicted criteria pollutants NO_2, SO_2, and $PM_{10}/PM_{2.5}$ concentrations ($\mu g/m^3$) as well as the maximum visibility impairment impacts at a variety of distances, for the scenario where the receptors were at the same elevation as the source. The tabulated impacts represent the maximum impact at the given distance for any of the elevation scenarios. For the impact assessment of primary $PM_{2.5}$ PM_{10} impacts were used as a conservative assessment given that primary $PM_{2.5}$ is a subset of primary PM_{10}.

Table 4.12-2 Exploration Drilling (Connected Actions) Impacts

Criteria Pollutant	Period	Class I	Class II	Concentrations ($\mu g/m^3$) at kilometers			
		Increment	Increment	1	5	10	20
SO_2	3-hour	25 $\mu g/m^3$	512 $\mu g/m^3$	0.16	0.05	0.02	0.01
	24-hour	5 $\mu g/m^3$	91 $\mu g/m^3$	0.07	0.02	0.01	0.00
	Annual	2 $\mu g/m^3$	20 $\mu g/m^3$	0.02	0.01	0.00	0.00
NO_2	Annual	2.5 $\mu g/m^3$	25 $\mu g/m^3$	10.1	3.39	1.63	0.77
PM_{10}	24-hour	8 $\mu g/m^3$	30 $\mu g/m^3$	12.4	2.77	1.20	0.53
	Annual	4 $\mu g/m^3$	17 $\mu g/m^3$	3.09	0.69	0.30	0.13
$PM_{2.5}$	24-hour	Undefined	Undefined	12.4	2.77	1.20	0.53
	Annual	Undefined	Undefined	3.09	0.69	0.30	0.13
AQRV	**Metric**	**Increment**	**Increment**	**1**	**5**	**10**	**20**
Deposition	NO_2 Dep	0.005	kg/hect/yr	0.356	0.0056	0.0022	0.0008
	SO_2 Dep	0.005	kg/hect/yr	0.0001	0.0000	0.0000	0.0000
Visibility [1]	Days $\Delta dv > 0.5$	Less than baseline	NA	6	2	2	1
	Days	Less than	NA	0	0	0	0

	Δdv >1.0	baseline					

Data is based on maximum impact values listed in Appendix A of the modeling report (Appendix SIR-1A).
[1] Visibility threshold: FLAG recommends that federal land managers report a change in light extinction (Δdv) impact of 10 percent, and consider requesting further analysis if change in light extinction (Δdv) reaches 5 percent with any regularity.

The modeling results shown in Table 4.12-2 indicate that emissions from predicted exploration activities would comply with the applicable NAAQS for Class II areas at all distances shown when combined with reasonable regional background values. The results also indicate there could be potential problems with compliance with incremental degradation limits for Class I areas for NO_2 out to between 5 and 10 km (3.1 - 6.2 miles).

As articulated in the FLAG document (USFS et al. 2008), Federal Land Managers (FLMs) have a responsibility to protect AQRVs, and in this respect, may consider whether emissions from a new or modified source may have an adverse impact on AQRVs and provide their comments to permitting authorities (States or EPA). Table 4.12-2 reports the necessary data to evaluate impacts on Visibility and Deposition AQRVs from connected actions to oil and gas leasing near Class I areas, in terms of the levels established in the FLAG Phase I Report (USFS et al. 2008). Section 4.12.2.5 discusses the results of the Visibility and Deposition data with regard to FLAG. Based on this information, all proponents of exploratory projects within 5km of a Class I area will be required to provide an additional AQRV analysis prior to project approval.

4.12.2.2 Production Field Development, Operating and Maintenance

The potential emissions resulting from oil field development activities predicted in the RFDS are NO_x, SO_2, and VOCs from the production facilities, and PM_{10} emissions from the operating and maintenance activities. The Air Quality Modeling Report developed generalized emissions from a 20-well oil field development scenario. Emission estimates in the Modeling Report were based on the equipment needed to support oil exploration and/or oil field development. Estimates in the report are conservative and utilized the following resources: Utah State Government's "Analysis of Emissions from O&G Wells in Utah", the O&G Emission Inventory Workbook for the Uinta Basin Study, information from existing oil field development on the Dixie and Fishlake National Forests, regional and national oil and gas field emission analyses, and EPA and industry emission factors to develop the emission estimates. Table 4.12-3 summarizes the emissions expected from a 20-well oil field in the Dixie National Forest. Note that these are estimates only and will vary depending on the actual location of the predicted oil field, the geology of the producing formations, the quantity of fossil fuel present, and the specific equipment necessary to extract the fossil fuel resources found at the site.

Table 4.12-3 Production Field Development Emissions

Source	$PM_{10}/PM_{2.5}$ (lb/hr)	NO_x (lb/hr)	SO_2 (lb/hr)
Drill Rig Engine	0.26	8.47	0.01
Exploration Flare	0.00	1.10	0.00
Compressors	0.04	2.20	0.00
Heater Treaters	0.07	0.95	0.01
Dehydration Units	0.01	0.10	0.00
Well Pumps	0.97	13.2	4.10
Production Flare	0.00	2.45	0.00
On-site Roads and Fugitives	1.00	0.20	0.00
Total	2.36	28.69	4.12

Assuming the connected actions predicted in the RFDS occur, the density of well fields, well field characteristics, and the success of development will be factors that determine impacts from connected actions to leasing. As stated above with any industrial activity, owners and operators must comply with the Clean Air Act and the Utah Air Quality Regulations, which regulate both operations that cause air emissions and air emissions. During the pre-construction stage of any proposed well field development, a site specific air analysis that includes refined air dispersion modeling would be required.

4.12.2.3 Sustainable Production

The potential emissions resulting from sustainable production fields predicted in the RFDS are primarily NO_x, SO_2, PM_{10}, $PM_{2.5}$, CO, and CO_2 resulting from oil and gas production, and ongoing oil field operating and maintenance activities. The emission estimates in Table 4.12-3 for the predicted production field development would also apply to sustained production. The impacts of specific pollutants are evaluated based on elevation and distance from the hypothetical production field. Impacts resulting from oil field development are further discussed in the Air Quality Specialist Report (13.0) and in the Modeling Report (Appendix SIR-1). A summary of the impact analysis is presented below. For the impact assessment of primary $PM_{2.5}$ PM_{10} impacts were used as a conservative assessment given that primary $PM_{2.5}$ is a subset of primary PM_{10}.

The modeling for the hypothetical production field included the following activities that affect air quality:

- Construction of twenty 5.5-acre drilling locations;
- One diesel fuel-fired drill rig engine with emissions based upon the 13.5 tons NO_x and 3.5 tons SO_2 per well reported in the WRAP Oil and Gas Emission Inventory prepared by Environ, and the 2005 Wyoming field survey from which that data was developed, with actual emissions adjusted downward to be compliant with recent tiered engine requirements;
    - The WRAP study indicated the mean drilling time is approximately 90 days per well, around the clock. Therefore, the longer-term average impact predictions effectively assume four wells drilled back to back in relatively close proximity;
- One exploratory flare, flaring off small quantities of gas;
- Total ground disturbance including new roads, well pads, central processing, and staging areas would be 270 acres;
- Support traffic to supply, maintain, and staff the drilling and pumping effort;
- Twenty 0.5 MMbtu/hr heater / treater separators, one at each well pad;
- Twenty diesel-powered, 100 HP well pumps to extract oil, one for each well; and
- One 0.5 MMbtu/hr dehydrator and one 500 HP compressor processing a low volume of natural gas at partial capacity.

Diesel-fired well pumps are assumed because the predicted development sites are expected to be remote from the electric power grid. Though a slight amount of natural gas production is included for conservatism, producible natural gas is not routinely expected and is not anticipated

in sufficient quantity to power the well pumps. If sufficient natural gas was found to fuel the well pumps, well pump emissions would be reduced.

Impact analyses, under the assumption that all of the connected actions described in the RFDS would occur, were conducted for distances ranging from 0.25 to 200 km (124.3 miles) from the source and at seven receptor elevations that ranged from 2,500 feet above to 2,500 feet below the source. The highest receptor impacts occurred when the model receptors were at or near the same elevation as the source. Table 4.12-4 documents the maximum predicted criteria pollutants NO_2, SO_2, and PM_{10} concentrations (µg/m^3) as well as the maximum visibility impairment impacts at a variety of distances, for the scenario where the receptors were at the same elevation as the source. The tabulated impacts represent the maximum impact at the given distance for any of the elevation scenarios.

Table 4.12-4 Sustainable Production (Connected Actions) Impacts

Criteria Pollutant	Period	Class I	Class II	Concentrations (µg/m^3) at kilometers			
		Increment	Increment	1	5	10	20
SO_2	3-hour	25 µg/m^3	512 µg/m^3	67.9	22.2	10.0	4.46
	24-hour	5 µg/m^3	91 µg/m^3	30.2	9.84	4.46	1.98
	Annual	2 µg/m^3	20 µg/m^3	7.55	2.46	1.11	0.50
NO_2	Annual	2.5 µg/m^3	25 µg/m^3	29.8	10.0	4.80	2.27
PM_{10}	24-hour	8 µg/m^3	30 µg/m^3	25.0	5.62	2.44	1.06
	Annual	4 µg/m^3	17 µg/m^3	6.25	1.40	0.61	0.27
$PM_{2.5}$	24-hour	Undefined	Undefined	25.0	5.62	2.44	1.06
	Annual	Undefined	Undefined	6.25	1.40	0.61	0.27
AQRV	**Metric**	**Increment**	**Increment**	**1**	**5**	**10**	**20**
Deposition	NO_2 Dep	0.005	kg/hect/yr	0.0774	0.0148	0.0059	0.0022
	SO_2 Dep	0.005	kg/hect/yr	0.0314	0.0055	0.0027	0.0011
Visibility [1]	Days Δdv >0.5	Less than baseline	NA	77	70	57	38
	Days Δdv >1.0	Less than baseline	NA	46	37	311	17

Data is based on maximum impact values listed in Appendix A of the modeling report (Appendix SIR-1A).
[1] Visibility threshold: FLAG recommends that federal land managers report a change in light extinction (Δdv) impact of 10 percent, and consider requesting further analysis if change in light extinction (Δdv) reaches 5 percent with any regularity.

Modeled emissions for the case where the receptors are at the same elevation as the source (Table 4.12-4) indicates potential compliance problems with the Class II increment only in the very near vicinity (about 1km or less) for NO_2. The modeling results indicate potential compliance problems with the Class I increment out to distances of approximately 10 km (6.2 miles) for SO_2; approximately 5 km (3.1 miles) for PM_{10}; and approximately 20 km (12.4 miles) for NO_2. Note that provincial background pollutant concentrations vary and need to be considered for all air dispersion modeling evaluations. Section 4.12.2.5 discusses the results of the Visibility and Deposition data with regard to FLAG.

The modeling also indicated that these emissions would be less if the receptors are lower than the source. This modeling indicated compliance with all increments for Class I areas within a distance of about 10 to 15 km (6.2 - 9.3 miles) and all Class II areas within about 2.5 to 5 km (1.6 - 3.1 miles) when the receptors are lower than the source.

The emission inventory for this analysis was conservative in that it assumed one new well was being drilled while the full field was operating, and also assumed that diesel-fired pumps were used at each well head. NO_2, SO_2, and visibility impacts would be decreased if either no well drilling occurred simultaneously with the operation of 20 wells, or if enough natural gas was recovered onsite to fuel the well pumps so that diesel-fired pumping would not be required. Further, NO_x, SO_2, and visibility impacts would be approximately 90 percent lower if electric power lines were built to power the oil production field and no fuel was needed to operate the well pumps.

4.12.2.4 Class I Cumulative Impact Analysis

If exploration drilling were to occur on the Forest, as predicted in the RFDS, the air quality modeling for a single exploration well shows the need to perform a cumulative air quality impact analysis in the future for criteria pollutants if Class I areas exist within 5 km (3.1 miles) of the drilling location.

If a production field were proposed on the Forest, the 20-well production scenario in the Air Model, using a set of reasonable assumptions, shows the need to perform a future cumulative impact analysis for criteria pollutants if Class I areas exist within 60 km (37.3 miles) of the production field.

As a result of the proposed impacts, Appendix C of the EIS provides lease stipulations that will compel development proponents to complete an additional air quality analysis for exploratory projects within 5km of any adjacent Class I area and for development projects within 60 km of an adjacent Class I area. Also, any project that will meet or exceed the total project emissions assumed within this EIS will be compelled to complete an additional air quality analysis.

4.12.2.5 Visibility and Deposition Analysis - FLAG

The visibility analyses showed that isolated exploratory wells were not likely to have any significant impact. Class I area deposition thresholds are met from 5 km (3.1 miles) out for SO_2 and from approximately 13 km (8.1 miles) out for NO_2. However, the development scenario could have visibility impacts potentially reaching the FLAG limit of 1 deciview out to 55 kilometers (34.1 miles) for the 20-well development scenario. Those analyses also indicate that the Federal Land Managers shall request a future cumulative visibility impact analysis for receptors out to 100 kilometers (62 miles) for the 20-well development scenario if it were to be built.

Similarly, FLAG-recommended deposition impact thresholds for Class I areas could be reached out to 45 km (27.9 miles) for the 20-well development scenario. Those estimates are driven by the assumption of diesel well pumps. If natural gas could be recovered in sufficient quantity to power the well pumps, the extent of potential visibility and deposition impacts would drop, probably by at least one third, mainly due to sulfur deposition. If electric power was available, emissions of pollutants affecting visibility impacts would be considerably lower than those used for the visibility impact analyses reported here. Comparably lower deposition impacts could be estimated using the screening tables (see Appendix SIR-1A).

As a result of the proposed impacts, Appendix C of the EIS provides lease stipulations that will notify development proponents about the need to complete an additional air quality analysis for exploratory projects within 5km of any adjacent Class I area and for development projects within 60km of an adjacent Class I area. Also, any project that will meet or exceed the total project emissions assumed within this EIS will be compelled to complete an additional air quality analysis.

4.12.2.6 Greenhouse Gas Emissions

Greenhouse gas emissions could increase if oil and gas activities on the Dixie National Forest occurred as predicted in the RFDS. Because there are no regulatory standards for comparison, these potential increases in greenhouse gases are compared to those at the state, national, and global scales. An increase in greenhouse gas emissions as a result of connected actions to leasing as predicted in the RFDS may also contribute to the global concentration of greenhouse gases that affect climate change.

If all oil and gas activities that are predicted in the RFDS do occur, these activities could emit greenhouse gases into the atmosphere. The specific oil and gas activities that could contribute to these emissions are listed below:

- Exploration drilling
- Production operations- drilling and pumping
- Transportation of crude oil from field to refinery
- Refining of crude oil into final product
- Transportation of final product to end user
- End use of product

Emissions from seismic exploration are not analyzed due to the relatively small contribution of these emissions to the total, and because seismic exploration could occur outside of the action alternatives. Including emissions from refining, transportation of refined product, and product end use is a conservative impact estimate because these emissions may occur regardless of the product source in order to satisfy current and future market conditions, and it could be argued that these actions are not necessarily related to oil and gas production on the Dixie National Forest.

Total emissions estimates for each predicted activity are summarized in Table 4.12-5. Emissions are reported in metric tons of Carbon Dioxide Equivalent (CO_{2e}) which is the standard unit of measure established by the EPA for GHG emissions. Non- CO_2 gases were converted to CO_{2e} by multiplying by the Global Warming Potential for each gas.

Table 4.12-5 Estimated Emissions for Connected Actions to Leasing (Metric Tons of Carbon Dioxide Equivalent)

Oil and Gas Activity	CO_{2e}
Exploration	9,993
Production	43,443
Transportation of Crude	2,161
Refining	21,019
Transportation of Refined	868
Product End Use (off-site)	268,312
TOTAL	**345,796**

As discussed in Appendix SIR-2, CO_2 emissions from predicted oil and gas activities on the Dixie National Forest (i.e., connected actions to leasing) could increase U.S. and world CO_2 emissions. At the national and global scales, this would be a negligible impact. On a state scale, CO_2 emissions from connected actions on the Dixie would constitute a minor increase over CO_2 emissions for Utah in 2007. It should also be noted that this GHG emission estimate for connected actions has included emissions from refining, transportation of refined product, and product end use. This is a conservative impact estimate because it could be argued that the emissions from the refinery and later activities are not connected actions to potential Dixie National Forest oil and gas production and may occur regardless of the product source in order to satisfy current and future market conditions.

Greenhouse gas emissions from potential oil and gas activities would incrementally contribute a relatively small amount to the total volume of greenhouse gases in the CEA (defined in Section 5.12.1) and consequently could be responsible for an increment of the predicted effects of climate change discussed in Appendix SIR-2. This incremental impact from connected actions to leasing on the Dixie National Forest would be negligible to minor and its duration would likely be long term. Climate change effects are global and cumulative in nature, thus the main discussion of climate change impacts with regard to air resources can be found under Cumulative Effects (Section 5.12.3).

4.12.2.7 Direct Ozone Impacts

The reasonably foreseeable development scenarios analyzed within this EIS document produce ozone precursor emissions that are extremely limited in scale. Additionally, impacts associated with atmospheric ozone are typically regional in nature and are related to the movement and aggregation of precursor emissions from multiple regional sources. As a result, the impacts associated with ozone will be addressed under the Cumulative Effects Section (5.12.3.1) of this document.

4.12.3 Impacts by Alternative

With the exception of Alternative A, estimated changes to ambient conditions (*Measurement Indicator #1*) and NAAQS exceedances (*Measurement Indicator #2*) would be the same under all alternatives. Changes in visibility (*Measurement Indicator #3*) compared to natural background conditions would be the same under all alternatives except Alternative A. Increases in GHG emissions (*Measurement Indicator #4*) would be the same for all alternatives, with the exception of Alternative A, because the action alternatives do not differ in terms of what activities are predicted under the RFDS.

Impacts by alternative are thus the same and as described in Section 4.12.2.

4.13 Unavoidable Adverse Impacts

Unavoidable adverse impacts are the residual adverse impacts that would remain after mitigation. The alternatives described in this EIS do not apply mitigation beyond what is provided by the BMPs described in Section 2.6 and the various leasing options (i.e., NSO, CSU, and TL). The impacts described for each resource are after taking these measures into account and no further mitigation would be applied to lessen any of the impacts described. As a result, the impacts described in this chapter represent the unavoidable adverse impacts. Additional mitigation may be developed during more site-specific NEPA analyses.

4.14 Relationship of Short-Term Uses and Long-Term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). This chapter provides the required disclosure of effects from oil and gas leasing activity projected to occur over the next 15 years by the Reasonably Foreseeable Development Scenario (RFDS, BLM 2007a). In general, short-term use is equated with exploration activities, including seismic exploration and exploratory drilling as described in the RFDS. Exploration activities have the greatest potential to impact long-term productivity if they: 1) result in the direct loss of wildlife habitat that is of substantial importance to a population, 2) result in large increases in erosion and sediment delivery to streams, or 3) remove vegetation that would not recover in the short term (i.e., mature forest).

With the exception of Alternative A, the amount of disturbance associated with exploration activities would be the same across all alternatives. This would include approximately 143 acres of disturbance on the Pine Valley Ranger District, 369 acres on the Cedar City Ranger District, and 452 acres on both the Powell and Escalante Ranger Districts (Table 2.2-2). As detailed in this chapter, the potential for impacts to long-term productivity are the least under Alternative B. Alternative B applies restrictive leasing options to many resources that would be particularly susceptible to losses in long-term productivity. In contrast, Alternative E does not apply restrictive leasing options and would result in the greatest impacts to long-term productivity. Alternatives C and D apply various leasing options to resources that may be susceptible to losses in long-term productivity, and they have varying impacts to short-term uses of the oil and gas resources on the Dixie National Forest.

4.15 Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of resources occurs if the commitment is permanent and cannot be changed once made. An irretrievable commitment of resources occurs when resources are used, consumed, destroyed, or degraded during oil and gas leasing activity and cannot be reused or recovered for the life of the activity (temporary) or beyond (permanent). Disturbance to the baseline natural conditions described in this chapter may be irretrievable for the duration of exploration or for the life of a production field. However, the disturbance may be reversible after the exploration or production is completed and the affected resources restored through reclamation. Commitments of resources that are irreversible are automatically irretrievable. Table 4.15-1 summarizes irreversible and irretrievable commitments of resources. The table does not consider alternatives as the disturbance predicted by the RFDS does not vary across alternatives, and although leasing options affect where the disturbance could occur, some disturbance is expected to occur to each resource regardless of alternative. The exception would be Alternative A, which does not authorize new oil and gas leases and would not have any irreversible or irretrievable commitments. For IRAs and suitable Wild and Scenic River segments, several of the alternatives would allow disturbance that may be irreversible to the characteristics of these areas, as discussed in Table 4.15-1.

Table 4.15-1 Irreversible and Irretrievable Commitments of Resources

Resource	Irreversible Commitment?	Irretrievable Commitment?[1]	Nature of Commitment
Visual Resources	No	Temporary	Oil and gas activities would alter the scenic value to the landscape. However, the scenic values of the affected areas would be regained over time with proper reclamation.
IRAs and WSRs	Yes (Alternatives D and E)[2] No (all other alternatives)	Temporary/Permanent[2]	Oil and Gas Activity within IRAs and within the corridor around suitable Wild and Scenic Rivers would impact roadless characteristics, wilderness attributes, and outstandingly remarkable values. Proper reclamation would restore these values. Impacts would be greater under Alternatives D and E for IRAs and Alternative E for suitable Wild and Scenic Rivers.
Recreation Resources	No	Temporary	Oil and gas activities would displace recreation use. Any recreation resource lost would be regained over time with proper reclamation.
Fish and Wildlife	No	Temporary	Oil and gas activities would displace species though direct disturbance and habitat loss. Habitat and species abundance would recover over time with proper reclamation.
Special Status Species	No	Temporary	Same as for Fish and Wildlife

Resource	Irreversible Commitment?	Irretrievable Commitment?[1]	Nature of Commitment
Water and Watershed Resources	Yes	Permanent	Oil and gas activity may fill wetlands, alter floodplains, and remove riparian vegetation. These impacts would be reversible for floodplains and riparian areas once these areas were restored. However, once the structure and function of a wetland is lost or altered, the same level of function cannot be fully restored, even with proper reclamation. Furthermore, changes to stream channel morphology may not recover, even with proper reclamation. As a result, the impacts to these resources would be a irreversible commitment of resources. Sediment related water quality impacts from construction in wetlands, floodplains, or riparian areas, or on upland areas susceptible to erosion would persist for the life of the development, but would return to baseline conditions following reclamation. Inadvertent impacts to lava fields over sensitive aquifers would recover over time once the source of impacts was removed.
Soils and Geologic Hazards	Yes	Permanent	Soil loss/displacement related to road, pipeline, and well pad construction would occur, particularly if these facilities are located in areas with steep slopes or high erosion potential. Physical disturbance of soils would result in a loss of productivity, a loss that would take centuries to naturally recover, even with proper reclamation. Impacts to cave resources (e.g., collapse or contamination) would also be an irreversible commitment of resources, as the cave could not be restored (particularly in the case of a collapse) through reclamation.
Vegetation	No	Temporary	Oil and gas activity would disturb and/or remove vegetation. Disturbance may include mature forest stands. Once mature forest stands are removed they are lost for the growing time of the tree species removed (greater than 100 years for some species). However, the loss would not be irreversible as mature stands can be reestablished. Introductions of non-native and invasive species would represent a loss in productivity of the vegetation communities affected, but would be reversible given proper eradication efforts.
Transportation	No	Temporary	Oil and gas activity would increase the use of the transportation system, but use would return to baseline levels following exploration or production.

Resource	Irreversible Commitment?	Irretrievable Commitment?[1]	Nature of Commitment
Socioeconomic Resources	No	Temporary	Oil and gas activity would increase jobs and income in the counties, while at the same time possible reducing recreation as a source of income. And changes income and jobs would return to some other level once oil and gas activities cease.
Air Resources	No	Temporary	Oil and gas activity would result in some minor degradation of air quality during construction and operation. Air quality would return to baseline conditions following construction and operation.

[1] Temporary indicates an irretrievable impact that would extend though exploration, production, and the time needed for reclamation. Permanent indicates duration would be in perpetuity and would be irreversible.
[2]. Under Alternative D and E with leasing allowed in IRAs (2001 Roadless Area Conservation Rule not in effect), road construction could occur in IRAs. Constructed roads could eventually be reclaimed and the roadless characteristics and wilderness attributes of an IRA restored. However, reclamation would take place over a long time span and the areas would not be able to be managed as IRAs in the foreseeable future, which would represent an irreversible commitment of this resource.

4.16 Compliance with Other Laws and Regulations

Oil and gas leasing as described in the various alternatives would be in compliance with all other applicable laws and regulations, except as described below.

4.16.1 2001 Roadless Area Conservation Rule

Alternative A, B, C, and Alternatives D1 and E1 with NSO applied under the dual analysis would meet the intent of the 2001 Roadless Area Conservation Rule. Alternatives D2 and E2 with leasing allowed in IRAs would allow road building and timber harvest in IRAs, which would not meet the intent of the 2001 Roadless Area Conservation Rule.

4.16.2 Executive Orders 11990, 11998, and Section 404 of the Clean Water Act

These laws require federal agencies to avoid the degradation of wetlands and floodplains. Section 404 of the Clean Water Act requires a permit for the discharge of fill in jurisdictional wetlands and prior to granting a permit the applicant must show that the wetland was avoided or impacts to the area minimized. If a permit were granted, the applicant would be required to mitigate the impacts.

4.16.3 Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

The Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act prohibits take of migratory birds and eagles. Oil and gas leasing with BMPs properly implemented, including appropriate surveys and mitigations (of the location) prior to disturbance, would prevent take of sensitive raptors and eagles. Take of migratory birds is to be avoided when feasible on USFS lands but some incidental, unintentional take is expected.

4.16.4 Clean Air Act

Any oil and gas development activities would have to comply with the Clean Air Act, the Utah air quality rules and regulations, as well as oil and gas specific US Environmental Protection Agency (EPA) regulations. A discussion of the permitting requirements is located in Section 3.12.4 of Chapter 3. There are currently several New Source Performance Standards (NSPS's) and National Emission Standards for Hazardous Air Pollutants (NESHAP's) that are directly

related to emission limits from oil and gas production facilities. In addition, it can be expected that there will be more regulations developed by EPA that control emissions from the oil and gas industry. As such, companies would have to comply with all existing and future state and federal air quality rules and regulations in order to construct and continue operation.

4.17 Forest Plan Consistency Determination

In general, the Land and Resource Management Plan (USFS 1986) was considered during the development of all alternatives. Under the action alternatives, the Land and Resource Management Plan would be amended to reflect the stipulations needed for resource protection. Only the management unit prescriptions for mineral management: oil, gas, and geothermal, are being amended. This decision does not affect forest-wide and management prescriptions for other resources. There is also no change to Forest Plan goals and objectives (FP pages IV-9, 7 – Minerals) or General Direction (FP IV-44) for minerals. A revised Forest Plan Appendix C will be provided in the decision. The revised Appendix C will incorporate the stipulations and maps from the selected alternative.

The Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements will be incorporated as Dixie National Forest-specific supplement in the Forest Service Handbook (FSH 2800 – Geology and Minerals).

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5.1 Introduction

Cumulative effects are the total effect, including direct and indirect effects, on a given resource resulting from the incremental impact of past, present, and reasonably foreseeable future actions. They can result from individually minor, but collectively significant actions taken over a period of time. Cumulative effects may arise from single or multiple actions and the effects may be additive or interactive. The net adverse effect of interactive actions may be less than the sum of the individual effects (countervailing) or the actions may interact to create a net adverse cumulative effect that is greater than the sum of the individual effects (synergistic). The magnitude and extent of the effect on a resource depends on whether the cumulative effects exceed the ability of a resource to function at a desired level (CEQ 1997).

5.1.1 Cumulative Effects Areas

In this Environmental Impact Statement (EIS), cumulative effects are evaluated in terms of each specific resource, ecosystem, and human community being impacted and, as a result, the boundaries of Cumulative Effects Areas (CEAs) vary by resource. The geographic layout of the Dixie National Forest, as well as public scoping input gathered for this EIS, provided the foundation for identifying CEAs. An attempt was also made for each resource to determine the extent to which the environmental effects could be reasonable detected and to include the geographic areas of resources that could be impacted by the environmental effects. However, for simplicity, ease of cumulative impact analysis, and in an attempt to avoid having only slightly different CEAs for some resources, CEA boundaries were left identical for the resources where is seemed reasonable and conservative to do so. In some cases, the CEA boundaries may be larger than absolutely required, but are still sized reasonably enough to prevent dilution of cumulative effects over large areas. Guidance from the Council on Environmental Quality (CEQ), “Considering Cumulative Effects” (CEQ 1997) was used in identifying both the CEA for each resource and the temporal boundaries of the analysis. The temporal boundary for all resources is 15 years, as this is the time period used in projections for the Reasonable Foreseeable Development Scenario (RFDS) (BLM 2007a). The CEA for each resource – and the rationale for its boundaries – is described in each resource subsection. Maps for each CEA are also included.

5.1.2 Past, Present, and Reasonably Foreseeable Future Actions

As the CEAs vary by resource, so do the list of past, present, and reasonable foreseeable future actions occurring within each CEA. However, at a minimum, all CEAs include the Dixie National Forest and for many CEAs, the Dixie National Forest makes up the majority or all of the CEA. As a result, the past, present, and reasonably foreseeable future actions on the Dixie National Forest have a proportionally greater focus in this analysis than off-Forest actions. As actions on the Dixie National Forest are common to all CEAs, they will be presented here and subsequent resource sections will refer back to this section for a discussion of these actions. This will help to avoid repetition between sections; however, as actions may affect resources in different ways, some discussion of these actions will also occur in each resource section. Additional actions on other land (primarily Bureau of Land Management (BLM)-administered, state, and private land) within the respective CEAs will be presented in the relevant sections. Furthermore, given the large size of the CEAs and the large number of individual actions within these areas, the discussion of actions will primarily focus on general land uses and management activity types. However, specific actions for which specific information is known will also be presented.

5.1.2.1 Dixie National Forest Management Activities

Much of the information used to summarize past, present, and future levels of management activities was taken from Dixie National Forest resource specialists and Specialist Reports for various projects on the Dixie National Forest, and Dixie National Forest annual Monitoring Reports through 2009. Information for future actions was obtained from the schedule of proposed actions (SOPA) for 2002 through 1st quarter of 2011, the Dixie National Forest website, the Dixie National Forest 5-year vegetation plan, the BLM Electronic Notification Bulletin Board (ENBB), and the State of Utah.

DEVELOPMENT AND POPULATION GROWTH

Population is increasing in southern Utah, particularly in Washington County and Iron County (see Section 3.11.4.1). Developments are occurring on private subdivisions within the Dixie National Forest boundary. The largest amount of private land within the boundary occurs on the Pine Valley Ranger District, on routes between Cedar City, Enterprise, and St. George; and on the Cedar City Ranger District, on routes between Panguitch, Hatch, Alton, Cedar City, Brian Head, and the numerous campgrounds and other recreation sites (e.g., Cedar Breaks National Monument, Brian Head ski resort, Panguitch Lake, and Navajo Lake). This type of development is expected to continue in the future. A relatively large future development is planned for private land around Panguitch Lake. The proposal would develop a resort, cabins, RV lots, and a boat marina.

FIRE

Historically, slow-moving ground fires and crown fires in old, dense timber played a major role in ecosystem processes on the Dixie National Forest. Historical fire cycles are thought to have constantly renewed the forest, creating a diverse mosaic-like forest landscape of mixed size and age classes. Historical fire levels likely averaged three percent per year, with up to six percent burning in active years (Bradley et al 1992, Barrett et al. 1997). One hundred and fifty years of fire suppression has created large mosaics of dense fuel loads in many areas, which has increased the frequency of large, severe fires. Large, severe fires remove vegetation, thus homogenizing landscapes, and increase the proportion of early succession (grasses and forbs) and nonnative invasive species such as cheatgrass (USFS 2006c). In addition to fire suppression, fuel loads are also the result of past management practices such as inadequate treatment of activity slash, lack of periodic disturbance resulting in higher levels of trees and fuel ladders, plant community succession from fire-resistant species to fire susceptible species (e.g., ponderosa pine to mixed conifer), exotic species introductions, and grazing practices. Beetle killed trees also contribute to the buildup of both ground fuel and ladder fuel, thus increasing the risk of dangerous and costly wildfires.

The largest fire season since 1970 was in 2002, in which 57,745 acres burned. The Sanford Fire in 2002 (Powell Ranger District) burned mainly sagebrush (41%), which is expected to reestablish in the short term by the existing seed bank, and mixed conifer (32%), which will be absent for the long term (USFS 2002). Aspen reproduction is thought to have been enhanced by the fire (USFS 2002). From 2004 to 2006 there has been a dramatic increase in the number of acres burned on the Pine Valley Ranger District within pinyon-juniper and mountain brush systems, which many have been brought on by the extensive levels of cheatgrass (Norton et al. 2004). Severe fires in the foreseeable future will remove vegetation and alter community composition by increasing the prevalence of early-succession species such as grasses, forbs, and aspen.

The use of prescribed fire and mechanical fuel treatments are also anticipated to increase over the next 5 to 10 years. From 2005 to 2009, an average of 4,347 acres has been burned by prescribed fires per year. The amount burned by prescribed fires will potentially increase to nearly 10,000 acres per year in the future. Most of the prescribed fires are small (average of 400 acres) and are low to moderate intensity. An increase in the number of prescribed fires and mechanical fuel treatments should ultimately lead to a decrease in the number of large, uncharacteristic fires.

LIVESTOCK GRAZING

Much of the CEA experienced intense overgrazing in the late 1800s and early 1900s prior to active management. Range conditions are generally better today than they were during the early 1900s (Kay 2002). Range vegetation trend studies were begun in 2004. According to monitoring reports: in 2004, localized heavy grazing occurred on the Pine Valley Ranger District, with nine of 14 study sites showing downward trends in composition and soil cover; in 2005, a downward trend was found at 52 of 65 sites; and in 2006, among three sites sampled a downward trend was found in two, both within the Pine Valley Ranger District on a burned area that had not yet recovered. In 2007, six of the 17 replicated upland range trend monitoring studies indicates a downward trend in vegetation condition, effective ground cover, and/or frequency of invasive species, and the other 11 sites demonstrated slightly upward trends (USFS 2008b). In 2008, ten of the 16 replicated monitoring studies indicated a downward trend in vegetation condition, effective ground cover, and/or frequency of invasive species, and the other six sites demonstrated stable or upward trends (USFS 2009a). According to AUM reports published annually, permitted AUMs on the Dixie National Forest have been relatively constant for the past five years. Grazing is expected to continue at current levels in the foreseeable future.

MINERALS ACTIVITY

Past oil and gas activity on the Dixie National Forest has been relatively low, with the Upper Valley Field being the only producing oil field. The Upper Valley Field is located on both the Dixie National Forest and on BLM-administered land. It is southwest of Escalante and consists of 19 wells. It was developed in 1964 and production is projected to continue into the future. In the past few years there has been a renewed interest in oil and gas on the Dixie National Forest. BLM records for oil and gas indicate that there are 54 authorized leases on the Dixie National Forest, with one pending lease. Five of these are located on the Cedar City, 40 on the Escalante, and 10 on the Powell Ranger Districts. In total, the 55 leases cover 13,454 acres. The Dixie National Forest is aware of many other oil and gas leases (including geothermal) on BLM lands adjacent to the forest, such as those just north of the Cedar City ranger district. Some of these leases fall within the CEAs for Recreation (5.4), Fish and Wildlife (5.5), MIS (5.6), Water and Watershed (5.7), and Transportation (5.10); refer to those sections for an overview.

Most mineral activity on the Dixie National Forest consists of the sale and free use of common mineral materials (e.g., sand, stone, gravel, pumice, cinders, and clay). The number of permits for mineral materials varies, and most of these permits are for existing gravel and cinder pits that have been in use for 30 to 40 years. Further, most of the operations are small and are often used for Forest and county projects. There is an increasing demand for mineral material sites and, as a result, the number of these sites will likely continue to increase. Other mineral activity (i.e., locatable minerals such as gold, silver, etc.) should be low due to a lack of such minerals on the Forest.

RECREATION

Overall, recreation on the Dixie National Forest has increased relative to past levels. A primary cause of the increase is the burgeoning populations in cities such as St. George and in Clark County (i.e., Las Vegas), Nevada. The areas of the Forest close to Interstate 15 (Pine Valley and Cedar City Ranger Districts) receive the largest amount of visitors from Clark County. Currently, most of the recreation on the Forest is centered on hiking (66 percent of visitors) and sightseeing (55 percent reported 'viewing natural features;' 43 percent reported 'viewing wildlife'; USFS 2010b).

In 2009, OHV use was reported by 5 percent of visitors and use of a designated OHV area was reported by 11.5 percent of visitors (USFS 2010b). Growth in demand for OHV use and other dispersed motorized recreation opportunities has increased on the Dixie, similar to other areas of the Western U.S. (USFS 2009c). The Dixie National Forest has completed a formal motorized route designation process that would eliminate off-trail or cross-country motorized travel (Motorized Travel Plan FEIS/ROD; USFS 2009c). The decision also makes moderate reductions in motorized route mileage across the Forest.

ROADS

There are approximately 2,700 miles of Forest Service Roads on the Dixie National Forest that are open to the public and approximately 1,000 miles of roads open to administrative uses (see Section 3.10, Transportation). The Motorized Travel Plan FEIS/ROD (USFS 2009c) reduces the amount of cross-country travel by OHVs and the mileage of "unauthorized" routes on the Dixie National Forest. Very few new roads are expected to be constructed in the future and the overall mileage of the entire system is expected to decrease from 2007 levels with additional projects designed to decommission unused roads. If the status of the 2001 Roadless Area Conservation Rule were changed due to judicial action, road construction could occur in IRAs at a rate similar to what is described above for the rest of the Dixie National Forest.

BARK BEETLE

Bark beetles (i.e., spruce beetle, mountain pine beetle, and Douglas-fir beetle) have been and continue to be the most notable cause of widespread tree mortality in the Intermountain Region for the past several decades. In the last 10 to 15 years, spruce beetle has caused up to 80 percent mortality on approximately 225,000 acres of Utah's National Forests (UDNR 2003). Many of the largest infestations in Utah are on the Dixie National Forest.

Insect and disease outbreaks are natural disturbances that have always shaped forests on the Dixie National Forest. Spruce beetle outbreaks are tied to (homogenous) stand density, (increased) tree age, lack of disturbance, climatic conditions, and triggers (e.g., drought, fire, and windthrow) that start the outbreak. During times of forest stress, particularly drought, forests are especially attractive to bark beetles because trees have less resin that ordinarily floods entrance holes and repels beetles (Hallion 2003). A lack of diverse forest structure also creates large, older stands, already under competition stress (for water and soil nutrients), and vulnerable to beetle outbreaks. For spruce greater than 10 inches dbh, mortality levels after an attack are often greater than 90 percent (Dymerski et al. 2001).

In the 1990s, spruce bark beetle populations grew to large landscape proportions in the Cedar City and Powell Ranger Districts. Spruce beetle infestation developed to large landscape proportions on the Escalante Ranger District by the early 2000s. Most of the mature and over-mature Engelmann spruce on the Cedar City Ranger District and parts of the Powell Ranger District was killed by 2004. Recent outbreaks have resulted in landscapes comprised of

thousands of dead trees (UDNR 2003) and the accumulation of downed woody debris. The historically spruce-dominated landscape on the Cedar City and Powell Ranger Districts is expected to revegetate initially to aspen (in the absence of excessive browsing) over the next century. Outbreaks are expected in the Pockets area of the Escalante Ranger District and mortality of most spruce greater that 10 inches dbh is expected.

TIMBER HARVEST

Historical logging, even-aged management, and historical fire suppression have created relatively dense, mid-succession, mixed conifer forests with relatively large accumulations of woody debris and fuel. In recent years, the number of acres harvested per year has generally decreased relative to historic levels as the emphasis of timber harvests has shifted from promoting wood growth (for production) to ecosystem health. Harvests such as clearcuts are rare; more frequent are commercial thinning treatments, salvage cuts, sanitation cuts, and thinning for stand improvement and to reduce susceptibility to bark beetle outbreaks. The levels of recent timber harvest have been variable and almost entirely in response to spruce beetle outbreaks. Timber harvests (mainly commercial thinning operations) were relatively high in 1998 (31,252 acres; 53% commercial thinning) and 1999 (20,280 acres; 94% commercial thinning). Annual harvest totals between 2000 and 2007 were only 2,657 acres on average and consisted mainly of sanitation cuts (61%), salvage cuts (19%), and improvement cuts (11%) in an attempt to create conditions favorable to tree regeneration and increased diversity in order to reduce the risk of severe outbreaks.

Spruce, fir, mixed conifer, and pine forests on the Dixie National Forest are relatively susceptible to fire, insects, and disease due to recent droughts (UDNR 2003) and past management, and are the focus areas of current timber management.

INVASIVE AND NON-NATIVE PLANTS

Invasive and nonnative plants, including noxious weeds, pose a new and serious threat to Utah's forests. In Utah, 350,000 new acres of infestations are added annually (UDNR 2003). Several species including knapweeds, leafy spurge, dyers woad, and thistles are spreading, reducing biological diversity, modifying wildlife habitats, altering fire and nutrient cycles, degrading soil structure, and damaging critical watersheds. Utah has 18 declared noxious weed species (Belliston et al. 2004) and another 14 species classified as new and invading.

There are over 1,800 acres of mapped weed infestations on the Dixie National Forest. In 2005, the Dixie National Forest reported 1,639 acres infested with invasive plants and treated 955 acres. The number of infested acres in 1998 was 930 acres, thus infestations are increasing. A few range areas in the Pine Valley Ranger District monitored by the Forest in 2006 indicated a downward trend in range condition due to cheatgrass invasion following fire (USFS 2006c). The trend of increased acres infested with invasive species is expected to continue on the Dixie National Forest. Weed treatments are scheduled for all four ranger districts but most will take place in the Pine Valley Ranger District over the next five years, as this is where most infestations have been reported. Yearly treatments planned in the foreseeable future (each year until 2011) include 46 acres on the Cedar City Ranger District, 7 acres on the Escalante Ranger District, at least 400-500 acres on the Pine Valley Ranger District, and 52 acres on the Powell Ranger District. About 700 acres of weeds have been treated on the Pine Valley Ranger District in each of the past four years.

VEGETATION CHANGES

Compared to historic conditions (late 1800s and early 1900s), most vegetation communities on the Dixie National Forest have changed in relative abundance. Grasslands and aspen communities have declined, having been replaced by dense coniferous forest in many areas (USFS 2006c). In general, late successional species (spruce-fir and pinyon-juniper) have invaded areas where early successional species (aspen, grass, forb, and sagebrush) once prevailed. Vegetation management on the Forest is currently attempting to reverse the trends of climax species encroachment.

WATER DIVERSIONS

Dams and other water diversions have resulted in changes to the quantity and timing of stream flow. For example, much of the water in streams coming off the Dixie National Forest is diverted and used for irrigation or municipal use; as this occurs, water quality deteriorates (BLM 2008a [Kanab Land and Resource Management Plan]) and in many cases streams are diverted to the point that water does not reach the major rivers (BLM 2008b [Richfield Land and Resource Management Plan]). Also, large dams alter hydrology by storing water for release during the irrigation season, for example, the Sevier River and its tributaries are regulated by storage reservoirs. Water demand is expected to increase due to increasing populations.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Dixie National Forest are listed below. Minor projects in the foreseeable future not listed below include routine maintenance, range projects, and minor ROW authorizations. Information on specific projects comes from the SOPA for 2002 through 3rd quarter of 2010, the Dixie National Forest website, the Dixie National Forest 5-year vegetation plan, and the State of Utah.

Table 5.1-1 Reasonably Foreseeable Future Actions on the Dixie National Forest

Project	Location	Description	Estimated Disturbance (if available)
Arial application of fire retardant	Forest-wide	The Forest Service proposes to continue the aerial application of fire retardant to fight fires on National Forest System lands, including the Dixie National Forest.	
Motorized Travel Planning	Forest-wide	Would designate identified routes open to motorized use. With designation of a motorized travel system, motorized cross-country travel would be prohibited. The Forest would remain open to other forms of cross-country travel such as hiking, horseback riding, cross-country skiing, and snowmobile use. FEIS ROD signed April 2009	Implementation is on-going and foreseeable
Cove Mountain Iron Ore Exploration Project	Pine Valley RD	Drilling and evaluation for iron ore deposits on mining claims. Located approximately 11 miles west of Central, Utah.	2 acres
Mt. Dutton Vegetation Management Project	Pine Valley RD	During the summer of 1998, several small spruce beetle mortality pockets were identified in the area of Pine Creek, Mt. Dutton, and Adams Head. These outbreaks tended to be isolated in areas previously not harvested. The project area is now infested by epidemic levels of spruce beetle. This has changed the live forest structure as the spruce beetle has killed nearly all the living mature spruce trees. These areas no longer have the number of live trees necessary to be classified as forested sites. The desired condition in these areas would be to establish a diverse mixture of conifer and aspen trees with at	870 acres 620 acres(2009) 200 acres (2010) 50 acres (2011)

Project	Location	Description	Estimated Disturbance (if available)
		least 150 live trees per acre. The project would include timber harvest, prescribed burns, reforestation, road reconstruction, and road decommissioning on 5,490 acres in the upper drainages of Hoodle Creek, Willow Spring Creek, Forest Creek, Pine Creek, and North Fork Deep Creek. Timber harvest would occur on approximately 870 acres, including approximately 620 acres in 2009, 200 acres in 2010, and 50 acres in 2011. Approximately 145 acres would occur in the Deer Creek IRA.	
Upper Santa Clara River Vegetation and Fuels Project	Pine Valley RD	The Project would treat vegetation in-and-around the Pine Valley Recreation Area on federal lands within the Dixie National Forest. This project entails vegetation treatments on approximately 1,662 acres of a 1,817-acre project area. There would be approximately 3.3 miles of temporary road construction, with 1.2 miles becoming part of system roads used to access existing campgrounds after Project completion. No activities will occur in any IRAs or within the Pine Valley Mountain Wilderness Area. Treatments will include a combination of timber harvest, thinning, brush removal, and prescribed burning. The purpose of the project is to modify the vegetation such that fuels will be reduced, wildland fire risk to private property and recreational facilities will be reduced, and forest health will be improved, while maintaining the vegetation esthetics of the Recreational Area. Pine Valley is included on the federal Register's list of Communities at Risk from wildfire. http://www.fs.fed.us/r4/fire/hfr/2009/upper_santa_clara_rvr.shtml	
Pine Valley Fuels Treatments	Pine Valley RD	Project involves the construction of fuel breaks around the communities of Pine Valley and Central. Approximately 516 acres were treated in 2003 and 2004. Future treatments include 217 acres in 2011.	217 acres (2011)
UNEV Pipeline	Pine Valley RD	Would install a petroleum pipeline from Salt Lake City to Las Vegas. The project would be located in the same ROW as the Kern River pipeline, which was last disturbed for another pipeline in 2003. Construction beginning 2010.	
Sigurd to Red Butte Powerline	Pine Valley RD	PacifiCorp, doing business as Rocky Mountain Power Company, has filed a ROW application seeking authorization to construct, operate, maintain, and decommission a 345 kV single-circuit overhead electric transmission line on Federal lands. The project would provide an additional 600 megawatts of reliable electrical capacity by 2014 to respond to anticipated load growth in Southwestern Utah. The proposed project begins at the existing Sigurd Substation near Richfield, Utah, and terminates at the existing Red Butte Substation near the town of Central, Utah. This analysis will also result in amending the SIO levels for several areas within the project area currently unassigned to either Low, Medium, High or Very High.	
New Harmony Irrigation Line	Pine Valley RD	The following are proposed for the project area: (1) Re-construct the point of diversion inlet structure. (2) Install approximately 5,300 feet of pipeline. a) Approximately 4,700 feet will be installed within Forest Road 30931. Approximately 600 feet will be installed within the existing irrigation ditch. (3) Provide 600 feet of temporary access for construction equipment from the end of Forest Road 30931 to the point of diversion construction site. (4) Construct a flow control sluice structure.	
Brian Head ATV Trail	Cedar City RD	This Project would involve new ATV trail construction to link the Brian Head community to the Markagunt ATV Trail System. Proposed trail is located southeast of Brian Head, Utah.	4 miles new ATV trail (2011)

Project	Location	Description	Estimated Disturbance (if available)
Duck Creek Fuels Treatment	Cedar City RD	The Project would treat approximately 13,700 acres on the Cedar City RD to reduce fuels, enhance fire-tolerant vegetation, and provide fuel breaks. The purpose of the fuels treatments is to reduce the risk of a large-scale high intensity wildfire from spreading to or from NFS lands, which may threaten or burn into public and private property and facilities within the Duck Creek area. In order to reduce this risk, surface, ladder, and crown fuels will be treated. Phase I of the Project treated 2,800 acres in 2007. Phase II will treat 600 acres in 2008 and Phase III 2,800 acres in 2008, 10,000+ acres in 2009, 5,000 acres 2010, and 1,500+ acres in 2011.	Phase I 2,800 acres (2007), Phase II 600 acres (2008), Phase III 2,800 acres (2008), 10,000+ acres (2009), 5,000 acres (2010), 1,500+ acres (2011)
Edward Spring Vegetation Treatment	Cedar City RD	Vegetation removal and increase in early succession grassland and aspen habitat.	1,108 acres
Harris Flat ATV Access Trail	Cedar City RD	The Project would involve new ATV trail construction to provide access from private lands to National Forest roads and trials. Located approximately 6 miles east of Duck Creek Village, Utah.	0.4 miles (2011)
Midway-Deer Valley Scenery Enhancement & Veg Treatment	Cedar City RD	The proposal is to accelerate improved visual quality along a scenic highway (Utah Highway 14). This will be done by treating dead vegetation in the Midway-Deer Valley area along State Highway 14, sixteen miles east of Cedar City, Cedar City Ranger District. The Project would remove dead vegetation and decadent aspen, including the salvage logging of dead spruce. The project would also include the construction of 3.8 miles of temporary roads and the prescribed burning of riparian meadows. Approximately 1,200 acres would be treated over the next three years: 600 acres in 2008, 400 acres in 2009, and 200 acres in 2010. The revenues generated from treatments will be used to accomplish ancillary activities associated with stewardship projects in recreation, vegetation, and wildlife habitat	1,200 acres 600 400 200
Little Creek-Red Creek Vegetation Treatment	Cedar City RD	Vegetation treatments, including mechanical and prescribed fire, to reduce forest fuels, regenerate aspen and sagebrush, thin conifer timber and reduce pinyon-juniper encroachment. Located approximately 9 miles east of Parowan, Utah.	9,281 acres (2011)
Navajo Basin Forest and Scenic Recovery	Cedar City RD	Salvage harvest of dead and dying Douglas-fir and other conifers. Regeneration of aspen and conifer reforestation. Located approximately 25 miles east of Cedar City, Utah.	4,737 acres (2011)
Red Desert Vegetation Treatment	Cedar City RD	This Project would involve vegetation treatments, including prescribed burning, to regenerate aspen. Located approximately 24 miles east of Cedar City, Utah.	2,225 acres (2011)
Tippets Salvage	Cedar City RD	Salvage dead and dying conifer. Located approximately 25 miles east of Cedar City, Utah.	250 acres (2011)
Cedar Mountain Winter Recreation Master Plan	Cedar City RD	Project would create new snowmobile and cross country skiing parking areas, as well as toilets along Highway 14. Expected implementation is 2011.	
Uinta Flat Dispersed Camping EA	Cedar City RD	Designation of up to 39 dispersed campsites by hardening and delineating. Located 4 miles east of Duck Creek Village, Utah.	9 acres (2011); no disturbance outside of existing campsites
Paunsaugunt Vegetation EA	Powell RD	Project would treat aspen stands to increase aspen regeneration, reduce conifer encroachment, and develop multi-aged aspen stands. Located south of Tropic Reservoir near the junction of Upper Kanab Creek and East Fork Sevier River	2,218 acres (2012)

Project	Location	Description	Estimated Disturbance (if available)
John's Valley Vegetation Project	Powell RD	Project would treat decadent sagebrush, pinyon, and juniper in an effort to rejuvenate the sage steppe community. Located in John's Valley on the East side of Mt. Dutton.	2,000 acres (2012)
Pink Cliffs Communication Site	Powell RD	Provide communications for Kane County and State of Utah Emergency Medical Services. Expected implementation is 2010.	3 acres
Tropic to Hatch 138kV Transmission Line	Powell RD	Construction of upgraded transmission line from Tropic, UT to Hatch, UT. EIS complete	31 miles transmission line 100 ft ROW to be constructed 2012
Bridge Fire Salvage and Restoration Project	Powell RD	Proposal is to salvage fire-killed or beetle-damaged timber, and to reforest within harvested area and to mitigate safety concerns from hazard trees along existing roads and dispersed camp sites. Located approximately 20 miles southeast of Panguitch, Utah, adjacent to Tropic Reservoir. Expected implementation is 2011.	711 acres
East Fork Boulder Creek Native Trout Restoration Project	Escalante RD	All fish would be removed from a section of Boulder Creek to prepare it for introduction of Colorado River cutthroat trout. This would involve chemical treatment with the fish toxicant rotenone, which would completely eradicate nonnative trout from the East Fork of Boulder Creek and a short segment of Boulder Creek. Located approximately 10 miles northwest of Boulder, Utah, within east fork of Boulder Creek drainage. The total treatment area would be as follows: 1) approximately 7.8 miles of East Fork Boulder Creek from the natural barrier (below headwater meadow) on the East Fork to its confluence with the West Fork Boulder Creek; 2) approximately 0.2 miles of lower West Fork of Boulder Creek from a previously constructed barrier to its confluence with East Fork Boulder Creek; 3) approximately 0.5 miles of Boulder Creek from the confluence of the East and West Forks of Boulder Creek downstream to a previously constructed fish barrier; 4) all seeps and springs flowing into those sections of streams proposed for fish removal; and 5) the Garkane Energy water transfer pipeline between the West Fork Reservoir and King's Pasture Reservoir ; Kings Pasture Reservoir; a pond on private property in King's Pasture, and the Garkane Energy penstock, between King's Pasture Reservoir and the Garkane Energy Boulder Creek Hydroelectric Power Plant.	8.5 miles of stream + seeps, springs, and reservoirs (2011)
Iron Springs Improvement and Salvage Project	Escalante RD	Commercial and non-commercial thinning to reduce stand densities, provide for more balanced age-class distribution and perpetuate aspen presences within the spruce-fir dominated forest. Located approximately 15 miles northwest of Escalante, Utah.	484 acres of salvage
Pretty Tree Bench Fire Treatments	Escalante RD	Project is to provide prescribed fire to create healthier vegetation conditions, enhance elk and deer winter range, reduce fuels, create a younger stand structure, and reduce stand densities within pinyon-juniper stands.	Approximately 12,000 acres over 8 years
Road Draw Salvage and Reforestation Project	Escalante RD	Salvage fire-killed or damaged timber within the 118-acre burn area. Located approximately 7 miles northwest of Boulder Utah along FR 166 (west of Highway 12).	82 acres

Project	Location	Description	Estimated Disturbance (if available)
Stump Springs Fire Treatments	Escalante RD	Project uses prescribed fire treatments to disturb vegetation, slowly moving heterogeneous patches towards a fine-grained landscape that is more resistant and resilient to fire and other disturbance.	Approximately 5,400 acres over 9 years
Dipping Vat Habitat Improvement Project	Escalante RD	Project would include the thinning of pine forests and the mechanical treatment of sagebrush for habitat improvement and fuels reduction in Johns Valley, approximately 7 miles north of Tropic. The Project would affect approximately 1,132 acres.	1,132 acres (2010)
McGath Lake Dam	Escalante RD	The McGath Lake Dam is deteriorating and in need of repair. Without action the dam is likely to fail and destroy an important fishery. McGath Lake is located approximately 16 miles north of Escalante. The Project is awaiting cooperative agreements.	
Pockets Vegetation Management	Escalante RD	The Project is designed to reduce bark beetle risk and improve habitat for northern goshawk. It would include commercial timber harvest, pre-commercial stand treatment, fencing, and travel management. Of 26 miles of existing road, 8.5 miles will be open to the public, 5 miles will be open as motorized trail only, 5 miles will be used for administrative purposes only, and 7.5 miles will be decommissioned.	2,233 acres conifer and 770 acres aspen would be treated
Toad Salvage	Escalante RD	Salvage of dead and dying ponderosa pine within the perimeter of a Wildland Fire Use burn area. September 2007, 1400 acres burned.	230 acres (2010)
Sawmill Point/Baldy Ridge Aspen Improvement	Escalante RD	Commercial aspen cleaning (121 acres), non-commercial cleaning (708 acres) and regeneration (65 acres); 0.7 miles temporary road construction.	894 acres (2011)

[1] Most of the project would occur on the Fremont River Ranger District administered by the Fishlake National Forest.

5.2 Visual Resources

5.2.1 Description of Cumulative Effects Area

The Cumulative Effects Area (CEA) for Visual Resources would include the entire Dixie National Forest including all of Cedar Breaks National Monument. In addition, the CEA would include all of Bryce Canyon National Park, a 1-mile buffer along the boundary between the Escalante and Fremont River Ranger Districts, a 1-mile buffer along the boundary between the Escalante Ranger District and the Grand Staircase-Escalante National Monument, and all area in between the Powell and Escalante Ranger Districts (Figure 5.2-1). The CEA is 2,037,882 acres (Table 5.2-1).

Table 5.2-1 Land Status within the Cumulative Effects Area

Land Management	Acres	Percent of Total CEA
Bureau of Land Management (BLM)	83,444	4
National Park Service	41,973	2
Private	109,777	6
State Lands	54,089	3
Forest Service	1,661,365	81
Forest Service Wilderness Areas[1]	85,323	4
Water	1,912	<1
Total	**2,037,882**	**100**

[1] Includes the Pine Valley Mountain, Ashdown Gorge, and Box-Death Hollow Wilderness Areas

5.2.1.1 Rationale

Cumulative effects of activities and actions within the Dixie National Forest may affect visitors to the Dixie National Forest as well as visitors to National Parks, National Monuments, and other National Forests with viewsheds that include Dixie National Forest lands. Oil and gas leasing activity possible on the Fishlake Forest or on state administered lands may compound visual effects of any potential oil and gas leasing activity on the fringes of the Dixie National Forest in these areas. The area in between the Powell and Escalante Ranger Districts was included as it is in close proximity to Dixie National Forest land and may also affect views from scenic Forest roads or wilderness areas. Activities outside the Forest may affect views from scenic Forest roads or wilderness areas.

5.2.2 Past, Present, and Reasonably Foreseeable Future Actions

Visual resources of the Dixie National Forest can be affected by any activities that change vegetation patterns or add man-made features to the Forest, or to areas beyond the Forest boundary, within Forest viewsheds. Natural events, such as wildfire or insect infestations may also impact the scenic resources of the Forest. In addition, the amount of casual use and recreation on Forest lands may affect the scenic experience. Past and present management activities continue to impact visual resources to some extent by altering vegetation communities. Development within and outside the Forest boundaries may affect scenic views.

General information on the past, present, and future levels of each type of activity for the Dixie National Forest is presented in Section 5.1.2.1. As a result, the information presented for these management activities in this section is relevant only to visual resources, information not

included in the general discussion in Section 5.1.2.1. Also any additional information relevant to other portions of the CEA (BLM-administered land, state land, and private land) is included.

DEVELOPMENT AND POPULATION GROWTH

As described in Section 5.1.2.1, population is increasing in southern Utah, with increased development on private land. With development is temporary land disturbance, landscape change, and increased use of produced light. Also, developments within and adjacent to the Forest remove vegetation permanently and increase the extent of urban-wildland interface which must be managed more intensely for fuels (e.g., Duck Creek and Pine Valley Fuels Treatments; see Table 5.1-1).

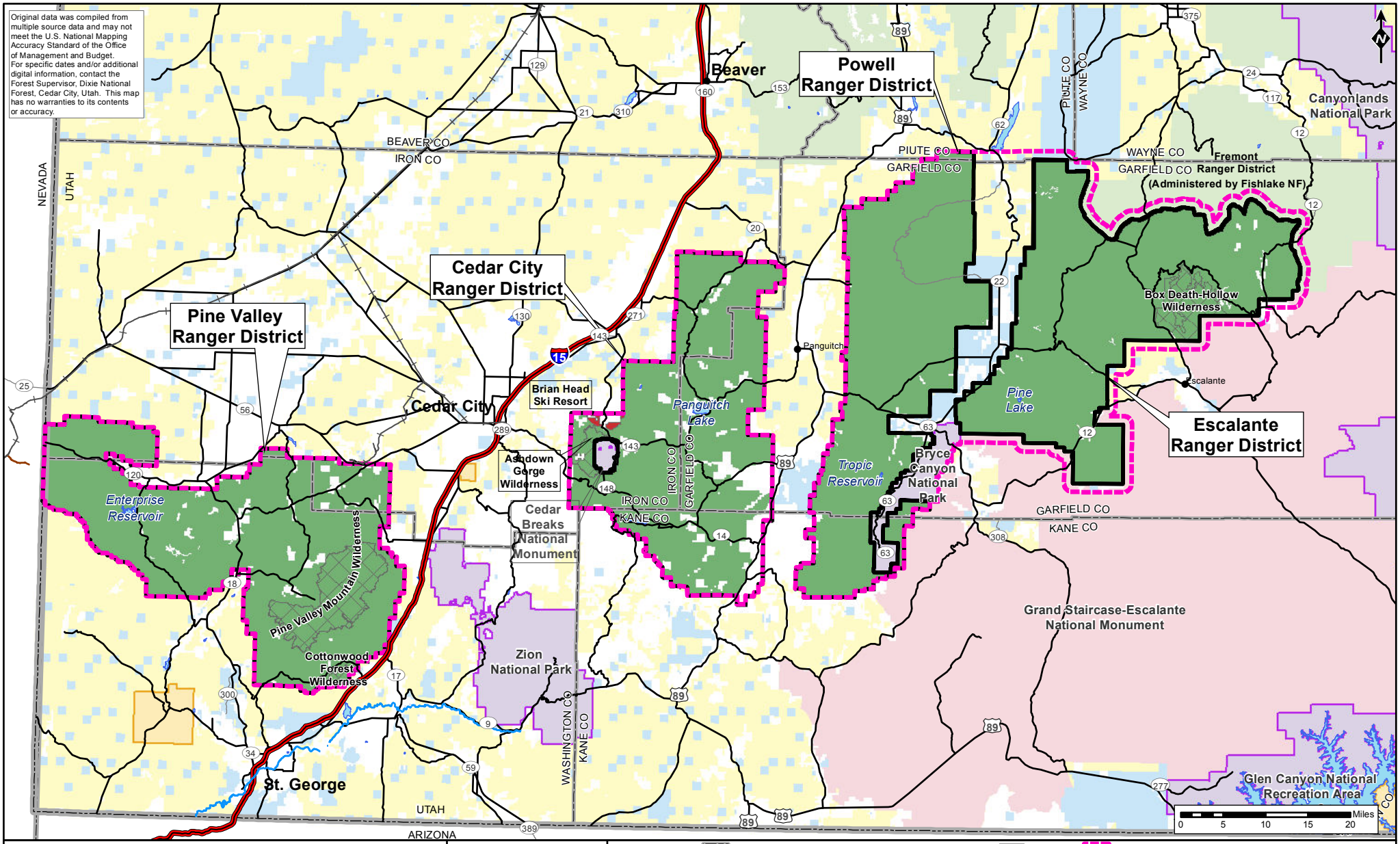
There are 109,777 acres of private land in the CEA (six percent). Of that, nearly 10 percent (10,752 acres) is within municipalities (Bryce Canyon City, Brian Head Town, Boulder, Enterprise, and Antimony). The majority of private land in the CEA outside of the Forest boundaries is within Garfield County. The Garfield County Planner indicated that the primary use of private land within the county is agriculture (outside of the municipalities). After agriculture, the primary industry is tourism. Accordingly, most development in the county consists of small subdivisions (second homes and recreational residences). Many of the subdivisions are single-lot splits, where a landowner splits a larger lot into 2-10 smaller lots. There are only 3-4 subdivisions planned that are larger, with over 50 lots. However, most of the subdivisions (both large and small) have not yet been developed. None of these subdivisions are of the large "resort" type and usually consist of dirt roads and single wells. There is also a RV park planned near Panguitch Lake (see Table 5.1-1), and a fair amount of development on private land around Panguitch Lake.

Population and development increases have brought higher levels of night lighting in proximity to National Parks and other areas where visitors seek solitude and the beauty of the night sky. Artificial light is 'practically nonexistent' in Bryce Canyon National Park such that the beauty of the night sky appears to be amplified (NPS 1987). Regarding development within the Grand Staircase National Monument, it is noted: "Few places are as dark as south-central Utah. It is one of the darkest spots on NASA's satellite image of the United States at night. As such, the BLM would not propose actions within the Monument that would contribute to light pollution, and would be proactive in preventing light pollution within the Monument. The BLM would also work closely with the surrounding communities to minimize light pollution (BLM 1999a)."

RECREATION AND MAINTENANCE

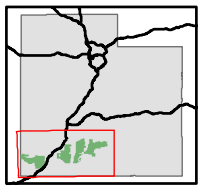
The increase in recreational use of the Dixie National Forest, including OHV use, is described in Section 5.1.2.1.

Maintenance of recreation facilities including trails can prevent visual degradation of landscapes. In Bryce Canyon National Park, there are three projects that have either recently been implemented, or are to be implemented in the near future. The Paria View Rehabilitation Project will rehabilitate walkways and railings at a scenic viewpoint. The Mossy Trail Rehabilitation Project will rehabilitate a trail that was washed out by a flood event, and will include installation of a viewing platform to reduce visitor impacts to the cave. The Tropic Canyon Highway Rehabilitation Project will fix a bridge damaged by flood events. These projects are expected to have minor, temporary, localized impacts, with beneficial effects for visitors to Bryce Canyon National Park.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest
FIGURE 5.2-1
Cumulative Effects Area
Dixie National Forest Boundary & Visual Impacts

1 in = 15 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Major Roads
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Includes Dixie National Forest Boundary, Bryce Canyon National Park, Cedar Breaks National Monument, area between Escalante & Powell Ranger Districts, and a 1-mile buffer of Escalante Ranger District.

The BLM's Richfield Field Office administers the BLM land around and to the south of Antimony, in between the Escalante and Powell Ranger Districts. Most of this area is Visual Class IV (Low SIO) which allows major modification. There are some Class III (Moderate SIO) areas along the western boundary of the Escalante Ranger District. Most of the area is open to cross-country motorized travel, except for roads up Pole Canyon, Pine Creek, Deep Creek, and Deer Creek (these are all canyons coming off the east side of the Powell Ranger District). The vegetation is mostly pinyon-juniper woodlands and is managed for livestock grazing.

FIRE

The past, present, and future levels of fire on the Dixie National Forest are discussed in Section 5.1.2.1. In the short term, fire can diminish the visual quality of the landscape, thus making some areas undesirable for viewing scenery and wildlife, and dispersed camping.

MINERALS ACTIVITY AND ENERGY DEVELOPMENT

Regarding existing oil and gas leases within the CEA, BLM data indicates that there are 55 authorized leases and one pending lease. In total, these leases cover 26,670 acres. Other than the Upper Valley Field, however, none of these leases are active.

Mineral leases in the Grand Staircase-Escalante National Monument include 18 federal coal leases encompassing nearly 53,000 acres, and 85 federal oil and gas leases encompassing about 136,000 acres. Estimates for disturbance related to development of valid existing mineral rights in the Grand Staircase-Escalante National Monument were not included in the FEIS for the management plan because of insufficient information on potential for discovery and extent of development (BLM 1999a). Existing BLM data indicates there are no pending leases on the portion of the Grand Staircase-Escalante National Monument included within the CEA. Development of wind energy in the Grand Staircase-Escalante National Monument is not allowed.

Within the BLM's Richfield District portion of the CEA, there are some oil and gas leases along the western edge of the Escalante Ranger District. However, the area has low development potential for oil and gas (BLM 2008b). It predicts an average of three wells per year (in an area that includes much more than the area between the two ranger districts) for the next 15 years. Estimated disturbance is 12 acres per well. The area is considered low potential for wind energy development, according to the programmatic EIS prepared for wind energy on all BLM land (BLM 2005).

Impacts to forest visual resources could occur as a result of the development of minerals on adjacent private land. Oil and gas activity on private lands near the forest is not required to meet the Forest's Land and Resource Management Plan standards for visual resources.

TIMBER HARVEST, BARK BEETLE OUTBREAKS, AND VEGETATION MANAGEMENT

These activities are described in Section 5.1.2.1.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

All of the above types of activities and development are expected to continue to some degree on the Forest and within the CEA. Project in the official planning stage on the Forest are listed in Table 5.1-1. The impacts to visual resources from these projects would be the same as already described. Regarding the Motorized Travel Management Project, it is anticipated that it will restrict motorized use to specific trails and will largely eliminate off-trail or cross-country motorized travel. This should reduce some of the impacts of recreation on visual resources. In

addition to the vegetation management projects listed in Table 5.1-1, vegetation restoration treatment of approximately 20,000 acres is also planned in the adjacent Grand Staircase-Escalante National Monument (BLM 1999a); however, the specific treatment areas are not disclosed.

Maintenance of recreation facilities is planned to continue within Cedar Breaks National Monument, and Grand Staircase-Escalante National Monument. In addition, the FEIS for the Management Plan for the Grand Staircase–Escalante National Monument (BLM 1999a) predicts several "Reasonably Foreseeable Actions," including communication sites, utility rights-of-way, road rights-of-way, and water developments.

Much of the 1-mile buffer in the CEA that includes Grand Staircase-Escalante National Monument is within zones designated as "primitive or outback." Activities that would impact visual resources such as rights-of-way would not be permitted in primitive zones, and communication sites would only be allowed for safety purposes. In the outback zones, communication sites and utility sites would only be allowed if no other reasonable location exists. Where they are allowed, new utility lines would be buried if possible, power lines would be non-reflective, and towers would be galvanized steel or wood.

In the portion of the CEA that occurs on lands administered by the BLM's Richfield Field Office, there is minor activity planned, including a few range projects, some work on the Piute Trail, and perhaps a few small ROW applications.

5.2.3 Cumulative Effects by Alternative

Generally, activities within the Forest or within BLM-administered lands are guided by the restrictions in place to maintain scenic resources. Cumulative impacts to visual resources of the Dixie National Forest would be likely to occur with extensive development of communities, industry, or natural disasters, within the viewsheds of the most highly utilized and appreciated scenic viewpoints. Other than natural disasters, which cannot be reliably predicted, other forms of extensive development are not included in the plans described above for areas adjacent to the Forest boundary. Based on this, the potential for cumulative effects to visual resources is minor, unless Forest Plan objectives are changed and activities are allowed to develop in scenic areas that are currently protected. In regard to the dark sky aspect of visual resources, although light pollution can be accurately measured, the cumulative effects of even minor development on the dark sky resources of the CEA are more difficult to assess, and extend far beyond the surface boundaries of the defined CEA.

5.2.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.2.3.2 Alternative B

Under Alternative B, the potential for cumulative effects to visual resources of the Dixie National Forest would be negligible to minor. The greatest potential for cumulative effects would be in Moderate SIO areas leased and developed under CSU-02, and High SIO areas that are adjacent to, or within view of private property developments or facility/resource development on non-Forest lands where compliance with scenic objectives is not required.

5.2.3.3 Alternative C

This alternative places a large portion of the Dixie National Forest into the NSO leasing option. Visual resources are protected under NSO. The potential for cumulative effects to visual resources would be greatest in Moderate SIO areas where development of oil and gas, in addition to any other development or vegetative management conditions, occur in the foreground or middleground views. Cumulative impacts to visual resources may occur in these areas if they have been impacted by and not recovered from past disturbance or if they are impacted by future management, development, and vegetation trends.

5.2.3.4 Alternative D1 (NSO in IRAs)

The scenic resources of IRAs would be protected under NSO under this Alternative. However, the scenic resources in High SIO areas of the Forest would not be adequately protected by a CSU leasing option assigned to this SIO under this alternative; this includes 57 percent of the High SIO lands. In these areas, there could be cumulative impacts to visual resources if exploration and development occur in concentrated areas and if such development occurs adjacent to, or within view of private property development or facility/resource development on non-Forest land where compliance with scenic objectives is not required. This scenario for cumulative effects is possible, but not likely to occur based upon the limited list of proposed developments on non-Forest lands.

5.2.3.5 Alternative D2 (CSU in IRAs)

Under this alternative the potential for cumulative impacts to visual resources would increase with IRAs available for leasing under CSU-04. For High SIO lands, the percentage increases from 57 to 83 percent of High SIO lands that would be inadequately protected. The amount of Moderate SIO areas under either CSU or SLT increases from 65 percent to about 91 percent of the Moderate SIO areas of the Forest. Accordingly, the potential for cumulative effects increases with the increased acreage available for leasing in categories that may not adequately protect visual resources, and with the associated increase in potential for adjacent lands being private or non-Forest lands and not subject to compliance with scenic objectives. This scenario for cumulative effects is possible, but not likely to occur based upon the limited list of proposed developments on non-Forest lands.

5.2.3.6 Alternative E1 (NSO in IRAs)

Under this alternative, cumulative effects to visual resources would be more likely than under Alternative D because more lands are available for leasing under less restrictive options. Accordingly, the potential for cumulative effects increases with the increased acreage available for leasing in categories that may not adequately protect visual resources, and with the associated increase in potential for adjacent lands being private or non-Forest lands and not subject to compliance with scenic objectives.

5.2.3.7 Alternative E2 (SLT in IRAs)

The potential for cumulative impacts to visual resources under this alternative is greater than under Alternative E with No Surface Occupancy in IRAs, since additional lands in IRAs are included as lands available under SLT.

5.3 Inventoried Roadless Areas, Unroaded and Undeveloped Areas, and Suitable Wild and Scenic Rivers

5.3.1 Description of Cumulative Effects Area

The CEA for IRAs, Unroaded-Undeveloped Areas (as defined in the Dixie National Forest's 2005 Inventory of Unroaded-Undeveloped Areas), and suitable Wild and Scenic Rivers is the Dixie National Forest boundary plus the outermost boundary of the Boulder Mountain/Boulder Top/Deer Lake and the Long Neck Mesa/Steep Creek/Oak Creek-Steep Creek/Oak Creek IRAs on the Dixie National Forest portion of the Fremont River Ranger District administered by the Fishlake National Forest (Figure 5.3-1). The outermost boundary incorporates all existing roads and other areas that were cherry stemmed out or excluded from these IRAs. The CEA is 1,936,223 acres (Table 5.3-1).

Table 5.3-1 Land Ownership within the Cumulative Effects Area

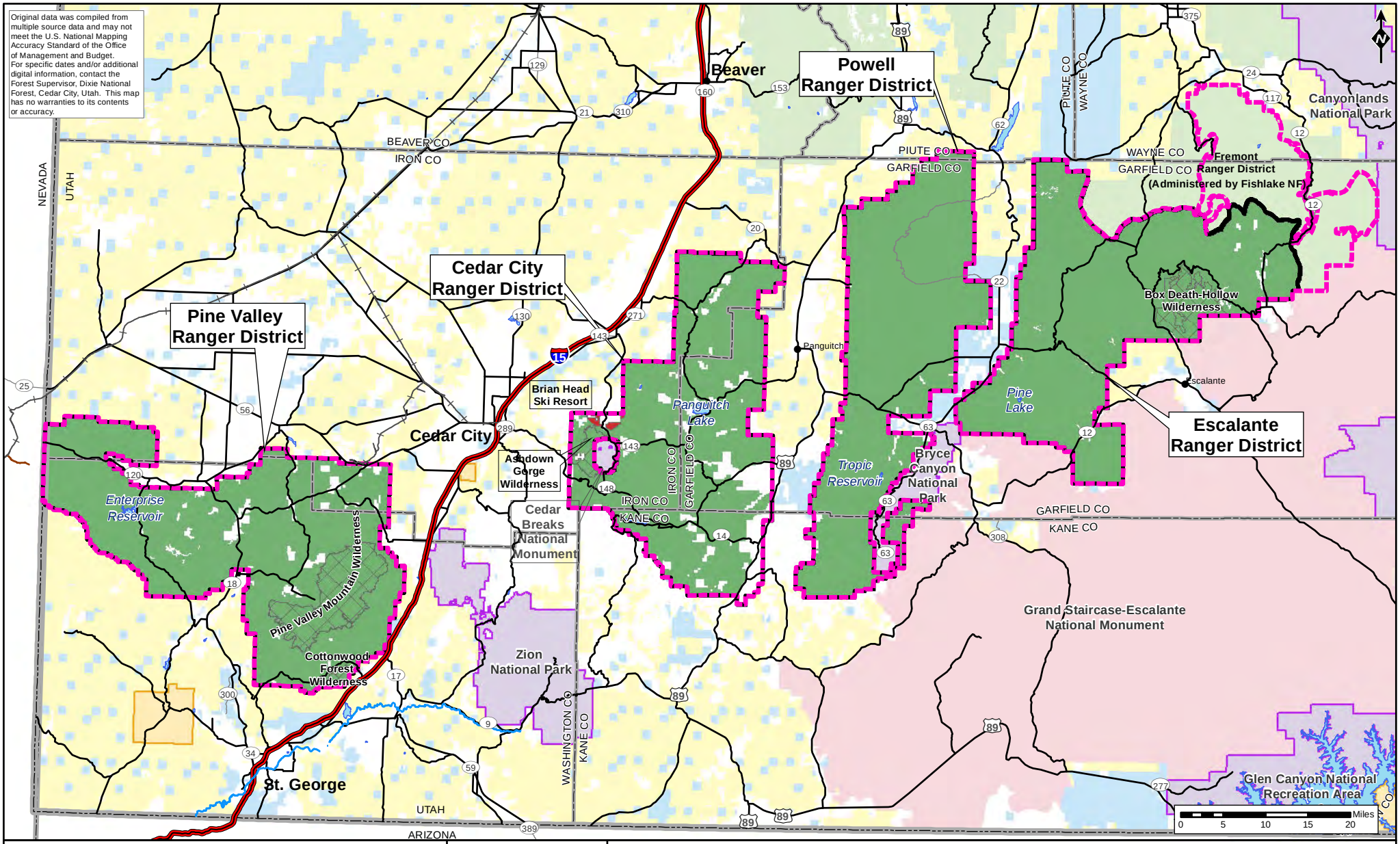
Land Management	Acres	Percent of Total CEA
Bureau of Land Management (BLM)	398	<1
National Park Service	75	<1
Private	78,083	4
Forest Service	1,770,403	91
Forest Service Wilderness Areas[1]	85,323	4
Water	1,942	<1
Total	**1,936,223**	**100**

[1] Includes the Pine Valley Mountain, Ashdown Gorge, Cottonwood Forest, and Box-Death Hollow Wilderness Areas

5.3.1.1 Rationale

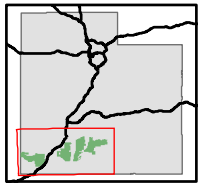
IRAs and Unroaded-Undeveloped Areas are designated on National Forest System land only and would generally only be affected by actions occurring within the Dixie National Forest. However, the Boulder Mountain/Boulder Top/Deer Lake and the Long Neck Mesa/Steep Creek/Oak Creek-Steep Creek/Oak Creek IRAs, as well as the Boulder Top and Long Neck Unroaded-Undeveloped areas, overlap the Dixie and Fishlake National Forest boundaries, with large portions of both IRAs/Unroaded-Undeveloped areas occurring on both Forests. The portions of these IRAs/Unroaded-Undeveloped Areas on the Dixie National Forest portion of the Fremont River Ranger District are included in the CEA as actions on the Dixie National Forest portion of the Fremont River Ranger District could affect the ability of these areas to be managed as IRAs/Unroaded-Undeveloped Areas.

Smaller areas that are not part of the IRAs, but are within the overall boundary were included both for simplicity as well as to incorporate any changes in these areas that could affect the ability of these areas to be managed as IRAs. In addition, some roadless characteristics such as the diversity of plant and animal communities and opportunities for solitude and primitive recreation could be affected by activities on land adjacent to the Dixie National Forest. However, these impacts would be discussed in the cumulative effects sections of other Specialist Reports, such as 5.4 (Fish and Wildlife) and 5.1 (Visual). In addition, all segments of streams suitable for inclusion in the National Wild and Scenic River System, including all upstream areas, are located entirely within the Dixie National Forest boundary and would not be affected by outside activities.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest
FIGURE 5.3-1
Cumulative Effects Area
Inventoried Roadless Areas & Suitable Wild & Scenic Rivers

1 in = 15 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Includes Dixie National Forest Boundary and Inventoried Roadless Areas and Areas of Wilderness Potential that intersect Fishlake National Forest.

5.3.2 Past, Present, and Reasonably Foreseeable Future Actions

As shown in Table 5.3-1, approximately 95 percent of the CEA is land managed by the Dixie or Fishlake National Forests. Only four percent is private land and most of that is located near developed areas (such as Duck Creek). Less than one percent of IRAs and Unroaded-Undeveloped Areas are on private land, and all suitable Wild and Scenic Rivers are located entirely on the Dixie National Forest. As a result, most of the discussion concerning past, present, and reasonably foreseeable actions will be focused on activities occurring on National Forest System land. Furthermore, the discussion will focus primarily on the following activities: timber harvest and road construction. In limiting the discussion to these activities, it is acknowledged that other types of activities may affect the broad array of roadless characteristics and wilderness attributes that help define IRAs and Unroaded-Undeveloped Areas. However, these activities will primarily be discussed in other sections.

General levels of timber harvest and road construction on the Dixie National Forest are discussed in Section 5.1.2.1. As a result, the only information presented here for these management activities is information relevant only to IRAs, Unroaded-Undeveloped Areas, and suitable Wild and Scenic Rivers, information not included in the general discussion in Section 5.1.2.1. Also, any additional information relevant to the Dixie National Forest portion of the Fremont River Ranger District is included.

ROADS

As discussed in Section 3.3.2, IRAs were set aside due to the fact that they were generally unfragmented by roads. Unroaded-Undeveloped Areas are those areas identified on the Dixie National Forest 2005 Inventory of Unroaded / Undeveloped Areas." According to Dixie National Forest GIS data, both open and administrative roads are present in IRAs and Unroaded-Undeveloped Areas. Projects on the Dixie National Forest and the portion of the Fishlake National Forests within the CEA that would include road construction are listed in Table 5.1-1. There are currently not any projects known on the Dixie National Forest portion of the Fremont River Ranger District that would involve new road construction. The only projects known to involve any road construction or reconstruction within IRAs/Unroaded-Undeveloped Areas are the Mt Dutton Vegetation Management Project on the Powell Ranger District, and the Pockets Vegetation Management project on the Escalante Ranger District and Tropic to Hatch 138 kV powerline. The Mt Dutton project would not involve any new road construction, but would involve maintenance and reconstruction of existing roads. The project would include a 274-acre portion of the Deer Creek IRA. Approximately 40 acres of this same area was previously harvested in 1990 and there is evidence of stumps, slash, skid trails, and landings, as well as three miles of Forest Road #30358 (USFS 2006d). The Pockets Vegetation Management project is only within Unroaded-Undeveloped areas, most of which have existing roads and previous timber harvest. The Tropic to Hatch Transmission line would widen and stabilize 3.5 miles of the existing administrative access routes in Cedar Fork Canyon in Henderson Canyon IRA.

On the North Fork of the Virgin River, a four-wheel-drive road provides access to private property below the Dixie National Forest Boundary. The only other road access is Forest Service Road #054, which ends 0.8 miles from the river corridor and is the starting point for the Cascade Falls Trail that provides access to a viewpoint at Cascade Falls. No other roads are planned on Forest Service land in the immediate vicinity; however, addition road construction could occur on private land below the Dixie National Forest Boundary.

TIMBER HARVESTING

Timber harvest is discussed in detail in Section 5.1.2.1 and future timber harvest projects planned for the Dixie National Forests are shown in Table 5.1-1. No timber harvests are planned within the portion of the CEA that includes the Dixie National Forest portion of the Fremont River Ranger District. None of the timber projects listed in Table 5.1-1 would impact suitable Wild and Scenic Rivers and only two, the Mt. Dutton Vegetation Management Project and the Pockets Vegetation project would occur within an IRA or Unroaded-Undeveloped Areas as described above for roads. If the status of the 2001 Roadless Area Conservation Rule were changed due to judicial action, timber harvest could occur in IRAs or Unroaded-Undeveloped Areas at similar levels to the rest of the Dixie and Fishlake National Forests.

5.3.3 Cumulative Effects by Alternative

5.3.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.3.3.2 Alternative B

Under Alternative B, a NL option would be applied to IRAs and suitable Wild and Scenic Rivers. As a result, oil and gas activity would have no direct effect on these resources. Indirect effects could occur as a result of oil and gas activity on adjacent land. Impacts to Unroaded-Undeveloped Areas would be limited to seismic activities and only minor impacts to wilderness attributes would occur. These effects would be negligible to minor and when combined with the past, present, and reasonable foreseeable actions in the CEA, would not be of a sufficient magnitude to result in cumulative effects.

5.3.3.3 Alternative C

Under Alternative C, direct effects to IRAs and suitable Wild and Scenic Rivers would be limited to seismic exploration by the application of an NSO leasing option (to IRAs), and overlap with NSO for Streams (for suitable Wild and Scenic Rivers). It is not expected that seismic exploration would produce disturbance of a magnitude sufficient to result in cumulative effects. For IRAs, the only portion of the CEA that is expected to be affected by other past, present, or reasonably foreseeable future actions is a small portion of the Deer Creek IRA on the Powell Ranger District. This area has been previously disturbed by a prior timber sale and may be disturbed by another (Mt Dutton Vegetation Treatment Project, see Table 5.1-1). If seismic exploration were to occur in the same area of the Deer Creek IRA, the disturbance would likely be undetectable relative to the disturbance that has occurred and will occur in the future from timber harvest. As a result, there would be no cumulative effects to IRAs under this alternative.

Some Unroaded-Undeveloped Areas that are covered partially by CSU under Alternative C would be affected by connected actions; these areas are listed in Section 4.3.5.3. Site-specific NEPA analysis would determine whether cumulative effects would occur to a specific Unroaded-Undeveloped Area if activities are proposed on a particular lease. In general, connected actions within Unroaded-Undeveloped Areas would not lead to cumulative effects when past, present, and future actions in Unroaded-Undeveloped Areas are considered.

5.3.3.4 Alternative D1 (NSO in IRAs)

Under Alternative D with NSO in IRAs, oil and gas activity in IRAs would be limited to seismic exploration by the NSO leasing option and there would be no cumulative effects as described for Alternative C. Cumulative effects to Unroaded-Undeveloped Areas would also be as described under Alternative C.

For suitable Wild and Scenic Rivers, up to 273 acres on the North Fork of the Virgin River could be disturbed by any of the activities predicted to occur by the RFDS, including roads, power lines, and pipelines, as limited by CSU-05. For the North Fork of the Virgin River, its outstandingly remarkable values are in spite of existing development in close proximity to the river. If this were combined with oil and gas activity of any type, it is possible that the stream would no longer be suitable for "Wild" status. This would be a major and long-term cumulative impact, as it would not likely be considered again in the near future.

5.3.3.5 Alternative D2 (CSU in IRAs)

Under this alternative, the majority of IRAs and Unroaded-Undeveloped Areas would be available under CSU and oil and gas activity within these areas could include pipelines, power lines, well pads, etc. However, the construction or reconstruction or roads would be prohibited in IRAs and the development of a production field would be precluded by the inability to construct roads. This alternative assumes that timber harvest and road construction could occur at rates similar to the rest of the National Forest System land within the CEA (due to changes in the 2001 Roadless Area Conservation Rule). Under this scenario, any areas of timber harvest would represent a direct loss of roadless acres for the life of the development. If oil and gas activity were to occur on the same IRA/Unroaded-Undeveloped Areas as other road construction or timber harvest, the direct loss of roadless acres would be larger than with either activity alone. This could result in increased fragmentation of these areas with subsequent impacts to the resources described in the roadless characteristics and wilderness attributes (see Section 3.3.2). As the amount of an IRA/Unroaded-Undeveloped Areas that may potentially be impacted by well pads is small and would not bisect the area into smaller segments, the cumulative impacts would be minor. The effects would be short term as the only likely development would be exploratory wells.

For suitable Wild and Scenic Rivers, the CSU-05 leasing option applied under this alternative would prevent degradation of the outstandingly remarkable values. As described for Alternative D1, disturbance under CSU-05 is not expected to be of a magnitude sufficient to result in cumulative effects. However, major and long-term cumulative impacts may result to the North Fork of the Virgin River (see Section 5.3.3.4).

5.3.3.6 Alternative E1 (NSO in IRAs)

NSO would limit oil and gas activity in IRAs to seismic exploration and there would be no cumulative effects as described for Alternative C. Cumulative effects to Unroaded-Undeveloped Areas would also be as described under Alternative C.

For suitable Wild and Scenic Rivers, up to 273 acres on the North Fork of the Virgin River could be disturbed by any of the activities predicted to occur by the RFDS, including roads, power lines, and pipelines. The impacts could include the degradation of outstandingly remarkable values and the possible loss of suitability for inclusion in the National Wild and Scenic River System due to the construction of roads.

5.3.3.7 Alternative E2 (SLT in IRAs)

Under this alternative, the majority of IRAs and Unroaded-Undeveloped Areas would be available under SLT and oil and gas activity within IRAs/Unroaded-Undeveloped Areas could include all activities predicted by the RFDS. This includes roads, pipelines, power lines, well pads, etc. Further, this alternative assumes that timber harvest and road construction could occur at rates similar to the rest of the National Forest System land within the CEA. Under this scenario, any road construction or timber harvest would represent a direct loss of roadless/unroaded acres for the life of the development. If oil and gas activity were to occur on the same IRA/Unroaded-Undeveloped Area as other road construction or timber harvest, the direct loss of roadless/unroaded acres would be larger than with either activity alone. This could result in increased fragmentation of these areas with subsequent impacts to the resources described in the roadless characteristics and wilderness attributes (see Section 3.3.2). Also, in some cases, particularly with the smaller IRAs/Unroaded-Undeveloped Areas, the fragmentation and loss of roadless acres may be enough that the area could no longer be managed as an IRA or considered as an Unroaded-Undeveloped Area, or simply as a large area of contiguous habitat. These impacts would be minor to moderate if they were to affect only a small portion of a larger IRA/Unroaded-Undeveloped Area; however, the impacts would range as high as major if a large proportion of IRAs/Unroaded-Undeveloped Areas and the unfragmented areas they cover were fragmented by roads and other development. The cumulative effects would be short term for exploratory wells and roads and long term for a production field with its associated roads.

For suitable Wild and Scenic Rivers, all of the streams located outside wilderness areas (i.e., North Fork of the Virgin River) would be available for lease under SLT and the impacts would be the same as described for Alternative E1. However, under this alternative more acres on suitable Wild and Scenic Rivers would be available under SLT and the potential for the impacts described in Alternative E1 to occur is increased.

Table 5.3-2 Summary of Cumulative Effects for IRAs, Unroaded-Undeveloped Areas, and Suitable Wild and Scenic Rivers

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Roads There are some existing roads within IRAs/Unroaded-Undeveloped Areas; however, these roads do not jeopardize the status of these areas. Timber Harvest Timber harvest was widespread throughout much of the CEA in the past.	Roads Most projects within the CEA focus on improving the management of roads and include road closures and decommissioning. A small amount of new roads are planned, mostly associated with timber harvest and salvage. Timber Harvest Timber harvest in the CEA has been greatly reduced relative to past levels and current harvest is primarily in response to spruce beetle outbreaks. Some portions of the Deer Creek IRA still show signs of past timber harvest.	Roads The amount of roads is not expected to increase. The Mt Dutton Vegetation Management Project would reconstruct roads in the Deer Creek IRA. If the 2001 Roadless Area Conservation Rule were not in effect, some road construction could occur in IRAs. Timber Harvest The Mt Dutton Vegetation Management Project would affect 247 acres of the Deer Creek IRA. If the 2001 Roadless Area Conservation Rule were not in effect, additional timber harvest could occur in IRAs.	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts.	There would be no cumulative effects of oil and gas activity due to the lack of direct and indirect effects.
			Alternative B NL and leasing options would prevent direct disturbance to IRAs and suitable Wild and Scenic Rivers. Parts of Unroaded-Undeveloped Areas may be affected by seismic under NSO.	There would be no cumulative effects of oil and gas activity due to the lack of direct affects and the minimal nature of indirect effects.
			Alternative C NSO would limit direct disturbance in IRAs and most suitable Wild and Scenic Rivers and Unroaded-Undeveloped Areas to seismic exploration.	There would be no cumulative effects of oil and gas activity due to the minimal nature of both direct and indirect effects combined with the small amount of disturbance from past, present, and future actions.
			Alternative D1 (NSO in IRAs) NSO would limit direct disturbance in IRAs and most suitable Wild and Scenic Rivers and Unroaded-Undeveloped Areas to seismic exploration. Some development could occur near streams under a CSU stipulation.	There would be no cumulative effects to IRAs due to the minimal nature of direct disturbance. If oil and gas activity were to occur near the North Fork of the Virgin River, the existing level of disturbance when combined with oil and gas activity could affect outstandingly remarkable values. This would be a major, long-term impact.
			Alternative D2 (CSU in IRAs) Direct disturbance (not including roads or production fields) could occur to IRAs, Unroaded-Undeveloped Areas, and suitable Wild and Scenic Rivers located outside wilderness or other areas not available for leasing.	Minor short- -term cumulative impacts to IRAs/ Unroaded-Undeveloped Areas could occur if timber harvest and well pads were to occur in IRAs. Cumulative effects to suitable Wild and Scenic Rivers would be the same as described for Alternative D1.
			Alternative E1 (NSO in IRAs) NSO would limit direct disturbance in IRAs and most suitable Wild and Scenic Rivers and Unroaded-Undeveloped Areas to seismic exploration. Some development could occur near streams under SLT. .	Cumulative effects for IRAs would be the same as described for Alternative C. Cumulative effects for suitable Wild and Scenic Rivers would major and long-term if oil and gas development affected stream suitability for inclusion in the National Wild and Scenic River System.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative E2 (SLT in IRAs) Direct disturbance could occur to IRAs, Unroaded-Undeveloped Areas, and suitable Wild and Scenic Rivers.	Cumulative effects for IRAs and Unroaded-Undeveloped Areas would be major if oil and gas development, combined with other road development, led to a loss of IRA status or unroaded classification for Unroaded-Undeveloped Areas. Cumulative effect to suitable Wild and Scenic Rivers would be the same as described for Alternative E1.

5.4 Recreation Resources

5.4.1 Description of Cumulative Effects Area

The CEA for recreation includes all 6th level HUC subwatersheds occurring on the Dixie National Forest that are within the following boundaries: north of the Virgin River, east of the Union Pacific rail line located west of the Utah-Nevada border, south and east of US Highway 56 and Desert Mount Road, east of Interstate 15 north of Cedar City, and south and west of US Highway 12 on the Fremont River Ranger District. The CEA would also include all of Bryce Canyon National Park and all land between the subwatersheds and a buffer extending 5 miles south from US Highway 12 between the towns of Boulder and Escalante. No data existed for one of the subwatersheds on the west side of the Pine Valley Ranger District and a buffer was created by extending a boundary west from the nearest subwatershed (Nephi Draw HUC 160300061301) along an existing dirt road to an intersection with the Union Pacific rail line at Brown, Nevada. These boundaries were placed on the 6th level subwatersheds due to the presence of several subwatersheds that covered only very small portions of the Dixie National Forest, but extended long distances from the Dixie National Forest boundary. The portions of these watersheds eliminated are likely beyond the extent of any cumulative effects.

5.4.1.1 Rationale

The CEA covered by the 6th level HUC subwatersheds encompasses all of the land between the Cedar City, Powell, and Escalante Ranger Districts and a large portion of BLM land surrounding all four ranger districts. This area, with Bryce Canyon National Park and the buffer around US Highway 12 included, encompasses all major roads and highways used to access the Dixie National Forest and should encompass most recreational activities and settings in the general area. The CEA would also cover a large portion of most Limited Entry hunt units that occur on the Dixie National Forest, with the exception of the Paunsaugunt and Kaiparowits units, which extend south to Lake Powell and the Arizona State line. However, the CEA covers all of the crucial and substantial habitat for elk and approximately 32 percent of the habitat for mule deer. As a result, the CEA is considered sufficient to analyze impacts to hunting.

5.4.2 Past, Present, and Reasonably Foreseeable Future Actions

In general, most surface disturbing activity has the potential to result in cumulative impacts to recreation resources. The following management activities may affect recreation resources: increased recreation, prescribed fire, timber harvest, and minerals activity (including oil and gas). General information on these activities for the Dixie National Forest is presented in Section 5.1.2.1. As a result, the information presented for these management activities in this section is relevant only to recreation resources, information not included in the general discussion in Section 5.1.2.1. Also any additional information relevant to other portions of the CEA (BLM administered land, state land, and private land) is included.

RECREATION AND OHV USE

Increased recreation use as discussed in Section 5.1.2.1 continues to strain resources due to a lack of funding that has led to a large backlog of deferred maintenance for recreation facilities on the Forest. OHV use is considered one of the biggest impacts to the National Forest System (USFS 2006c) and the Dixie National Forest is no exception. It is anticipated that the Motorized Travel Plan, which restricts motorized use to designated routes and will largely eliminate off-trail or cross-country motorized travel. This should reduce some of the impacts of motorized

recreation on other resources; however, increased use will still continue on those routes open to motorized travel.

As a primary activity, OHV use will generally continue to trend upward. This is particularly the case for OHV use on established motorized trail systems. Monitoring of the trail system in 2004 and 2005 indicates that there was a Forest-wide increase in use of the more heavily traveled trails on the Forest, while there was a slight decrease in the amount of use on lesser-used trails (USFS 2004b). Much of the increased use on the heavily used trails can be attributed to an overall increase in OHV use on the Forest (USFS 2009c). Implementation of the MTP will increase maintenance on trails left on the system as motorized use is restricted to designated routes.

FIRE

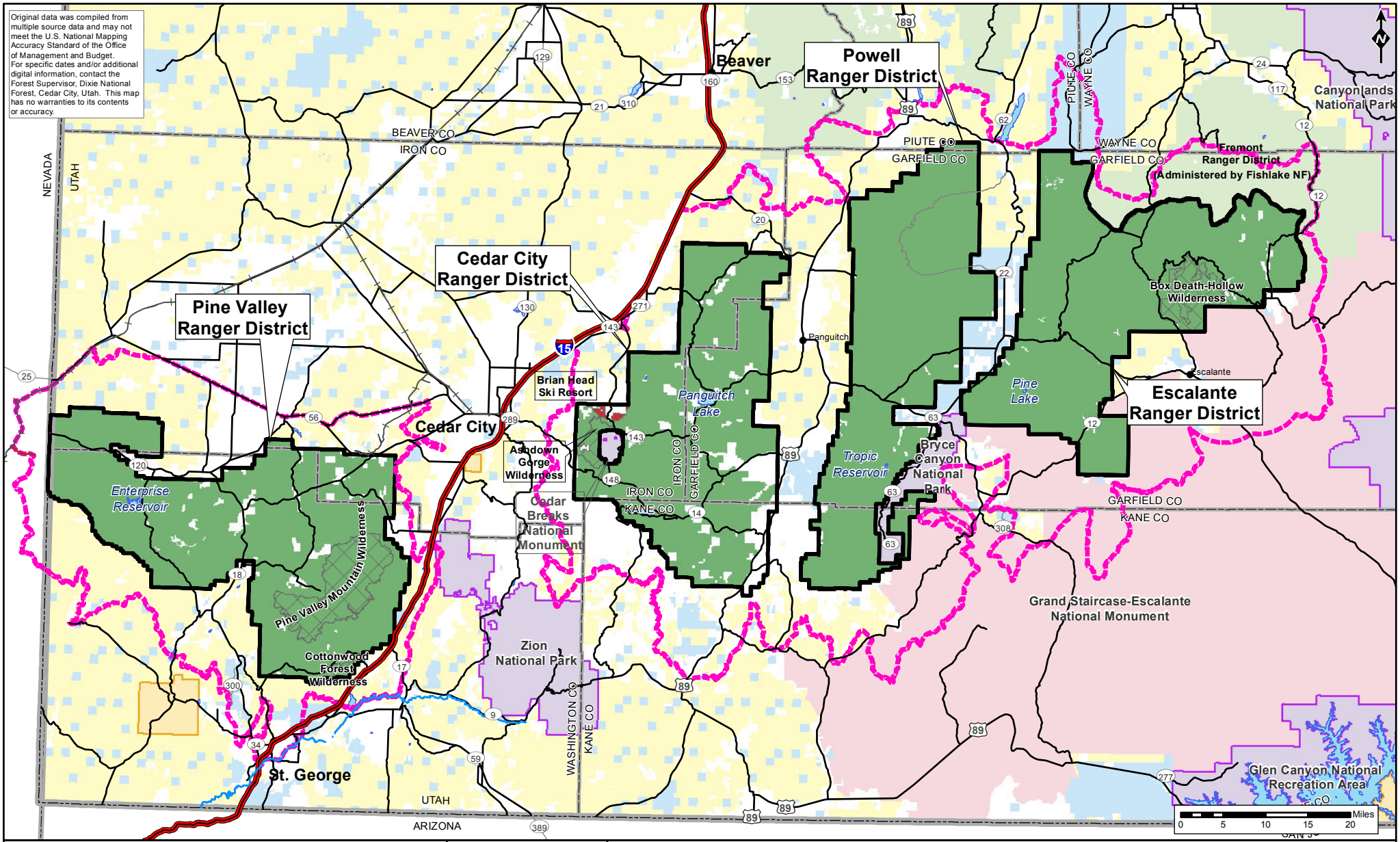
Fire on the Dixie National Forest was described in Section 5.1.2.1. Historical fire levels on other lands outside the Dixie National Forest are likely similar for timbered lands near the Dixie National Forest boundary, and lower in the lower elevation grasslands. Areas affected by fire are frequently closed to recreational activities until vegetation begins to recover. Fire can also diminish the visual quality of the landscape, thus making some areas undesirable for viewing scenery and wildlife, and dispersed camping.

TIMBER HARVESTING AND VEGETATION MANGEMENT

Timber harvest and vegetation management on the Dixie National Forest is described in Section 5.1.1.2. Timber harvest in other portions of the CEA (BLM, state, and private land) would be less that on the Forest, due to a lack of timber at these lower elevations. However, vegetation management, such as the chaining of pinyon-juniper may occur on BLM land.

The most common effects to recreational user groups include decreased forest lands available for recreation, disruption of visual quality, increased noise, increased traffic, and increased (temporary) road construction, reconstruction, decommissioning. Ultimately these effects can cause user groups to relocate to other areas. Should oil and gas exploration take place in close proximity to these activities, cumulative impacts to recreation could occur. The majority of these effects are temporary in duration, lasting as long as the harvest or management activity is active. Impacts associated with large-scale timber harvests, timber salvage, and prescribed burns tend to be short-term in duration. Impacts of these activities are generally associated with visual disruptions. However, once the vegetative integrity of these areas has recovered, the scenic quality of the affected area is often improved beyond pre-activity conditions.

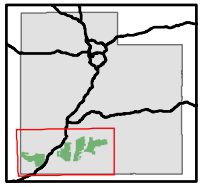
Ongoing and future timber harvesting and vegetation management projects are detailed in Table 5.1-1. Projects that could potentially result in cumulative impacts include, but are not limited to: the Mount Dutton vegetation management project, the Upper Santa Clara River vegetation and fuels project, the Duck Creek fuels treatment, Midway-Deer Valley scenery enhancement and vegetation treatment, and Pockets vegetation management.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 5.4-1
Cumulative Effects Area for Recreation Resources

1 in = 15 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Comprised of 6th-Level (HUC 12) Watersheds that occur on Dixie National Forest. Clipped to Selected Highways, the Virgin River, Railroads, Bryce Canyon National Park, and a 5-mile buffer of Highway 12 between Escalante and Boulder.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Forest are listed in Table 5.1-1. Table 5.4-1 re-lists these projects and describes the potential effects to recreation from each.

Table 5.4-1 Potential Impacts to Recreation Resources from Projects listed in Table 5.1-1

Project	Potential Impacts to Recreation Resources
Aerial application of fire retardant	Would temporarily increase noise and human disturbance. Would temporarily displace campers to other areas.
Pine Valley Campground Bridge Construction	Would temporarily increase noise, human disturbance, and traffic. Would temporarily displace campers to other areas. In the long term, it would improve access.
Mt. Dutton Vegetation Management Project	Would temporarily increase noise, human disturbance, and (temporary) traffic. Would enhance the long-term visual qualities of the forest.
Upper Santa Clara River Vegetation and Fuels Project	Would temporarily increase noise, human disturbance, and (temporary) traffic. Would facilitate campground access and reduce risk of wildfire.
Duck Creek Fuels Treatment	Would temporarily increase noise, human disturbance, and traffic. Would reduce wildfire risk.
Edward Spring Vegetation Treatment	Would temporarily displace campers to other dispersed areas until vegetation recovers.
Midway-Deer Valley Scenery Enhancement & Veg Treatment	Would temporarily increase noise, human disturbance, and (temporary) traffic. . Increase funding to accomplish ancillary projects in recreation.
Brian Head ATV Trail	Would temporarily increase noise and human disturbance; long term would increase motorized recreation opportunity.
Harris Flat ATV Access Trail	Would temporarily increase noise and human disturbance; long term would increase motorized recreation opportunity.
Outfitter Guide Special Use Permit Issuance	Would facilitate users in need of guides and outfitters.
Dipping Vat Habitat Improvement Project	Would temporarily increase noise, human disturbance, and traffic.
McGath Lake Dam	Would temporarily increase noise and human disturbance. May temporarily displace anglers to other areas. Would ensure the security of the fishery once complete.
Pockets Vegetation Management	Would temporarily increase noise, human disturbance, and (temporary) traffic. Long term, the project should enhance visual quality.
Toad Salvage	Would temporarily increase noise, human disturbance, and traffic. Long term, the project should enhance visual quality.

5.4.3 Cumulative Effects by Alternative

5.4.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.4.3.2 Alternative B

Under Alternative B, Developed Sites, Semi-Primitive Non-Motorized, and Recreation Residences would be categorized as NSO; however, large parts of these areas would be NL or NA due to overlapping leasing options with other resources. No cumulative impacts would occur to any recreation resources from seismic activities under NSO because noise and human presence impacts would be temporary. Semi-Primitive Motorized and Roaded Natural areas would be open to leasing under CSU or a more restrictive leasing option. Adverse cumulative effects could occur from the construction of roads if approved, exploratory well pads, and particularly a production field if these facilities are constructed in areas that have been impacted by past visual disturbance, such as fire or clearcuts. Future management activities such as timber harvests, facilities upgrades, and vegetation maintenance could add to noise, human presence, and traffic in such areas. These past and future disturbances could result in user displacement and groups abandoning certain areas. However, CSU regulations would require the oil and gas activities to be located so that they would not be obvious or interfere with recreation users, including controlling access routes and providing for extensive reclamation. Mitigation measures may also require that proposed well sites be individually sited on a case-by-case basis to take advantage of vegetative or topographic screening. These regulations could prevent oil and gas activities from being located in close proximity to areas of past disturbance and other management activities, and thus could prevent cumulative effects from occurring in Semi-Primitive Motorized and Roaded Natural areas. Cumulative impacts to recreation resources under Alternative B would be negligible.

5.4.3.3 Alternative C

Alternative C has less restrictive leasing options than Alternative B and more restrictive options than Alternative D. As under Alternative B, cumulative impacts from seismic activities in areas covered by NSO would be negligible because impacts would be temporary. Cumulative impacts in Semi-Primitive Motorized and Roaded Natural areas covered by CSU would also be negligible. Management activities that increase in noise, human presence, traffic, and other visual interruptions (such as timber harvest, thinning, and salvage) are occurring and will continue to occur in these areas. Because of oil and gas activities occurring in settings for various dispersed recreation activities in addition to current and foreseeable future management actions, users may abandon these sites and/or be displaced to other areas of the Forest; however, cumulative impacts would be negligible because dispersed activities can usually easily move to other locations.

5.4.3.4 Alternative D1 (NSO in IRAs)

The potential for cumulative impacts to recreation resources would be slightly higher under Alternative D with NSO in IRAs, relative to Alternative C, because more of these and surrounding areas are available for leasing. Primitive settings would be subject to NSO or NA under this alternative and Developed and Semi-Primitive Non-Motorized areas would be open to leasing under CSU or a more restrictive leasing option. Seismic activity noise and human presence under NSO would not lead to cumulative impacts within Primitive ROS settings. Oil

and gas developments within Developed Sites may lead to cumulative impacts considering the substantial amount of current and foreseeable management activities (i.e., fuels projects) occurring in these areas and the general lack of funding for maintenance. Cumulative impacts to Developed sites under Alternative D (both alternatives) could be minor and short to long term, depending on the duration of activities. Oil and gas developments within Semi-primitive Non-Motorized areas could change the character of these areas through road building and activities that involve vehicles; however, due to the substantial overlap with IRAs within Semi Primitive Non-Motorized ROS settings (63 percent NSO in IRAs), impacts are more likely to be limited to seismic noise and human presence. Thus there would probably be temporary impacts in these areas and no cumulative impacts.

5.4.3.5 Alternative D2 (CSU in IRAs)

Cumulative impacts to recreation resources would be the same duration and intensity as under Alternative D with NSO in IRAs with the exception of Semi Primitive Non-Motorized ROS settings. Cumulative impacts would be possible in these areas because 97 percent would be CSU or TL (for another resource), under which any oil and gas activities could occur. Although the CSU leasing option is designed to protect this resource, any motorized activity could compromise the character of a non-motorized area. Cumulative impacts to Semi Primitive Non-Motorized ROS areas under this alternative could be long term and minor.

5.4.3.6 Alternative E1 (NSO in IRAs)

Cumulative effects under this Alternative would be the same as described for Alternative E with SLT in IRAs, with the exception of Semi-Primitive Non-Motorized ROS settings. As under Alternative D with NSO in IRAs, these areas substantially overlap IRAs and would likely only be affected by temporary seismic noise and human presence under NSO. Cumulative impacts in Semi-Primitive Non-Motorized ROS areas would be negligible.

5.4.3.7 Alternative E2 (SLT in IRAs)

Cumulative impacts would be possible to Semi-Primitive Non-Motorized areas, developed sites, and recreation residences. Cumulative impacts to Semi-Primitive Non-Motorized areas would be as described under Alternative D with CSU in IRAs (the majority of these areas overlap IRAs). Cumulative impacts to developed sites would be as described under Alternative D with NSO in IRAs (these areas do not overlap IRAs). Cumulative impacts to recreation residences may occur for similar reasons as for developed sites: these areas are within those currently affected by fuels treatments and past impacts (i.e., fires, spruce beetle outbreaks) and thus may be rendered completely unsatisfactory to users if oil and gas developments occurred in the vicinity. Recreation residences are few in number and thus displacement could not be mitigated. Cumulative impacts to recreation residences under Alternative E (both alternatives) could be minor and short to long term.

5.5 Fish and Wildlife

5.5.1 Description of Cumulative Effects Area

The CEA for fish and wildlife is all 6th level HUC subwatersheds occurring on the Dixie National Forest that are within the following boundaries: north of the Virgin River, east of the Union Pacific rail line located west of the Utah-Nevada border, south and east of US Highway 56 and Desert Mount Road, east of Interstate 15 north of Cedar City, and south and west of US Highway 12 on the Fremont River Ranger District. No data exists for one of the subwatersheds

on the west side of the Pine Valley Ranger District and a buffer was created by extending a boundary west from the nearest subwatershed (Nephi Draw HUC 160300061301) along an existing dirt road to its intersection with the Union Pacific rail line at Brown, Nevada. These boundaries were placed on the 6th level subwatersheds due to the presence of several subwatersheds that covered only very small portions of the Dixie National Forest, but extended long distances from the Dixie National Forest boundary. The portions of these watersheds eliminated are likely beyond the extent of any cumulative effects.

The CEA is shown in Figure 5.5-1. Lands within the CEA are managed primarily by the Dixie National Forest (50% of the CEA, includes Wilderness). Twenty eight percent of lands in the CEA are managed by the BLM, within the Grand-Staircase Escalante National Monument or the Richfield, Kanab, Cedar City, or St. George BLM Districts. Sixteen percent of the CEA is private land; and the remainder is State Trust Lands (4%), National Park Service (1%; Cedar Breaks National Monument and Bryce Canyon National Park), and State Parks or wildlife reserves (1%). Actions within the CEA are discussed within 1) the Dixie National Forest National Forest, 2) the Grand Staircase-Escalante National Monument, or 3) various BLM districts (Richfield, Kanab, Cedar City, or St. George), since these areas make up the majority of the CEA. Actions on private or other lands are not discussed due to the small representation in the CEA or lack of data.

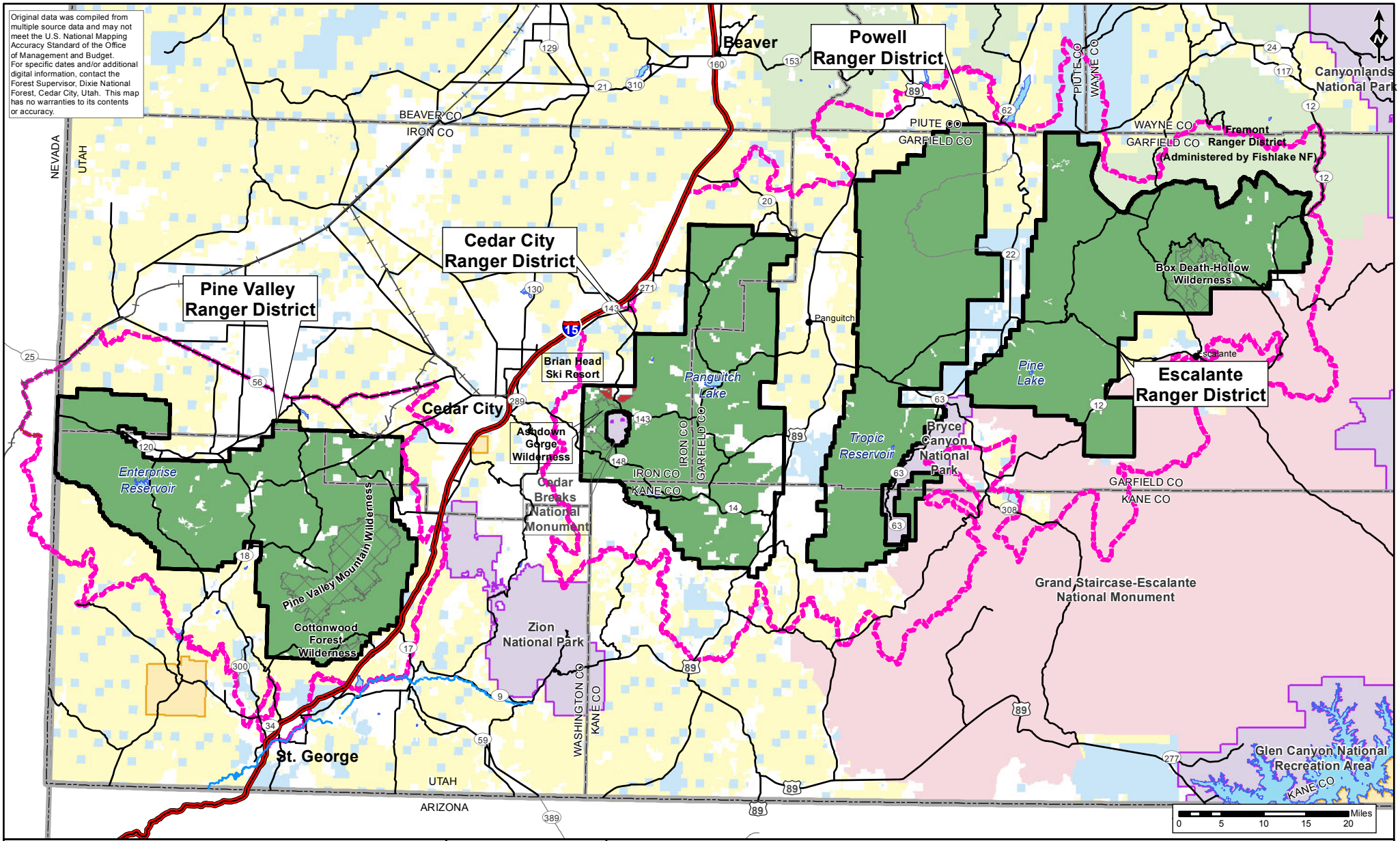
5.5.1.1 Rationale

The 6th Level HUC subwatershed level was chosen as the CEA because native fish are unlikely to migrate beyond these boundaries. Further, native fish are unlikely to migrate beyond the artificial boundary placed on several of the subwatersheds due to the distance these subwatersheds extend and a general lack of large streams in these subwatersheds. The subwatershed level would cover most terrestrial wildlife movements with the exception of migratory birds and wide-ranging predators and big game.

5.5.2 Past, Present, and Reasonably Foreseeable Future Actions

Throughout the CEA, wildlife habitats have been shaped by natural disturbances as well as active management and manipulation by humans. On Forest Service land, many forests are characterized by overstocking, layering, and encroachment by shade-tolerant climax tree species, which increases the susceptibility of these areas to fire and insect outbreak that can remove large areas of habitat. Past and present management activities on public lands (USFS and BLM) continue to impact habitat by removing vegetation and altering vegetation communities by changing species composition. In general, private lands are assumed to be in various stages of increasing development and to contain little wildlife habitat.

Within the Utah High Plateaus and Mountains region, riparian areas have been degraded by a variety of activities over the past several decades. Negative effects include the lowering of water tables, erosion of stream channels, invasive plant encroachment, removal of beaver populations, increased water temperatures, concentrated runoff and increased sediment from road construction, and changes in upland vegetation density and composition. Impacts to riparian and wetland areas on the Forest are discussed in Section 4.7 and 5.7. Native fishes and other aquatic species have been affected by the changes to riparian habitats, primarily by increased sediment levels from erosion where riparian vegetation has been altered or removed. Sedimentation reduces the amount of exposed gravels for native fish spawning, broadens stream channels, creates shallow waters, reduces the abundance and quality of pools, and increases water temperatures, all of which create conditions that are less suitable for native fishes and other aquatic species.


Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
Beaver
Powell Ranger District
Canyonlands National Park
BEAVER CO
IRON CO
PIUTE CO
WAYNE CO
GARFIELD CO
Fremont Ranger District (Administered by Fishlake NF)
NEVADA
UTAH
Cedar City Ranger District
Pine Valley Ranger District
Box Death Hollow Wilderness
Panguitch
Escalante
Escalante Ranger District
Brian Head Ski Resort
Panguitch Lake
Pine Lake
Cedar City
Ashdown Gorge Wilderness
Tropic Reservoir
Bryce Canyon National Park
Enterprise Reservoir
Cedar Breaks National Monument
KANE CO
Pine Valley Mountain Wilderness
Cottonwood Forest Wilderness
Grand Staircase-Escalante National Monument
Zion National Park
WASHINGTON CO
St. George
ARIZONA
Glen Canyon National Recreation Area
Miles
0 5 10 15 20
Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest
FIGURE 5.5-1
Cumulative Effects Area for Fish & Wildlife
1 in = 15 miles
1:1,000,000
Horizontal Datum = NAD 83
Coordinate System = Zone 12N
Cities
Railroad
Minor Roads*
Major Roads
Freeways
Virgin River
Water Bodies
County Boundaries
State Lines
National Forest System Lands
Dixie National Forest
Wilderness Areas
Fishlake National Forest
Brian Head Ski Resort
Other Land Administration
Bureau of Land Management
GSENM**
National Park Service
Private
State of Utah
Tribal
Cumulative Effects Area***
*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Comprised of 6th-Level (HUC 12) Watersheds that comprise Dixie National Forest. Clipped to Selected Highways, the Virgin River, and Railroads.

The following management activities have had or may have impacts on fish and wildlife within the CEA in the foreseeable future: roads, livestock grazing, vegetation changes, fire, invasive plants, recreation, and oil and gas leasing. While impacts in the CEA continue to occur, many of the activities listed have decreased or become better managed in recent years on federally managed lands as the importance of overall ecosystem health has been recognized. The past and present levels of each type of activity on the Dixie National Forest and the expected level of future activity are presented in Section 5.1.2.1. This section described the general impacts to fish and wildlife that have resulted and any activity on lands other than the Dixie National Forest.

ROADS

The construction of roads in close proximity to streams has altered the structure and function of these areas within the CEA. Roads can channel surface water runoff directly into streams, when it would normally travel slowly or diffusely through the watershed. The result is that sediment inputs to streams are high in some areas and have degraded the quality of aquatic habitat. Table 5.5-1 shows the miles of Forest Service routes that have the potential to, or are currently impacting aquatic habitat.

Table 5.5-1 Forest Service Routes Impacting Aquatic Habitat

Impacts[1]	Miles of Forest Service Routes			
	Pine Valley	Cedar City	Powell	Escalante
Route presents a high or moderate risk to soil and water resources	342.2	374.2	426.1	551.4
Route impacts stream channels, floodplains, wetlands, or riparian areas	385.1	346.9	152.8	478.0
Route is within a stream channel	0.0	2.2	0.0	0.0
Routes with stream crossing	640.5	591.7	682.7	604.3
Routes within 200 feet of streams	700.7	670.1	815.8	710.2

Source: Dixie National Forest Route Analysis Database

[1] Motorized Travel Plan implementation (see USFS 2009c) will close some routes that are negatively impacting soil, water, and wildlife resources, and/or are not needed for future resource management activities.

LIVESTOCK GRAZING

Grazing is thought to have had moderate adverse impacts on watershed (Section 5.7) and aquatic habitat on the Dixie National Forest from grazing allowances in riparian areas, including a reduction in plant cover and soil compaction that have led to a decrease in natural surface water infiltration, a concomitant increase in surface water runoff, and changes in stream channel morphology (USFS 1995a). On all BLM lands, including the Grand Staircase-Escalante National Monument, grazing is allowed and is managed in accordance with BLM guidelines to protect the watershed, aquatic habitat, and water quality, and move toward or maintain properly functioning condition (BLM 1999a). Grazing in the Kanab BLM district has decreased significantly in order to recover from recent droughts and improve the range condition in recent years. Grazing on the Grand Staircase-Escalante National Monument, on BLM land, and on the Dixie National Forest is managed according to Utah Standards of Rangeland Health.

VEGETATION CHANGES

Habitat changes that have occurred on the Dixie National Forest (described in Section 5.1.2.1) have reduced the habitat available for many migratory bird species that breed in or utilize early succession habitats. Vegetation management on the Forest is currently attempting to reverse the trends of climax species encroachment, and vegetation "restoration" treatments on the Grand Staircase-Escalante National Monument are expected to cover approximately 20,000 acres over the next 15 years (BLM 1999a).

FIRE

Fire on the Dixie National Forest is described in Section 5.1.2.1. Large, severe fires remove vegetation and decrease infiltration rates, increasing the potential for large flood and sedimentation events, which can degrade aquatic habitats and alter channel morphology (Dwire and Kauffman 2003, Wondzell and King 2003). The removal of vegetation also directly decreases the amount of shaded habitat areas for fish and increases the water temperature. The Sanford Fire (Powell Ranger District, Dixie National Forest) that occurred in 2002 has resulted in changes to channel morphology in the Cottonwood Creek, Deep Creek, and Deer Creek watersheds (USFS 2004c). The frequency of large, severe fires is expected to increase in the future due to the limited acres than can be treated to reduce fuel loads and climatic changes. On the Grand Staircase-Escalante National Monument, fires have played a smaller role in the shaping of the landscape and there is little suppression activity (BLM 1999a). On the Richfield BLM District, there has been a spike in fire frequency over the past ten years; however, aquatic habitat in scarce due to water diversions.

INVASIVE AND NONNATIVE PLANTS

Invasive and nonnative plants on the Dixie National Forest are described in Section 5.1.2.1. Cheatgrass is a problem being addressed on the Richfield BLM District and has contributed to the increased fire frequency in addition to the loss of desert scrub, sagebrush, and grasslands. The BLM, including the Grand Staircase-Escalante National Monument, works cooperatively with local governments and private landowners to identify and control invasive plants. Many terrestrial species in the CEA have been affected by the spread of invasive plants, which are often less nutritious and less functional than natives as part of wildlife habitats. Invasive plants usually deplete soil and water resources more quickly and aggressively than native plants, thus out-competing them, and reducing the diversity of the vegetation, which tends to diminish the value of wildlife habitats in general. In riparian areas, tamarisk (*Tamarix ramosissima*), whitetop (*Cardaria draba)*, and Russian olive (*Elaeagnus angustifolia*) are slowly replacing native riparian vegetation such as willows (*Salix* spp.) and cottonwoods (*Populus* spp.) in the CEA. Aquatic habitats become degraded due to invasive plants replacing natives because grasses tend to replace native shrubs and trees that had stabilized banks from erosion (and sedimentation) and shaded the stream, keeping the water temperature low. Aquatic and wildlife species in the CEA have been impacted by the spread of invasive plants, and invasions are expected to increase in the foreseeable future.

RECREATION

OHV use, described for the Dixie National Forest in Section 5.1.2.1, particularly cross-country travel, has resulted in direct impacts to riparian and upland vegetation as well as noxious weed introductions. However, OHV cross-country use on the Dixie NF is expected to decrease as a result of the implementation of the MTP decision signed April 2009. On BLM districts, OHV use has increased from 5 to10 years ago and management strategies are still being devised to protect wildlife and fish habitats.

MINERALS ACTIVITY

Past and present oil and gas activity on the Dixie National Forest, including the Upper Valley oil field, is described in Section 5.1.2.1. In the past few years there has been a renewed interest in oil and gas within the CEA and there are currently 122 authorized leases and 14 pending leases, with a combined total lease area of 101,682 acres (UDNR 2008b). While these leases occur throughout the CEA, they tend to occur in clusters. Some of the larger clusters are to the south and north of the Cedar City Ranger District, in between the Cedar City and Powell Ranger Districts, and off the southeast corner of the Escalante Ranger District (an extension of the Upper Valley Field). Only the Upper Valley Field is currently active. The only other recent activity on these leases has been the drilling of a five wildcat wells on state and private land, all of which have been plugged and abandoned (UDNR 2008a). While the lease acreage is not reflective of potential surface disturbance area, it may be likely that the larger lease areas and the lease clusters may eventually have a greater area of surface disturbance than a smaller, isolated lease. Further, it can be assumed that similar types of impacts as are described for on-Forest leases could occur on these leases as well.

The portion of the CEA within the BLM's Richfield District has a low development potential for oil and gas (described in Section 5.2.2). The RFDS for the BLM's Kanab District predicts 90 new well sits and up to 1,500 miles of seismic data. These would disturb an estimated 2,070 acres (23 acres per well) and 905.5 acres, respectively. Some of this development could occur on the portions of the Kanab District within the CEA. The BLM's Cedar City District RFDS on the eastern portion of the Field Office is three exploratory wells per year (BLM 2008d). There are currently 254 authorized oil and gas leases in the Cedar City Field Office, totaling over 450,000 acres, over 90 percent of which occur within the eastern half of the district in an areas bounded by I-15 (on the east) and the Union Pacific Railroad (on the west). Although nearly all public lands in the Cedar City Field Office have been under federal oil and gas lease at some time in history, future leasing interest is likely to be focused within this area. There are currently no oil and gas production facilities within the Cedar City Field Office.

On state land, there is the possibility of unquantified drilling for coal bed methane within the John's Valley area within the next 15 years. This would likely involve not only drilling but also establishment of a gas delivery system to market the gas if it occurred in paying quantities. Production would most likely be gas rather than oil. One of the five wells that was plugged and abandoned was a coal bed methane well in this area.

In addition to oil and gas activity, there are currently 25 separate minerals activities, more than half of which are on BLM land surrounding the Pine Valley Ranger District. These mineral activities are all very small operations (less than five acres) and primarily target materials such as sandstone, limestone, silica, rhyolite, alabaster, and travertine (UDNR 2008b). There are a few larger mines for iron, gold, and silver; however, all of these are inactive or in some stage of reclamation. There are two larger mines proposed for the near future: the Alton Coal Hollow mine and the Iron Spring iron mine.

Alton Coal Mine

The Coal Hollow mine is proposed by Alton Coal Development, LLC. The company plans to mine up to 2 million tons of surface coal on 635 acres of private land. An engineering evaluation and air quality impact analysis done for the air quality permit process found the proposed strip-mine development project meets federal and state air quality rules and regulations. The permit

for mining on private reserves was approved on November 8, 2010 after being upheld following contests from environmental groups.

The initial stages of mining will slowly roll out a smaller number of highway-approved tractor-trailers transporting coal from Alton to Intermountain Power Agency's plant near Delta. The number of trucks could eventually expand to as many as 300 coal trucks per day passing through Panguitch and other towns on state Route 89 (St. George Spectrum 09/20/2010).

Iron Springs Mine

Palladin Iron Corporation was recently granted Tentative Approval of Amended Notice of Intention to Commence Large Mining Operations at the Iron Springs mine. These mines were last active over 50-years ago and previously disturbed 417 acres. Plans over the next five years include the disturbance of 48 currently undisturbed acres and 14 acres that were previously disturbed.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Dixie National Forest are listed in Table 5.1-1. Table 5.5-2 re-lists these projects and describes the potential effects to fish and wildlife in the CEA from each. Focus areas for vegetation management on the Dixie National Forest in the near future include Mount Dutton, East Fork Sevier River, and the spruce fir forests on the Escalante Ranger District.

Table 5.5-2 Potential Impacts to Fish and Wildlife from Projects listed in Table 5.1-1

Project	Potential Impacts to Fish and Wildlife Resources
Upper Santa Clara River Vegetation and Fuels Project	Habitat removal: 1,662 total treatment acres, of which 352 acres will be treated in 2008, and 596 acres will be treated in 2009; decreased risk of uncharacteristic wildfire that would remove habitat.
Pine Valley Fuels Treatments	Habitat removal: 217 acres in 2011; decreased risk of uncharacteristic wildfire that would remove habitat.
Navajo Basin Forest and Scenic Recovery	Habitat removal (dead/dying conifers); regeneration of aspen and conifer habitat on 4,737 acres in 2011
Red Desert Vegetation Treatment	Habitat removal: prescribed burning to regenerate aspen habitat on 2,225 acres in 2011.
Tippets Salvage	Habitat removal (dead/dying conifers) on 250 acres in 2011.
Duck Creek Fuels Treatment	Habitat removal: Phase II will treat 600 acres and Phase III 2,800 acres in 2008, 10,000+ acres in 2009, 5,000 acres 2010, and 1,500+ acres in 2011; decreased risk of uncharacteristic wildfire that would remove habitat.
Edward Spring Vegetation Treatment	Vegetation removal and increase in early succession grassland and aspen habitat: 1,108 acres.
Paunsaugunt Vegetation Management	Habitat removal and modification in aspen stands to regenerate aspen habitat: 2,218 acres in 2012.
Sawmill Point/Baldy Ridge Aspen Improvement	Habitat removal and regeneration of aspen stands on 894 acres in 2011.
Midway-Deer Valley Scenery	Habitat removal, including spruce, aspen, and meadow; treatments include 600 acres in 2008, 400 acres in 2009, and 200 acres in 2010.

Project	Potential Impacts to Fish and Wildlife Resources
Enhancement and Vegetation Treatment	
Pretty Tree Bench Fire Treatments	Would enhance elk and deer winter range.
Stump Springs Fire Treatments	Habitat removal: 5,400 acres over 9 years; decreased risk of uncharacteristic wildfire that would remove habitat.
Dipping Vat Habitat Improvement Project	Improvement of sagebrush habitat on 1,132 acres.
John's Valley Vegetation Project	Improvement of sagebrush habitat on 2,000 acres beginning in 2012.
Mt. Dutton Vegetation Management Project	Habitat removal on approximately 870 acres, including approximately 620 acres in 2009, 200 acres in 2010, and 50 acres in 2011. Conifer and aspen trees would be established, thus creating a more diverse habitat than what existed before the outbreak.
East Fork Boulder Creek Native Trout Restoration	Impacts to non-native trout; long term would increase distribution of Colorado River cutthroat trout.
McGath Lake Dam	Reduce risk to fisheries in McGath Lake: 2008
Pockets Vegetation Management	Conifer (4,721 acres) and aspen (2,647 acres) habitat removal.
Toad Salvage	Removal of ponderosa pine trees.
UNEV Pipeline	Minor habitat disturbance due to pipeline establishment in existing ROW.

Projects in the official planning stage on BLM lands are listed below in Table 5.5-3. Minor projects in the foreseeable future not listed below include routine maintenance, range projects, minor ROW authorizations, permit renewals, wind testing projects.

Table 5.5-3 Reasonably Foreseeable Future Actions on the BLM land with the CEA

Project	Project Description	Approximate Project Location	Potential Impacts to Fish and Wildlife
Projects on BLM-administered land			
Sigurd to Red Butte Power Line Upgrade Project	Upgrade an existing power line from the Sigurd substation (6 miles northeast of Richfield) to the Red Butte substation (near Central).	BLM lands north of Pine Valley Ranger District	Would remove some wildlife habitat within the 150-foot ROW
Upper Kanab Creek Project	Within the upper Kanab Creek watershed, reduce hazardous fuels, restore sagebrush, increase plant species diversity, enhance habitat conditions for mule deer and sagebrush-obligates, and decrease pinyon-juniper encroachment. Project Area	BLM lands south of Cedar City and Powell Ranger Districts	Would remove some habitat for forest-dependent species; long term habitat enhancement for sagebrush obligates and mule deer;

Project	Project Description	Approximate Project Location	Potential Impacts to Fish and Wildlife
	includes 90,000 total acres of BLM lands.		
Alton Sage Grouse Habitat Project	Restore sage-grouse movement corridors by mechanical vegetation treatments and seeding. Project Area includes 400 acres of BLM lands predominantly pinyon-juniper/sagebrush	BLM lands south of Alton	Long-term enhancement of sagebrush habitat, also beneficial impacts to mule deer.
Shinob Kibe Riparian Treatment	Removal of salt cedar and planting of desirable riparian and upland species on 24 acres along the Virgin River floodplain.	BLM lands near Washington, Utah	Long-term improvement of riparian habitat for Virgin River chub, woundfin, Virgin spinedace, southwestern willow flycatcher, and yellow-billed cuckoo

5.5.3 Cumulative Effects by Alternative

Cumulative impacts to migratory birds, including raptors, could be minor to moderate under Alternatives B, C, D, and E. Cumulative impacts to native fishes and other aquatic species could be moderate under Alternatives D and E (see Sections 5.5.3.4, 5.5.3.5, 5.5.3.6, and 5.5.3.7). Hybrid sport fish and smallmouth bass are unlikely to be affected by oil and gas because they are confined to reservoirs and controlled through stocking by UDWR (see Section 4.6 for impacts to salmonid sport fish, i.e., MIS trout). There would be no cumulative impacts to these species.

5.5.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects to fish or wildlife.

5.5.3.2 Alternative B

Cumulative impacts may occur to migratory birds, due to habitat losses from connected actions. Past and present habitat losses from all activities discussed in Section 4.5.5.2 have led to declines in migratory bird populations (Parrish et al. 2002) and human-caused disturbances and degradation of habitats are considered the greatest threat to migratory bird populations (USFWS 2002c). Further declines due to connected actions on oil and gas leases would lead to cumulative impacts to migratory bird populations at a landscape scale; however, oil and gas leasing would be in compliance with the Migratory Bird Treaty Act for all connected actions. Cumulative impacts may occur because high value migratory bird habitats in Utah are currently in jeopardy due to past human disturbances and degradation. These cumulative impacts from connected actions would be minor. Cumulative impacts would be short to long term depending on the duration of the disturbance and whether restoration of the habitat is successful in the short term (less than 10 years).

The potential for effects to streams would be eliminated under Alternative B by the application of a NL option to a 300-foot buffer around streams, lakes, reservoirs, and springs and a NSO stipulation to a 500-foot buffer around these resources. Due to these stipulations, impacts to

aquatic species under Alternative B would be negligible and there would be no cumulative impacts.

5.5.3.3 Alternative C

As under Alternative B, cumulative impacts may occur to migratory birds due to habitat losses.

The potential for effects to streams would be low under Alternative C due to NSO stipulations applied in a 300-foot buffer around streams, lakes, reservoirs, and springs and a 500ft. buffer around all streams with fisheries habitat. Stream crossings and seismic activities would be allowed within these buffers, but not in fisheries Habitat. Seismic exploration would not affect aquatic species, and road crossings could result in detrimental effects to native, non-sensitive fishes (in streams not within fisheries Habitat) if sediment were introduced. These impacts would not lead to cumulative impacts to aquatic species, however, because the amount of sediment that may be introduced by a crossing would not be of sufficient magnitude to affect the aquatic habitat when past, present, and foreseeable future impacts are considered.

5.5.3.4 Alternative D1 (NSO in IRAs)

As under Alternative B, cumulative impacts may occur to migratory birds due to habitat losses.

Cumulative impacts to aquatic species would be possible under Alternative D with NSO in IRAs. Major indirect impacts to aquatic species are possible under Alternative D due to the risk of a hazardous substance spill or accident, sedimentation, or stream crossings in the vicinity of or within a stream during drilling activities. Considering the amount of past and present disturbances to streams in the CEA, and the general lack of aquatic habitat in the CEA outside of the Dixie National Forest, a spill event within a stream on the Forest could lead to a measurable cumulative impact to aquatic species because the amount of suitable aquatic habitat is limited in the region. Cumulative impacts to aquatic species could be long term because restoration and mitigation efforts in aquatic habitat are often difficult and not effective at restoring the habitat to its original condition. Successful restoration efforts can take more than ten years, thus impacts to aquatic habitats, including Blue Ribbon Fisheries, could be long term. Impacts to aquatic species would be minor to moderate, depending on the location and extent of the degradation of aquatic habitat. In some areas, populations of aquatic species could be affected by a loss of habitat on the Dixie National Forest and cumulative impacts would be moderate considering the high value of aquatic habitat on the Forest in the context of the CEA.

5.5.3.5 Alternative D2 (CSU in IRAs)

As under Alternative B, cumulative impacts may occur to migratory birds due to habitat losses. The protection of stream, lakes, reservoirs, and springs could be the same as under SLT. As described under Alternative D with NSO in IRAs, cumulative impacts to aquatic species could be minor to moderate and long term with fewer acres protected under NSO than under Alternative D1.

5.5.3.6 Alternative E1 (NSO in IRAs)

Cumulative impacts may occur to migratory birds due to habitat losses. As described under Alternative D with NSO in IRAs, cumulative impacts to aquatic species could be minor to moderate and long term.

5.5.3.7 Alternative E2 (SLT in IRAs)

As under Alternative E with NSO in IRAs, cumulative impacts may occur to migratory birds due to habitat losses. As described under Alternative D with NSO in IRAs, cumulative impacts to aquatic species could be minor to moderate and long term. There would be fewer acres protected under NSO for this alternative than E1.

Table 5.5-4 Summary of Cumulative Effects for Fish and Wildlife

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Development on private lands, fires, and the spread of invasive plants has occurred on the Pine Valley Ranger District. Sanford, Sequoia fires have degraded some streams. Degradation of riparian and aquatic habitats has occurred from grazing, fires, and recreation (see Specialist Report 8.0).	Vegetation treatments are in progress to improve fish and wildlife habitats. Trout are being reintroduced to burned aquatic habitat (Specialist Report 6.0) and other native fish populations are recovering.	Population growth (and development) and the spread of invasive plants are expected to increase in the foreseeable future. Vegetation treatments designed to improve fish wildlife habitat including chaining of shrubs and pinyon/juniper, and rehabilitation of riparian areas are expected to continue at current levels in the foreseeable future.	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts to fish or wildlife as a result of oil and gas activity.	There would be no cumulative effects under Alternative A.
			Alternative B Overlapping NL options would prevent direct disturbance to fish or wildlife habitat in most areas (70%). NSO would prevent permanent disturbance to habitat on (20%) of the forest. Connected actions could still occur on CSU lands (4%). No impacts to aquatic habitats.	Cumulative impacts to migratory birds are possible (habitat loss). These impacts could be moderate and long term.
			Alternative C NSO would prevent permanent disturbance to fish or wildlife habitat in most areas (76%; includes areas within IRAs). Direct and indirect impacts from seismic activities could occur in most habitats. Only crossing disturbances could occur in aquatic habitats.	Cumulative impacts to migratory birds would be the same as described under Alternative B.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative D1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 41% of the forest, which includes all IRAs. Most fish or wildlife habitat would be covered by CSU or TL. Disturbances could occur in aquatic habitats.	Cumulative impacts to migratory birds would be the same as described under Alternative B. Cumulative impacts to aquatic species are possible. These impacts, if they occurred, would be long term and minor to moderate.
			Alternative D2 (CSU in IRAs) NSO would cover 9% of the Forest. Other areas of the forest would be largely available for lease and impacts from connected actions: 80% of the forest is CSU or TL. Disturbances could occur in aquatic habitats.	Cumulative impacts would be the same as under Alternative D1. However, fewer acres would be protected under NSO than D1.
			Alternative E1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 35% of the forest. Connected actions could occur elsewhere, including all aquatic habitats.	Cumulative impacts to migratory birds are possible from habitat losses. Cumulative impacts to aquatic species are possible. These impacts, if they occurred, would be long term and minor to moderate.
			Alternative E2 (SLT in IRAs) Direct disturbance from connected actions could occur anywhere on the forest, including all aquatic habitats.	Cumulative impacts would be the same as under Alternative E1. However, fewer acres would be protected under NSO than E1.

5.6 Special Status Species

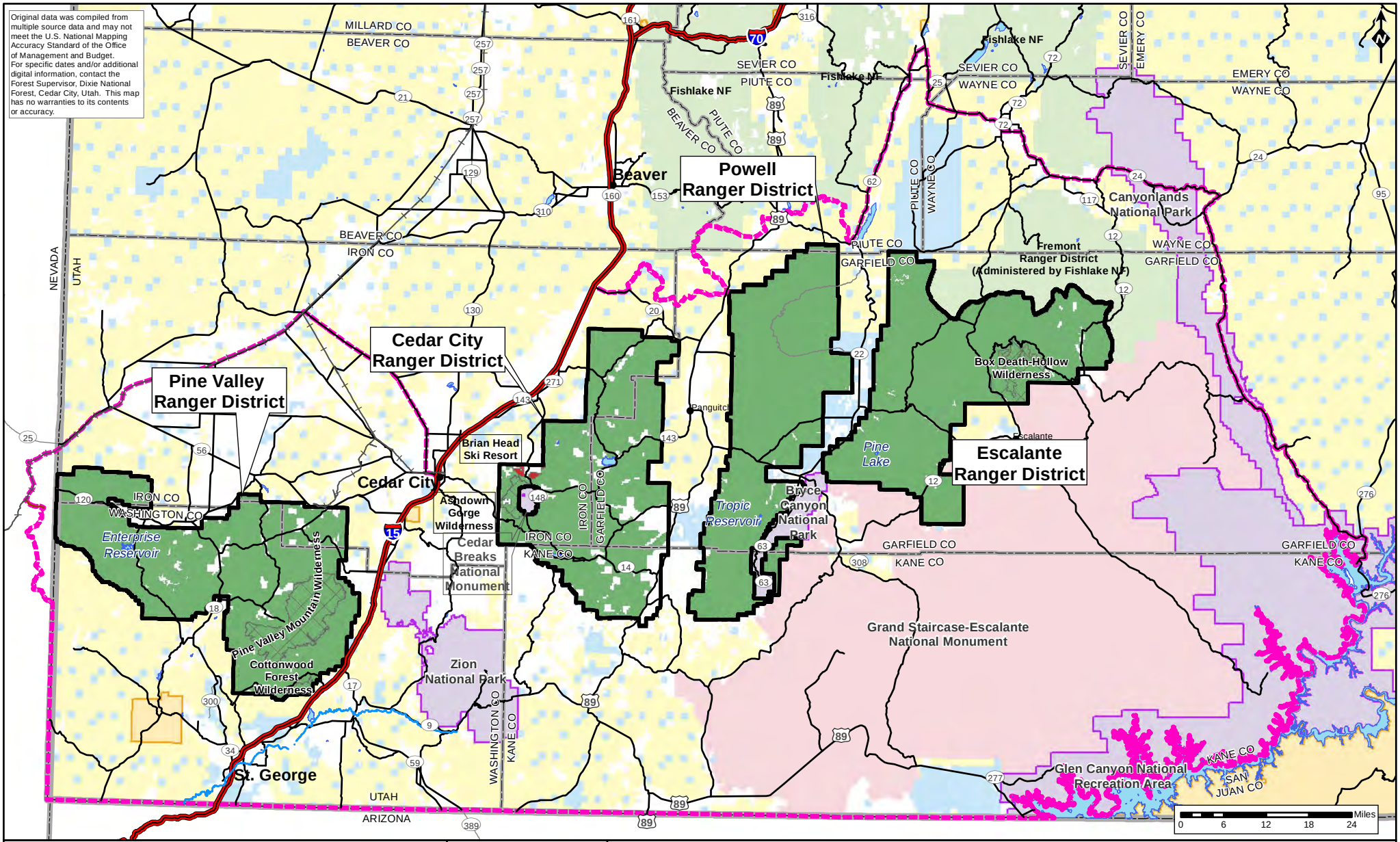
5.6.1 Description of Cumulative Effects Area

The CEA for Special Status Species includes all 6th level HUC subwatersheds occurring on the Dixie National Forest that are within the following boundaries: north of the Virgin River, east of the Union Pacific rail line located west of the Utah-Nevada border, south and east of US Highway 56 and Desert Mount Road, east of Interstate 15 north of Cedar City, and south and west of US Highway 12 on the Fremont River Ranger District. The CEA would also include areas of Designated Critical Habitat units that fall outside the Dixie National Forest boundary. These include the CP-12 unit for Mexican spotted owls (overlaps Escalante Ranger District) and Ash Creek (including the 300-ft buffer) from the boundary of the Pine Valley Ranger District to the La Verkin Creek confluence. The CEA would also include the full extent of all big game hunt units (Wildlife Management Units) located on the Dixie National Forest. No data exists for one of the subwatersheds on the west side of the Pine Valley Ranger District and a buffer was created by extending a boundary west from the nearest subwatershed (Nephi Draw HUC 160300061301) along an existing dirt road to its intersection with the Union Pacific rail line at Brown, Nevada. These boundaries were placed on the 6th level subwatersheds due to the presence of several subwatersheds that covered only very small portions of the Dixie National Forest, but extended long distances from the Dixie National Forest boundary. The portions of these watersheds eliminated are likely beyond the extent of any cumulative effects.

Lands within the CEA (Figure 5.6-1) are managed primarily by the BLM (45% of the CEA), 50 percent of which is the Grand Staircase Escalante National Monument (23% of the CEA). Twenty three percent of lands in the CEA are managed by the Dixie National Forest. Fifteen percent of the CEA is private land, ten percent in National Park Service (Cedar Breaks National Monument, Zion National Park, Bryce Canyon National Park, Canyonlands National Park, Glen Canyon National Recreation Area), and six percent is state land with five percent SITLA (remaining one percent state land includes state parks and wildlife reserves). Actions within the CEA are discussed within the various BLM districts (Richfield, Kanab, Cedar City, or St. George) and the GSENM or the Dixie National Forest since these areas make up the majority of the CEA.

5.6.1.1 Rationale

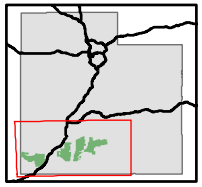
The 6th Level HUC subwatershed level was chosen as the CEA for Sensitive species and MIS because Sensitive and MIS fish discussed in this Specialist Report are unlikely to migrate beyond these boundaries. Sensitive and MIS fish are also unlikely to migrate beyond the artificial boundary placed on several of the subwatersheds due to the distance these subwatersheds extend and a general lack of large streams in these subwatersheds. The subwatershed level would cover all terrestrial wildlife movements with the exceptions of some elk and mule deer, migratory birds, and possibly migratory sage grouse populations and northern goshawk. Regarding elk and mule deer, by including the full extent of all big game hunt units most movements would occur within the CEA. This area was selected because it represents the area in which the species evaluated occur during spring, summer, fall and winter. Migratory species are not covered in this analysis because it is unknown where they go during the winter months, therefore oil and gas activities are not likely to impact these species during this time period. Including critical habitat units within the CEA for TEC species allows for evaluation of cumulative impacts in relation to specific recovery goals for endangered and threatened species.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 5.6-1
Cumulative Effects Area for Special Status Species

1 in = 18 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Includes extent of all Wildlife Management Units (Utah Division of Wildlife Resources) that intersect the Dixie National Forest and 6th-level HUCS.

5.6.2 Past, Present, and Reasonably Foreseeable Future Actions

As discussed in Section 5.5.2, natural disturbance and human activity has impacted habitat for species such as greater sage-grouse, goshawks, flammulated owls, and three-toed woodpeckers. BLM lands in the CEA have been affected by increasing OHV use and fire and may be affected in the foreseeable future if some of the many oil and gas leases are developed. Past and present management activities on public lands (USFS and BLM, including the Grand Staircase-Escalante National Monument, and National Park Service) continue to impact habitat by removing vegetation and altering vegetation communities by changing species composition. Recently, SITLA lands have been managed for fire rehabilitation, OHV access and closures, sage grouse habitat protection, noxious weed control, grazing management, and energy development (SITLA 2007). In general, private lands are assumed to be in various stages of increasing development, but may contain substantial amounts of MIS or Sensitive species habitat such as for big game, sage grouse, or MIS trout.

Many riparian areas in the CEA have been degraded by management and other activities. This has resulted in lowered water tables, eroded stream channels, invasive plant encroachment, removal of beaver populations, increased water temperatures, concentrated runoff, increased sediment from road construction, and changes in upland vegetation density and composition. Impacts to riparian and wetland areas on the Dixie National Forest are discussed in Section 5.7. MIS and sensitive trout, and boreal toads have been affected by the changes to riparian habitats, primarily by increased sediment levels from erosion where riparian vegetation has been altered or removed. Boreal toads in the CEA have likely been impacted by the removal of beaver populations and possibly by the infestation of chytrid fungus. Sensitive trout species have become isolated in headwater streams on the Dixie National Forest due to habitat loss from impacts such as fire and sedimentation, in addition to exotic species introductions and water diversions. BLM and other lands (i.e., private) in the CEA contains little to no habitat for sensitive trout. The desired future expansion of cutthroat trout would therefore occur on National Forest lands. Other MIS trout species can be found on many lands in the CEA, including rainbow and brown trout on BLM land (Beaver Dam Wash, Slaughter Creek, Mammoth Creek, Parowan Creek, Boulder Creek, Calf Creek, and Deer Creek) and brown, brook, rainbow, and cutthroat trout in several stream reaches on private lands (e.g., Santa Clara River at Pine Valley, Blue Springs Creek, Mammoth Creek, Panguitch Creek, Parowan Creek, East Fork Sevier River, Boulder Creek near Boulder, and portions of Deer Creek).

The following management activities have the largest impacts on special status species: fragmentation from roads and development, livestock grazing, vegetation changes, uncharacteristic fire, management responses to insect outbreaks and timber harvest, recreation, water diversions, noxious weed infestations, and mining/mineral exploration. While impacts in the CEA continue to occur, many of the activities listed have decreased or become better managed in recent years on federally-administered lands as the importance of overall ecosystem health has been recognized. The past and present levels of each type of activity on the Dixie National Forest and the expected level of future activity are presented in Section 5.1.2.1. This section describes the general impacts to special status species that have resulted and any activity on lands other than the Dixie National Forest.

DEVELOPMENT, POPULATION GROWTH, AND ROADS

As described in Section 5.1.2.1, the human population is increasing in southern Utah. Development is occurring both within the Dixie National Forest boundary and on private land. Twenty eight percent of private land on the CEA is within municipalities. In general, roads,

power lines, pipelines, and other developments remove vegetation, fragment habitat, and increase the potential for noxious weed invasion by creating permanently disturbed areas. Private lands within the Forest fragment wildlife habitat if they are developed, and developments within the Forest are assumed to be increasing. Conversion of lands to agriculture in the CEA generally reduces native shrub vegetation and decreases the amount of habitat available to sage grouse, pygmy rabbit, and big game (winter range). Agriculture development contributes to fragmentation as well as habitat loss (Bosworth 2003). Cannonville, Henrieville, and Tropic are within Mexican spotted owl Critical Habitat; however, fragmentation is not considered a major threat to this species.

The construction of roads in close proximity to streams has altered the structure and function of these areas within the CEA as described for general fish and wildlife in Section 5.5.2. See Table 5.5-1 in Section 5.5-2 for the miles of Forest Service routes that have the potential to, or are currently impacting aquatic habitat and that may affect MIS and Sensitive trout species.

Big game are also affected by road density because they move long distances between seasonal ranges and barriers such as roads can force stressed individuals with limited reserves to take alternate (i.e., longer) routes. Road density is currently high in many areas of the CEA, particularly the Cedar City Ranger District of the Dixie National Forest where some summer range occurs. According to UDWR (2003), winter range (for mule deer) in the CEA needs "improvement" mainly in the areas north of the Escalante Ranger District and between the Cedar City and Powell Ranger Districts. The area between the Cedar City and Powell Ranger Districts also contains areas with high road density that may be contributing to the decline in quality of this winter range. Implementation of route rehabilitation from Duck Swains and the MTP decision is expected to bring road density closer to Forest Plan direction.

LIVESTOCK GRAZING

Grazing on the Dixie National Forest is discussed in Section 5.1.2.1. On all BLM-administered lands, including the Grand Staircase-Escalante National Monument, grazing is allowed and is intended to be managed in accordance with BLM guidelines to protect the watershed, aquatic habitat, and water quality, and move toward or maintain properly functioning condition (BLM 1999a). Grazing on the Grand Staircase-Escalante National Monument, on surrounding BLM, and on the Dixie National Forest is managed according to Utah Standards of Rangeland Health.

In general, grazing can change the composition, structure, and function of vegetation, which can adversely affect special status animal and plant species. For Utah prairie dog, the impacts of grazing on grassland habitats are not clearly adverse or beneficial (USFWS 2007b). Grazing has also altered the species composition of grass, forb, and shrub layers of aspen forests that make up goshawk foraging habitat (Reynolds et al. 1992). Many sensitive plants, particularly those that do not occur on limestone or sandstone formations, such as sensitive paintbrushes and several *Penstemon spp.* on the Dixie National Forest, are palatable to domestic livestock and wild ungulates and have been directly affected by grazing (Rodriguez 2008).

Grazing has affected sagebrush-dependent species in the CEA such as sage-grouse and pygmy rabbit, by directly removing or modifying habitat. Livestock grazing is the most widespread land use across the sagebrush biome, and most sagebrush habitats have been grazed in the past century (Connelly et al. 2004). Grazing is one of several factors that have contributed to the degradation of sagebrush steppe through conversion to pinyon juniper (Bosworth 2003) and cheatgrass or other exotic species infestations in the CEA. Adverse impacts to sagebrush habitat from grazing can occur through 1) grazing below Forest Plan

standards that depletes the grass and forb understory, tramples soils, and disrupts macrobiotic crust cover, 2) invasions of exotic plants (due to loss of understory, altered soils, loss of macrobiotic crusts, etc), particularly cheatgrass, 3) increased fire intensity and frequency, 4) reduced water infiltration, 5) increased soil erosion (Connelly et al. 2004). Dynamics of sagebrush communities are complex, and plant species' response to grazing may not be predictable. Grazing can alter water and nutrient availability, soils, and vegetation past thresholds to which the system can return, such that some vegetation community states may be irreversible. Regarding management, assumptions about current vegetation communities vs. community 'ideal' states may not be accurate, and conversely, releasing vegetation communities from grazing may have no or unpredictable results, such as exacerbating the influence of exotic plants such as cheatgrass. For these reasons, the impacts of grazing on sagebrush habitats are unclear.

VEGETATION CHANGES

Vegetation changes on the Dixie National Forest are described in Section 5.1.2.1. These changes reduce the habitat available for Utah prairie dogs, sage grouse, pygmy rabbit, and big game (winter range). A decline in aspen to conifer encroachment has reduced the available habitat for elk, goshawk, and three-toed woodpecker, although the sensitive bird species can also use conifers. An increase in conifers has generally increased the nesting substrate available to sensitive raptors and woodpeckers. Vegetation restoration treatments on the Grand Staircase-Escalante National Monument are expected to cover approximately 20,000 acres over the next 15 years (BLM 1999a).

FIRE, SPRUCE BEETLE OUTBREAKS, AND TIMBER HARVEST

The role of fire on the Dixie National Forest is discussed in Section 5.1.2.1. In riparian areas, large, severe fires remove vegetation that provided cover and shade over streams as well as an infiltration barrier to protect against sedimentation and flood events. The Sanford Fire and Sequoia Fire (Powell and Pine Valley Ranger Districts, Dixie National Forest) that occurred in 2002 and 2004 resulted in a collapse of trout populations in Cottonwood Creek, Deep Creek, and Deer Creek watersheds on the Powell, and Upper Ash Creek tributaries on the Pine Valley Ranger District that are now in various stages of recovery after reintroductions of Bonneville cutthroat trout. Because native Bonneville and Colorado River cutthroat trout are limited to isolated headwater drainages, the risk of losing individual populations during extreme fire and flood events has increased. On the Grand Staircase-Escalante National Monument (BLM), fires have played a smaller role in the shaping of the landscape and there is little suppression activity (BLM 1999a). On the Richfield BLM District, there has been a spike in fire frequency over the past ten years.

The large-scale mortality of spruce due to bark beetle infestations on the Dixie National Forest (see Timber Harvest in Section 5.1.2.1) has contributed to reduced habitat for sensitive raptors (i.e., goshawk, flammulated owl) and three-toed woodpecker. For some sensitive species such as three-toed woodpecker, the death of large stands of spruce has increased the number of available snags and forage opportunities in the short-term. For Mexican spotted owl, fires and timber harvests within the National Forest remove foraging habitat. Potential nesting areas (i.e., steep walled canyons) on the Dixie National Forest have undergone less change than areas more accessible to timber harvest and other uses. On the Grand Staircase-Escalante National Monument, the potential for large fires that would remove foraging habitat is minimal (BLM 1999a).

INVASIVE AND NON-NATIVE PLANTS

The trend in invasive and nonnative plant introduction on the Dixie National Forest is discussed in Section 5.1.2.1. Cheatgrass is a serious problem being addressed on the Richfield BLM District and has contributed to the increased fire frequency in addition to the loss of desert scrub, sagebrush, and grasslands. The BLM, including the Grand Staircase-Escalante National Monument, works cooperatively with local governments and private landowners to identify and control invasive plants. Many MIS and Sensitive species in the CEA have been affected by the spread of invasive plants, which are often less nutritious and less functional than natives as part of wildlife habitats. Invasive plants usually deplete soil and water resources more quickly and aggressively than native plants, thus out-competing them, and reducing the diversity of the vegetation, which tends to diminish the value of wildlife habitats in general. Declines in range conditions have been attributed to weed invasions, among other factors, and have affected pygmy rabbit, sage grouse, and big game (winter range) habitats.

The impact to aquatic habitats due to the introduction of invasive plants is discussed for general fish and wildlife in Section 5.5.2. The introduction and establishment of exotic fish species has also affected fish in the CEA, particularly sensitive trout species on the Dixie National Forest. The presence of exotic fish species is one of the factors that have forced salmonids, including sensitive cutthroat trout, into isolated headwater drainages and left species more susceptible to extinction (Rieman et al. 1993). The introduction and establishment of non-native fish species also reduces the suitability of the small amount of remaining habitat for the woundfin and Virgin River chub. There are 10 known introduced fish species; however, the red shiner (*Cyprinella lutrensis*) and the black bullhead (*Ameiurus melas*) are the most abundant. Red shiners compete with woundfin for food and habitat, and possibly feed on woundfin larvae, and are both competitor and predator of Virgin River chub.

RECREATION

The levels and types of recreation (including OHV use) on the Dixie National Forest are discussed in Section 5.1.2.1. Regarding special status species, OHV use, particularly cross-country travel, has resulted in direct impacts to riparian and upland vegetation as well as noxious weed introductions. OHV use in upland areas can destroy or alter vegetation, or introduce invasive plants, which degrades wildlife habitat. Sensitive plants, including yellow-white catseye (*Cryptantha ochroleuca*), wildstoe buckwheat (*Eriogonum aretioides*), Jones golden aster (*Heterotheca jonesii*), and rock tansy (*Sphaeromeria capitata)*, may be directly affected by OHV users (Rodriguez 2008). The vast majority of the Grand Staircase-Escalante National Monument area within the CEA is classified as “primitive” or “outback” zone, where motorized and mechanized access is permitted on designated routes (“outback”) or is limited to authorized users (“primitive;” BLM 1999a). OHV use on the Grand Staircase-Escalante National Monument is restricted within habitats of TEC species (BLM 1999a). Few sensitive plants discussed in this technical report occur on the Grand Staircase-Escalante National Monument or other BLM lands, thus they have generally not been affected by OHV use outside the Dixie National Forest.

Regarding Mexican spotted owl, there is currently one recreation site and 34.2 miles of trails, in addition to off-trail foot traffic, within 0.5 miles of Mexican spotted owl nesting sites that may be affecting this species on the Grand Staircase-Escalante National Monument (BLM 1999a). The designation of climbing areas is prohibited in known Mexican spotted owl nesting sites, and in established areas where spotted owls are found, seasonal closures are implemented (BLM 1999a). Over the next 15 years within the entire Grand Staircase-Escalante National

Monument, less than 100 acres of new recreation sites, including primitive camping areas, would be established (BLM 1999a).

WATER DIVERSIONS

Building of dams and associated reservoirs, water diversion structures, canals, laterals, aqueducts, and the dewatering of streams cause loss or degradation of available habitat for endangered fish. The decline in range and population numbers is due to the physical reduction in available habitats within the various river systems caused by these water projects.

Ash Creek provides a direct connection between waters of the Dixie National Forest and the habitat of endangered fishes. Land ownership within the 300-foot buffer around South Ash Creek, from the Forest boundary, to the confluence with Ash Creek and down to the confluence with La Verkin Creek, is predominantly (68%) private land and the remainder is BLM. The Toquerville and Ash Springs diversions are both municipal water diversions for La Verkin City, located just south of the town of Toquerville. Another diversion just upstream of the town of Toquerville is for the Toquerville water department. In total, the Utah Division of Water Rights has record of 36 water rights on Ash Creek, although some of these are located upstream of the South Ash Creek confluence. There are records for five water rights on South Ash Creek, with four of them for the Pintura Irrigation Company (Pintura being the closest town downstream) and one for the Washington County Water Conservancy District, which sells water to the various towns (Utah Division of Water Rights 2007). Many of these water rights are likely inactive (A.H. Rohm, Wildlife Biologist, UDWR, Personal Communication). Woundfin and Virgin River chub are threatened by habitat loss and modification, including changes in water flow regimes (USFWS 2008).

MINERALS ACTIVITY

Past and present oil and gas activity on the Dixie National Forest, including the Upper Valley oil field, is described in Section 5.1.2.1. There are currently 230 authorized leases and 65 pending leases, with a combined total lease area of 302,700 acres (UDNR 2008b), primarily on BLM lands. The larger lease clusters are to the south and north of the Cedar City Ranger District, in between the Cedar City and Powell Ranger Districts, and off the southeast corner of the Escalante Ranger District (an extension of the Upper Valley Field). Only the Upper Valley Field is currently active. The only other recent activity on these leases has been the drilling of five wildcat wells on state and private land, all of which have been plugged and abandoned (UDNR 2008a). While the lease acreage is not reflective of potential surface disturbance area, it may be likely that the larger lease areas and the lease clusters may eventually have a greater area of surface disturbance than a smaller, isolated lease. Further, it can be assumed that similar types of impacts as are described for on-Forest leases could occur on these leases as well.

Refer to Section 5.5.2 for information on BLM oil and gas development potential in the CEA.

In addition to oil and gas activity, there are currently 50 separate minerals activities, more than half of which are on BLM land surrounding the Pine Valley Ranger District. These mineral activities are all very small operations (less than five acres) and primarily target materials such as sandstone, limestone, silica, rhyolite, alabaster, and travertine (UDNR 2008b). There are a few larger mines for iron, gold, and silver; however, most of these are inactive or in some stage of reclamation. There are two larger mines proposed for the near future: the Alton Coal Hollow mine and the Iron Spring iron mine. These are discussed in Section 5.5.2.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Forest are in Table 5.1-1. The impacts of these projects to fish and wildlife are described in Table 5.5-2. The projects in the official planning stages on BLM, state, and private land are listed, and the impacts to fish and wildlife described, in Table 5.5-3. The projects and the impacts would be the same for special status species as described in these tables.

5.6.3 Cumulative Effects by Alternative

Cumulative impacts would not occur to the species (or habitat for) Virgin River chub, woundfin, California condor, or Western yellow-billed cuckoo. Regarding Virgin River chub and woundfin, minor and long-term impacts are possible under Alternative E due to the risk of stream contamination. However, these would not lead to cumulative impact because the main threats to the species involve dewatering and exotic fish competition and predation. Regarding California condor, cumulative impacts would not result from possible impacts to nesting birds because the Dixie National Forest is largely nonessential habitat for the condor and is at the margins of its range. Regarding Western yellow-billed cuckoo, cumulative impacts would not result for similar reasons: habitat on the Dixie National Forest is marginal for the species, thus any impacts within the Dixie National Forest from oil and gas would not register a measurable impact considering the current threats to the species and that its main range occurs south of the forest.

Cumulative impacts may occur to MIS and sensitive trout species or to sensitive plants as a result of connected actions from oil and gas leasing. Cumulative impacts are less likely but may still occur to other MIS or Sensitive species, including sensitive bats, big game, sensitive raptors, sage grouse, or three-toed woodpecker. Individual raptors, bats, or sage grouse could be affected by oil and gas activities that remove habitat or create disturbances that disrupt behavior, and populations of these sensitive species could be affected in the context of past, present, and foreseeable future threats to persistence. Because many populations of sensitive plants, and populations of sensitive trout, on the Dixie National Forest are small and isolated on the Forest and are found in few other locations, affects to persistence are more immediate and could be caused by one or a few oil and gas disturbances on the Dixie National Forest. Cumulative impacts to these species are the most likely to occur, although cumulative impacts to all Sensitive species are measurable in this analysis.

5.6.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.6.3.2 Alternative B

There would be no cumulative impacts to TEC species under Alternative B because oil and gas activities would have mostly negligible impacts. Likewise, there would be no cumulative effects to any MIS or Sensitive species because direct and indirect impacts from oil and gas activities would be negligible or minor.

5.6.3.3 Alternative C

Under Alternative C (and D and E), there would be cumulative impacts to big game. Within the CEA, existing road density and road density increases in the foreseeable future are impacts to security and other functions of suitable big game range. A further increase in road density

associated with oil and gas developments under Alternative C could diminish the effectiveness of remaining habitat areas that currently provide isolation from human disturbances (e.g., traffic, poaching, general human presence) that are essential to big game persistence. An increase in road density from oil and gas activity in the context of road density within the CEA would be a cumulative impact to big game. This impact could be long term if roads are associated with a production well, as roads would probably last for longer than ten years. Cumulative impacts would be minor to moderate, depending on where the roads occur: impacts could be moderate if road density increases in a critical habitat area (such as high value winter range) that currently provides enough isolation to be suitable but that has been impacted in the past by roads. If this area were to become unsuitable for big game then cumulative impacts could be moderate.

5.6.3.4 Alternative D1 (NSO in IRAs)

Cumulative impacts to Mexican spotted owl would be possible under this alternative. Regarding Mexican spotted owl, considering current and foreseeable future impacts in the Escalante Ranger District from oil and gas developments, vegetation changes, and increasing use for recreation, an extended noise disturbance from oil and gas activities would lead to a measurable cumulative impact on this species that would be short term and minor. Impacts would be minor because nesting Mexican spotted owls have not been confirmed on the Dixie National Forest; oil and gas developments would lead to a cumulative impact due to the loss of potential nesting habitat that is relatively isolated from human disturbances (including noise). Cumulative impacts to Mexican spotted owls would be short term because extended noise disturbances would (most likely) last less than one year.

Cumulative impacts to sage grouse may occur due to fragmentation caused by oil and gas; sage grouse move relatively long distances over land between seasonal ranges, and oil and gas disturbances may contribute to the general discontinuity of sage grouse habitat that has been occurring and is expected to continue in the foreseeable future. In addition, roads and other linear disturbances provide movement corridors for animal predators and recreationists that directly reduce sage grouse numbers and habitat, respectively. Thus fragmentation in the context of current and foreseeable adverse habitat modifications would be a cumulative impact to sage grouse; this impact could be long term and moderate in most locations. Impacts would be long term if a production well were developed in sage grouse habitat. Impacts would be moderate if a production well occurred in the vicinity of a lek or blocked a movement corridor. If a production field occurred within a vast expanse of sage-grouse habitat, such as John's Valley, Boulder Top, or the Aquarius Plateau, then cumulative impacts to sage-grouse would be major.

Cumulative impacts to MIS and sensitive fish would be possible under Alternative D1 because road crossings are allowed in Fisheries Habitat. If road crossings are improperly installed, they can pose a barrier to trout populations or otherwise affect fish habitat on the Dixie National Forest. Because sensitive fish populations are currently isolated on the Forest, connected actions to oil and gas leasing could have cumulative impacts to the species by isolating populations to the point that persistence of the species could be threatened. MIS and Sensitive fish are also affected by sedimentation, increased water temperature (from shade/vegetation removal), and dewatering that can be directly or indirectly caused by the installation and removal of stream crossings. These impacts, if they occurred, would reduce the amount of suitable habitat for trout on the Dixie National Forest. Cumulative impacts to MIS and sensitive fish could be moderate and long term. Long-term impacts to aquatic habitat are possible because restoration and mitigation efforts in aquatic habitat are often difficult and not effective at restoring the habitat to its original condition. Successful restoration efforts can take more than ten years, thus impacts to aquatic habitats could be long term. Impacts could be moderate if a

portion of aquatic habitat on the Dixie National Forest is no longer suitable for trout, because the Dixie National Forest contains the best and most valuable trout habitat in the CEA and trout have few options elsewhere (i.e., on BLM, state, or private lands). Thus, a loss of habitat on the Dixie National Forest would be more adverse in the context of the CEA, in which habitat on the Forest is essential to the persistence of MIS and Sensitive trout species.

Cumulative impacts to big game would be as described under Alternative C.

Cumulative impacts to sensitive plants would be possible under Alternative D1 because SLT stipulations may not be sufficient to avoid partial disturbance of a sensitive plant population. Many sensitive plants occurring on the Dixie National Forest are endemic to or isolated within a small area, thus a loss of a substantial number of individuals in one area could affect the persistence of a sensitive plant species. Cumulative impacts to sensitive plants could be moderate, because the persistence of sensitive plant species could be threatened by oil and gas activities and long term because sensitive plant populations of most species tend to be present in very few areas and most are not likely to recover in numbers within ten years if disturbed.

5.6.3.5 Alternative D2 (CSU in IRAs)

Cumulative impacts to Mexican spotted owl would be possible under this alternative, and would be of greater magnitude than under Alternative D1. A substantial habitat loss in a PAC or Critical Habitat would be a possibility under this alternative that could lead to additional cumulative impacts to what would be caused by noise. Habitat losses would result in long term and minor cumulative impacts to this species.

Cumulative impacts to sage grouse, MIS and sensitive fish, big game, and sensitive plants would be these same as described for Alternative D1. However, there would be fewer acres protected under NSO for this alternative, relative to D1.

5.6.3.6 Alternative E1 (NSO in IRAs)

Cumulative effects would be the same as described for Alternative D1, with the exception of Utah prairie dog. Considering the past losses of Utah prairie dog habitat and unsuccessful reintroduction program, cumulative impacts to Utah prairie dog could occur under this alternative as a result of impacts from an exploration or production well development permitted within a Utah prairie dog colony area. Impacts would be long term, because habitat would probably not be suitable for a prairie dog colony after reclamation, and minor to moderate, depending on the extent of the disturbance. Cumulative impacts could be moderate if a colony area was removed and prairie dogs were relocated. Cumulative impacts would be minor if habitat within a colony area was removed and prairie dogs were not directly affected.

Cumulative impacts to sensitive raptors would be possible under Alternative E1. Considering past, present, and foreseeable future habitat losses to sensitive raptors, connected actions on oil and gas leases may lead to cumulative impacts if a substantial number of any sensitive raptor species fails to successfully reproduce due to nest abandonment as a result of oil and gas disturbances. In the context of past, present, and foreseeable future habitat losses and modification, including from the increasing levels of timber harvest due to insect outbreaks and fire, and encroachment of recreational activities into raptor habitat, the failure of sensitive raptors to reproduce in the remaining suitable habitat could lead to a cumulative impact. Impacts would be short term because displaced raptors would find alternate sites the following

year, and would be minor because the viability of raptor species would not be threatened by oil and gas activities.

Cumulative impacts to sensitive bats and pygmy rabbit would also be possible under Alternative E1. Considering past, present, and foreseeable future disturbances to sensitive bat habitat, further removal of roosting or foraging habitat due to a production field development in the vicinity of a roost or completely within foraging habitat would constitute a cumulative impact to sensitive bats that would be short term and minor. Pygmy rabbit habitat is also decreasing due to the conversion of sagebrush to pinyon-juniper and the influx of invasive grasses, thus a large disturbance of sagebrush habitat for a production field under Alternative E1 could lead to a cumulative impact on pygmy rabbit. Cumulative impacts to both species would be short term and minor. Impacts to both species would likely be short term because habitats could be restored within ten years.

Cumulative impacts to sage grouse, MIS and sensitive fish, big game, and sensitive plants would be these same as described for Alternative D1.

5.6.3.7 Alternative E2 (SLT in IRAs)

For Mexican spotted owl, cumulative effects are likely to occur under this alternative and would be the same as described for Alternative D2. Cumulative impacts to Utah prairie dogs would be the same as under Alternative E1.

Cumulative impacts to sage grouse, MIS and sensitive fish, big game, and sensitive plants would be these same as described for Alternative D1. Cumulative impacts to sensitive raptors, sensitive bats, and pygmy rabbits would be as described under Alternative E1. However, there would be fewer acres protected under NSO for this alternative, relative to E2.

Table 5.6-1 Summary of Cumulative Effects for Special Status Species

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Past grazing, fire suppression, and spruce beetle outbreaks have led to the death of large stands of spruce fir. The greatest impacts have occurred in forests on the Cedar City and Powell Ranger Districts. Development on private lands, fires, and the spread of invasive plants has occurred on the Pine Valley Ranger District. Fires have degraded aquatic habitat for sensitive and MIS fish.	Vegetation treatments are in progress to improve wildlife habitats. Bonneville cutthroat trout populations are showing signs of recovery in degraded streams where they have been introduced.	Population growth (and development) and the spread of invasive plants are expected to increase in the foreseeable future. Vegetation treatments designed to improve wildlife habitat including chaining of shrubs and pinyon-juniper, are expected to continue at current levels in the foreseeable future. Introductions of Bonneville cutthroat trout in degraded streams would continue.	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts to special status species' habitat as a result of oil and gas activity.	There would be no cumulative effects under Alternative A.
			Alternative B Overlapping NL options would prevent direct disturbance to habitat in most areas (75%). NSO would prevent permanent disturbance to habitat on (20%) of the forest. Connected actions could still occur on CSU lands (4%).	There would be no cumulative effects under Alternative B.
			Alternative C NSO would prevent permanent disturbance to special status species' habitat in most areas (76%; includes areas within IRAs). Direct and indirect impacts from seismic activities could occur in most habitats.	Cumulative effects could occur as a result of oil and gas activity in areas degraded by past and future management activities. Specifically, cumulative impacts could occur to big game as a result of increased road density; this cumulative impact could be long term and moderate.
			Alternative D1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 33% of the forest, which includes all IRAs. Most special status species' habitat would be covered by CSU or TL.	Cumulative impacts to big game would be as described under Alternative C. Cumulative impacts to sage grouse could occur due to fragmentation and could be long term and moderate, or major within the largest expanses of sagebrush habitat. Cumulative impacts to sensitive plants could occur if part of a plant population were disturbed; these impacts could be moderate and long term. Cumulative impacts would also be possible to Mexican spotted owl due to noise. These impacts would be short term and minor.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative D2 (CSU in IRAs) NSO would cover 8% of the Forest. Other areas of the forest would be largely available for lease and impacts from connected actions: 80% of the forest is CSU or TL.	Cumulative impacts to spotted owl would be more adverse than under Alternative D with CSU in IRAs, due to possible habitat losses in addition to noise: cumulative impacts would be long term and minor. Cumulative impacts to Sensitive species and MIS would be as described under Alternative D with NSO in IRAs.
			Alternative E1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 33% of the forest. Connected actions could occur elsewhere.	Cumulative impacts to Mexican spotted owl would be the same as under Alternative D with NSO in IRAs. Cumulative impacts to Utah prairie dog would be possible due to habitat losses: impacts would be long term and minor to moderate. Cumulative impacts to sage grouse, MIS and sensitive fish, big game, and sensitive plants would be as described under Alternative D with NSO in IRAs. Cumulative impacts to raptors could occur if a substantial amount of nest abandonment was caused by oil and gas activities; these cumulative impacts would be short term and minor. Cumulative impacts to pygmy rabbit and sensitive bats could also occur if a production field occurred in suitable habitat for either species. Cumulative impacts to pygmy rabbit and bats would be short term and minor.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative E2 (SLT in IRAs) Direct disturbance from connected actions could occur anywhere on the forest, including all Critical Habitat and other special status species' habitat areas.	Cumulative impacts to Mexican spotted owl would be the same as under Alternative D with CSU in IRAs. Cumulative impacts to Utah prairie dog would be the same as under Alternative E with NSO in IRAs: long term and minor to moderate. Cumulative impacts to raptors, pygmy rabbit, and sensitive bats would be as described under Alternative E with NSO in IRAs. Cumulative impacts to sage grouse, MIS and sensitive fish, big game, and sensitive plants would be as described under Alternative D with NSO in IRAs.

5.7 Water and Watershed Resources

5.7.1 Description of Cumulative Effects Area

The CEA for water and watershed resources is the same CEA as for Fish and Wildlife. See Section 5.5.1 for a description and Figure 5.5-1 for a map of the CEA. Table 5.7-1 shows the land ownership within the CEA boundaries.

Table 5.7-1 Land Ownership within the Water and Watershed Cumulative Effects Area

Land Ownership	Acres	Percent of Total CEA
Bureau of Land Management (BLM)	1,000,286	28
National Park Service	40,357	1
Private	560,731	16
State Lands[1]	174,904	5
Forest Service	1,835,470	50
Water	2,907	<1
Total	**3,614,656**	**100**

[1]Includes: State Park (Nevada): 2,025 acres, State Parks and Recreation: 8,994 acres, State Trust Land: 156,955, and State Wildlife Reserve/Management Area: 6,931

5.7.1.1 Rationale

The 6th level HUC subwatershed was chosen to incorporate any impacts of oil and gas activity that could be transmitted downstream of the Dixie National Forest boundary and, in combination with off-Forest activities, result in larger impacts. Impacts to water and watershed resources from oil and gas activity are not expected to be of a magnitude large enough to be transmitted beyond the 6th level HUC subwatershed and a larger CEA does not appear justified. Also, the subwatershed boundaries that were limited by the roadways were eliminated due to the distance they extended beyond the Forest boundary and impacts are not likely to extend beyond the boundaries created. Further, assuming that all available environmental protection measures are applied correctly and that accidental events do not occur, the predicted water and watershed resources impacts should be confined to within the Dixie National Forest boundaries.

5.7.2 Past, Present, and Reasonably Foreseeable Future Actions

As shown in Table 5.7-1, approximately one-half of the CEA is National Forest land and about one-half is other lands (predominantly private and BLM). However, in regard to water and watershed resources (as measured both by quantity and by importance), National Forest lands dominate the CEA. Their position within the higher elevation, greater precipitation zone of the CEA means that Dixie National Forest lands capture, store, and release water that supports not only their proximate ecosystems, but many off-Forest ecosystems and human uses as well. For example, the 15 municipal water systems on the Dixie National Forest serve as the only (or predominant) source of culinary water for the 28 municipalities within the CEA. Thus, degradation of a water source on the Dixie National Forest may literally have a greater impact to a community outside the Forests' boundaries than degradation of a stream adjacent to - or within - the community itself. When dealing with watersheds and stream networks, the conditions at a specific point in the watershed are usually a result of local conditions at that site combined with conditions in the upstream portions of the watershed. Conditions in the lower reaches of a watershed, however, do not necessarily have an effect on upstream reaches. As noted in USFS (2006g) "it will be a continuing challenge to retain sufficient water for healthy

watersheds, streams, aquatic species, wildlife, and vegetation, while also providing water for the needs of local communities and traditional rural activities." For this reason, in the analysis of cumulative effects, the past, present, and reasonably foreseeable actions on the Dixie National Forest have a proportionally greater focus than off-Forest actions.

In addition, the potential for impacts to water resources as a result of connected actions associated with oil and gas leasing is related more to degrading water quality than to reducing water quantity. In earlier sections of this Specialist Report, potential water quality degradation was attributed to two types of occurrences related to oil and gas leasing or production: sedimentation due to surface disturbances and vegetation removal, soil compaction, and drainage pattern alteration; and isolated introduction of pollutants such as hydrocarbons or chemicals due to accidental spills. Only the former is realistically relevant to cumulative effects analysis; while the latter may represent an impact that could be locally significant, it would be limited in duration and unlikely to exacerbate or be exacerbated by other similar simultaneous impacts that would result in a cumulative effect. For this reason, past, present, and reasonably foreseeable actions that can result in erosion and sedimentation, and thus contribute to increased sediment yields in a given watershed, represent the bulk of actions discussed in this section.

In-stream sedimentation can result from various sources, activities, and land uses. Upland erosion due to generally poor watershed condition (such as due to forest fires, poorly managed timber cutting, or overgrazing) can introduce sediments via overland flow or storm runoff, as well as from mass movements due to slope destabilization. Direct surface disturbances related to industrial or construction activities (such as roads, well pads, mines, or subdivisions) often result in ground compaction and drainage pattern alteration, which in turn increase flow velocities and sediment transport capacities. Stream alterations (such as culverts, road realignments, or irrigation diversion structures) can affect a channel's stability and result in in-channel erosion that transports sediments downstream. Agriculture can also degrade water quality by introducing sediments through poor tillage practices and ill-managed irrigation systems.

Compared to historic conditions (late 1800s and early 1900s), watershed conditions have improved on many parts of the Dixie National Forest and on lands now managed by the BLM. However, recent past and present management activities have continued to impact watershed conditions. Past and present impacts to watershed resources, which in turn, relate to water quality include: road systems in riparian and wetland areas; livestock grazing of upland and riparian areas; developed and dispersed recreation – notably off-road vehicle use; water diversions and dams; uncharacteristic fire; timber harvest; and minerals activity (including oil and gas exploration and development; USFS 2009c). These activities are described in Section 5.1.2.1 for the Dixie National Forest. Note that road system impacts and off-road vehicle use impacts will be minimized through implementation of the MTP (USFS 2009c). The section below presents information relevant to water and watershed resources that was not included in Section 5.1.2.1. These activities also occur on off-Forest lands, notably on both private and BLM-administered lands, but less so on state lands within the CEA as those are predominantly associated with State Parks. Activities that occur predominantly on private lands and that can threaten water resources include agriculture and expanding municipalities.

ROADS

The construction of roads in close proximity to streams, including within wetland and riparian areas, has occurred in the past, and is still occurring in the present, within the CEA. Roads can alter the structure and function of watershed resources and channel surface water runoff directly

into streams, water that would normally travel slowly or diffusely through the watershed. Roads can also alter channel morphology due to culvert placement and straightening. The result is that sediment inputs to streams are high in some areas, which can further destabilize channels and in-turn increase sediments. Overall, as described in Section 4.7.4.6, roads represent one of the greatest sources of impacts to water quality. General information regarding roads on the Dixie National Forest is provided in Section 5.1.2.1. Table 5.7-2 shows the miles of Forest Service routes that have the potential to, or are impacting watershed resources.

Table 5.7-2 Miles of Forest Service Routes Impacting Watershed Resources.

Route Impacts[1]	Miles of Forest Service Routes			
	Pine Valley	Cedar City	Powell	Escalante
Route presents a high risk to soil and water resources	206.5	44.9	65.5	189.1
Route presents a moderate risk to soil and water resources	135.7	329.3	360.6	362.3
Route impacts stream channels, floodplains, wetlands, or riparian areas	385.1	346.9	152.8	478.0
Route crosses riparian areas	111.3	210.6	164.3	276.4
Route is in riparian areas (within banks or high water mark)	67.00	146.0	105.1	48.00
Route is within ½-mile of a riparian area	185.2	174.6	416.3	515.8
Route is within a stream channel		2.2		
Routes with stream crossing	640.5	591.7	682.7	604.3
Routes within wetlands		2.6		0.7
Routes within 200 feet of streams	700.7	670.1	815.8	710.2

Source: Dixie National Forest Route Analysis Database

[1] Motorized Travel Plan implementation (see USFS 2009c) will close some routes that are negatively impacting soil, water, and wildlife resources, and/or are not needed for future resource management activities.

Similar details on road/stream relationships are not readily available for the non-Forest portions of the CEA: however, a simple measure of road density can provide some indication about the potential for roads as a whole to impact watershed resources. This is based upon the assumption that the greater the network of roads in a watershed area (all else being the same), the greater the likelihood of channel alteration, sedimentation, etc. Throughout the CEA, there are numerous HUC 6 watershed areas with an Open Motorized Road Density (OMRD) of two miles/square mile or greater: notably these include off-Forest lands to the north of the Pine Valley Ranger District, much of the southern 2/3 of the Cedar City Ranger District, and a significant part of the Escalante Ranger District. An OMRD of two miles/square mile would also be considered high when considering road effects on a watershed. On the Escalante Ranger District, roads and recreation use on Carcass and Pleasant Creeks have impacted riparian

areas and led to stream channel widening (USFS 2004c). In addition to road density, soil type, slope steepness, geology, and other aspects of a watershed are also related to potential impacts from roads.

In recent years, some roads and trails within the Dixie National Forest have been relocated away from streams or have been obliterated. The Duck Creek – Swains Access Management Project is one project designed to lessen the impact of roads on riparian areas. This project along with the implementation of the MTP in 2009 is closing or decommissioning unneeded roads, which will potentially decrease the adverse affects to water resources. Further, in recent years, the Forest Service has placed more focus on proper road placement, design, and maintenance, all with an eye towards reducing impacts to water resources.

However, similar efforts to relocate or obliterate roads outside the Dixie National Forest boundary have not occurred, with one exception possibly being within the Grand Staircase-Escalante National Monument, where the BLM plans to implement road closure projects in the future, as funding permits. While off-Forest roads are also currently likely better managed and subject to more thought toward environmental considerations prior to construction than in the past, their numbers are increasing; more roads are constructed than are obliterated. This generally means than, in the CEA, there is an increasing network of roads and a generally increasing road density. One exception would be within the St. George Field Office, BLM where there are three wilderness study areas (Cougar Canyon, Red Mountain, and Cottonwood Creek; note the former two areas were added to the National Wilderness Preservation System by the 2009 Omnibus Public Land Management Act) that are at least partially within the CEA (BLM 1999a). Road construction in these areas would not be likely.

Ongoing road maintenance, repair, construction, and reconstruction occur in various locations throughout the CEA. For example, Bryce Canyon National Park's Tropic Canyon highway rehabilitation project involves repairing a bridge damaged by flood events. In addition, a 50-foot bridge will be constructed across Ash Creek north of Pintura as part of a road project, and will involve a significant amount of fill material to construct the bridge abutments. These types of projects often involve at least some ground disturbance, with consequent erosion; usually they are subject to sediment control practices that are intended to minimize off-site impacts. When such impacts occur, they are usually short term and decrease following construction. These types of projects can also correct poor drainage and actually improve water quality. An example of this would be the Cottonwood Wash Road (located within the Grand Staircase-Escalante National Monument and within the boundaries of the CEA), which is restricted by the BLM's management plan to maintenance for stabilization to prevent erosion and sediment loading in drainages (BLM 1999a).

Within the CEA, the impacts of roads are likely to slightly decrease in the future due to the increased awareness of the importance of maintaining stream stability quality and water quality.

LIVESTOCK GRAZING

Grazing on the Dixie National Forest is described in Section 5.1.2.1. This includes moderate impacts to watershed resources, particularly riparian areas. For example, in 2005 and 2006 only 64 and 65 percent of riparian sites sampled, respectively, attained the current Forest standards and guidelines, which are to maintain at least 70-percent of the linear distance of all riparian ecosystems in at least an upper mid-seral successional stage (USFS 2005a, 2006c). The result of over-utilization of riparian ecosystems by grazing livestock is a reduction in plant cover, decreased streambank stability, and increased soil compaction, which can decrease

surface water infiltration, increase surface water runoff, and changes in stream channel morphology (USFS 1995a). The result can be increased sediment loads and channel instability (USFS 1995a). In some areas of the Dixie National Forest, grazing activities have contributed to the conversion of riparian vegetation from the typical deep-rooted, hydric vegetation to less desirable species such as Kentucky bluegrass (USFS 2006c). Grazing also occurs on all other BLM-managed land within the CEA and is expected to continue at present levels (BLM 2008b). Impacts of grazing on riparian areas on some portions of BLM land have had similar impacts as described for the Dixie National Forest (BLM 2008b). Also, on the Grand Staircase-Escalante National Monument, grazing is currently being managed with consideration given to ensuring that water quality standards are being met (BLM 1999a). Grazing also occurs on private lands within the CEA, and may have higher levels of impacts due to a lack of oversight and monitoring.

DISPERSED RECREATION

Dispersed recreation activities, particularly camping and OHV use that is concentrated along riparian areas, can remove riparian vegetation, compact soils, and create roads and trails that interrupt flow patterns and increase sediment delivery to stream channels. Within the entire CEA, OHV use has recently experienced a dramatic increase and is likely to continue to increase (BLM 2008a, 2008b). However, in many areas of the CEA, it is anticipated that travel management projects will lead to decreased impacts as discussed for the Dixie National Forest in Section 5.1.2.1. Within the Grand Staircase-Escalante National Monument, OHV use is already limited to designated routes (BLM 1999b) and the proposed RMP (BLM 2008a) for BLM land administered by the Kanab Field Office (most areas in between and to the south of the Cedar City and Powell Ranger Districts) would similarly limit OHV use. There are also areas closed to motorized use such as on the three WSAs south of the Pine Valley Ranger District. However, there are also many areas within the CEA where cross-country motorized travel is not restricted, including private land, state land, and much of the BLM land not mentioned above. Also, regarding other types of dispersed recreation (i.e., camping); much of the CEA (including federal, state, and private land) is open to such use without regulation. Exceptions are the Grand Staircase-Escalante National Monument, which regulates all dispersed recreation.

WATER DIVERSIONS

See Section 5.1.2.1.

FIRE

Wildfire can occur over entire watersheds or over significant portions of them, and result in impacts to water quality. The fire regime of the Dixie National Forest is discussed in Section 5.1.2.1. It highlights the increased frequency of large, severe fires, which is also true for BLM land within the CEA. Large, severe fires remove vegetation and decrease infiltration rates increasing overland flow and erosion, as well as large mass movements such as debris flows, which can remove or bury riparian vegetation, alter floodplain surfaces, and alter channel morphology (Dwire and Kauffman 2003, Wondzell and King 2003). For example, the Sanford Fire that occurred in 2002 has resulted in changes to channel morphology and riparian vegetation in the Cottonwood Creek, Deep Creek, Deer Creek, and Sanford Creek watersheds (USFS 2004e).

As mentioned in Section 5.1.2.1, the use of prescribed fire is also expected to increase in the future. Because of the low intensity of prescribed fires, and the ability of riparian and wetland vegetation to recover quickly following fire, most prescribed burns have very minor, short-term effects on watershed resources (Dwire and Kauffman 2003, Wondzell and King 2003). Further,

an increase in the number of prescribed fires and mechanical fuel treatments should ultimately lead to a decrease in the number of large, uncharacteristic fires.

TIMBER HARVESTING

Within the CEA, the majority of timber harvest occurs on the Dixie National Forest as most BLM, private, and state lands are in lower elevation areas dominated by pinyon-juniper woodlands. Timber harvest on BLM, state, and private lands would be limited to fuelwood (green or dead and down) harvesting, post cutting, and Christmas tree cutting. However, on the Cedar City Field Office, BLM, there are also numerous planned thinning and fuels treatment projects (see Table 5.7-3). Timber harvest on the Dixie National Forest is summarized in Section 5.1.2.1.

MINERALS ACTIVITY

The past, present, and future minerals activity, including oil and gas activity, is described for the CEA in Section 5.5.2. The largest future developments are the Alton Coal Hollow Project and the Iron Mountain iron mine. All mines, coal and iron, are regulated to ensure that excessive erosion does not occur, that stream water quality standards are met, and that the land is ultimately reclaimed; however, there is likelihood of some occasional or short-term sediment loading in the streams within the affected watersheds.

OTHER ACTIVITIES THAT CAN AFFECT WATER QUALITY

Within private lands of the CEA, agriculture is the dominant land use (over about 502,000 acres) outside of the municipalities (about 58,000 acres). As municipalities grow, some agricultural land is being converted to subdivisions; this is expected to continue into the future. While agriculture can increase sediment loads and salinity in streams, construction activities and increased runoff rates due to development likely represent greater impacts to water quality, at least on a per-area basis.

Aside from specific land management practices or activities, water quality can also be affected by geology. A specific mention of this is given the *Kanab Field Office Resource Management Plan and Final Environmental Impact Statement* (BLM 2008a), which states that, generally, as water moves downstream and is diverted and used, water quality deteriorates due to natural sedimentation from highly erosive substrates and anthropogenic non-point sources, and increased salinity levels. This likely applies to many other areas within the CEA, as well.

One measure of how land uses, specific activities, and perhaps natural pollutant sources affect water quality is the State of Utah's 303(d) list. As described in Section 5.7.2 above, streams and lakes that the state considers impaired, and thus not able to meet their designated beneficial uses, are reported on this list, which is updated every other year. Within the CEA, there are several stream reaches on the current (2006) list:

- Escalante River and some tributaries from Boulder Creek confluence to Birch Creek confluence (temperature);
- Paria River from start of gorge to headwaters, and Paria River and tributaries from the Arizona-Utah State line to Cottonwood Creek confluence (TDS);
- Virgin River and tributaries from Santa Clara River confluence to Quail Creek Diversion, excluding Quail and Leeks Creeks (TDS);
- Sevier River and tributaries from Long Canal to Mammoth Creek confluence, Sevier River and east side tributaries from Horse Valley Bridge diversion upstream to Long

Canal, and Sevier River and tributaries from Circleville Irrigation Diversion to Horse Valley Diversion (total phosphorus and sediment); and

- East Fork Sevier River and tributaries from Sevier River to Antimony Creek confluence excluding Otter Creek and tributaries (total phosphorus and temperature).

Most relevant to this discussion of cumulative impacts is 303(d)-listed segments that are impaired due to sediment concentrations, because that is the parameter that is most likely to be exacerbated by oil and gas activities. As indicated in the above list, certain reaches of the Sevier River and selected tributaries are the only streams currently impaired for sediments within the CEA. This area is located within the east side of the Cedar City Ranger District, the west side of the Powell Ranger District, and the land between the two.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Dixie National Forest are listed in Table 5.1-1. The majority of the projects listed would involve surface disturbance and could increase erosion. Some projects, however, would improve conditions. For example, the motorized travel planning would eliminate cross-country travel by OHVs, which would reduce erosion potential. Table 5.5-3 lists projects in the official planning stages on BLM, state, and private land that may affect water and watershed resources. The overall impact of all projects in the table would be surface disturbance and vegetation removal, which can increase erosion.

5.7.3 Cumulative Effects by Alternative

5.7.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.7.3.2 Alternative B

The potential for cumulative effects to water and watershed resource would be reduced under Alternative B by the application of a NL option to a 300-foot buffer and a NSO stipulation to a 500-foot buffer around these resources. Seismic exploration could occur in the buffered areas between the 300-foot and 500-foot zones, but it is not expected to produce disturbance sufficient to contribute to cumulative effects. However, adverse cumulative effects could occur from the construction of roads, exploratory well pads, and particularly a production field in upland areas if these facilities are constructed in areas that have been impacted by past wildfires or in areas that may be impacted by future timber harvest or vegetation management. These effects would primarily be associated with the increased potential for erosion in these areas. Large fires and timber harvest can reduce the ability of precipitation to infiltrate and increase surface water runoff and erosion (Wondzell and King 2003). Building roads, well pads, and production fields in these areas would exacerbate the problem as these facilities also have the potential to reduce natural infiltration and channel surface water runoff.

Areas that may be susceptible to these types of cumulative effects are the Cottonwood, Deep, and Deer creek watersheds (Powell Ranger District) that were impacted by the Sanford Fire in 2002; the area to be affected by the Clayton Salvage Project (Escalante Ranger District); the Antimony Creek watershed that will be affected by the Pockets Vegetation Management Project (Escalante Ranger District); and the area to be affected by the Midway-Deer Valley Scenery Enhancement and Vegetation Treatment Program (Cedar City Ranger District). Further, adverse cumulative effects could occur from the construction of roads, exploratory well pads,

and particularly a production field in upland areas if these facilities are constructed in areas that have an already high drainage density, such as in the southern 2/3 of the Cedar City Ranger District and a significant part of the Escalante Ranger District. Through the application of the BMPs in Appendix C and BLM and USFS (2007), the cumulative impacts would remain in the range of minor to moderate. Impacts would be short term for exploration activities and long term for production facilities.

Other management activities such as livestock grazing, dispersed recreation, and water developments are not expected to be of a magnitude sufficient to result in cumulative effects to water resources when combined with the effects of oil and gas activity in upland areas, except perhaps in those watershed areas which drain to the portions of the Sevier River and tributaries that are listed for sediment impairment on the State's 303(d) list. Overall, due to the restrictions on locating oil and gas activity, the level of cumulative impact is probably minimal.

5.7.3.3 Alternative C

The NSO stipulation applied to the 300-foot buffer around streams, lakes, reservoirs, and springs under this Alternative would limit the likelihood of oil and gas activity directly contributing to cumulative effects, though less so than under Alternative B because of a narrower stream buffer width and perpendicular stream crossings being allowed within a portion of these buffers. Further, seismic exploration could occur in all the buffered areas. If stream crossings are properly designed, constructed, and maintained the amount of sediment introduced should also be negligible. However, given the surface disturbance required for the construction of a stream crossing (i.e., bridge construction and culvert placement) and the presence of a road in close proximity to the stream, the potential exists for the introduction of measurable amounts of sediment. Further, if the area impacted by road and bridge construction is subjected to future heavy grazing or is open to dispersed recreational use, the impacted area may be slow to re-vegetate following reclamation (for an exploratory well) or post-construction stabilization (for a production field). Increases in sediment delivery and bank erosion can result in adverse impacts to stream channels and water quality as described in Section 4.7.4.6. Given the BMPs listed in Appendix C, these impacts would be relatively minor and short term for roads associated with exploratory wells.

For a production field, the impacts may range from minor to moderate and be long term due to the length of time that roads would be present. For example, the longer the roads are present, the greater the likelihood of an event such as a severe fire occurring in the area, which would exacerbate erosion problems.

Under Alternative C, there is also the potential for cumulative effects if oil and gas activities occur in adjacent areas impacted by the management activities described in Section 5.7.2. As the amount of disturbance in adjacent areas would be the same as for Alternative B, the types of potential cumulative effects to wetlands, stream channels, floodplains, and riparian areas would be similar as described for Alternative B. However, given the narrower buffer under Alternative C, disturbance in upland areas has the potential to be located closer to wetlands, stream channels, floodplains, and riparian areas than under Alternative B. As a result, the potential for impacts to watershed resources is increased.

5.7.3.4 Alternative D1 (NSO in IRAs)

NSO applied to IRAs would prevent disturbance on 41 percent of wetlands, stream channels, floodplains, and riparian areas on the Dixie National Forest. As a result, there would be no cumulative effects resulting from disturbance directly related to oil and gas activity in these

areas. Direct disturbance to these resources not within IRAs and would consist of seismic exploration and the potential for spills due to the possibility of having oil gas facilities in increased proximity to these resources. Mechanical disturbance would be prohibited, which eliminates the potential for sediment related impacts in areas that have high road densities (these areas are described in Section 5.7.3.2) or have been degraded by grazing, dispersed recreation, or fire. As a result, the impacts would be minor and short-term as described for Alternative C.

5.7.3.5 Alternative D2 (CSU in IRAs)

Under this alternative, 13 percent of the buffered areas created for the protection of water and watershed resources would be off limits to oil and gas development (six percent would not be available for leasing and seven percent would be under NSO). The remainder of these areas would be available for leasing under CSU. Overall, potential cumulative effects under this alternative would be similar as described for Alternative D1; however, given the lesser amount of water and watershed resource components that would be under NSO, the potential for cumulative effects would be greatly increased.

5.7.3.6 Alternative E1 (NSO in IRAs)

Direct disturbance to water and watershed resources could occur in areas not within IRAs and would consist of seismic exploration, construction and reconstruction of roads, exploratory well pads and associated facilities, and production wells with their associated facilities. The construction and reconstruction of roads presents the greatest potential for cumulative impacts to water and watershed resources if construction occurs in areas that have high road densities (these areas are described in Section 5.7.3.2) or have been degraded by grazing, dispersed recreation, or fire. Furthermore, areas developed for oil and gas have an increased probability of being subjected to additional future degradation. For example, Dwire and Kaufman (2003) indicate that riparian areas are more susceptible to long-term degradation by wildfire if impacted by past human disturbance. Overall, these processes would produce cumulative effects to water quality primarily by increasing the potential for erosion and sediment deposition. Cumulative effects to wetlands and riparian areas would be more associated with the additive effect of vegetation removal, which would alter the structural integrity of these areas, and the alteration of flow paths due to roads. The impacts of altered drainage patterns on these areas are described in Section 4.7.4.6. Taken together, impacts may range from minor to major depending upon the location and amount of oil and gas activity. For example, a single exploratory well or a small amount of roads within a degraded area may only have minor cumulative impacts, but a production field or multiple wells with their associated roads would have major impacts. Impacts would be both short term and long term.

5.7.3.7 Alternative E2 (SLT in IRAs)

The cumulative effects under this alternative would be the same as described for Alternative E1.

Table 5.7-3 Summary of Cumulative Effects for Water and Watershed Resources

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Road construction and dispersed recreation in wetland and riparian areas has resulted in reduced function of these resources and increase in sediment in some locations on the Forest and impacts are likely the same in much of the CEA. Livestock grazing and fire have impacted wetland and riparian areas on the Forest. Livestock grazing is prevalent in all of the CEA. These activities have reduced the ability of the soil to naturally absorb precipitation in upland areas. The result is an increase susceptibility to additional disturbance.	The impacts of roads, grazing, development, and dispersed recreation continue to occur in many areas within the CEA.	The impacts of dispersed recreation should remain about the same. Road impacts would decrease with implementation of MTP. Grazing impacts should lessen slightly with improved management. The frequency of large, severe fires is likely to increase in the future. Several projects have the potential to impact watershed resources in the future including several timber harvests.	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts to wetlands, stream channels, floodplains, and riparian areas as a result of oil and gas activity.	There would be no cumulative effects of oil and gas activity due to the lack of direct and indirect effects.
			Alternative B NL and NSO leasing options would prevent direct disturbance to water and watershed resources.	Cumulative effects could occur as a result of oil and gas activity in upland areas degraded by past and future management activities. Impacts would range from minor to moderate.
			Alternative C NL and NSO stipulations would prevent most direct disturbance to water and watershed resources. However, perpendicular road crossings could occur on a portion of the designated buffers.	Cumulative effects could occur as a result of road crossings if they occur in areas with high road densities or in areas previously degraded by livestock grazing or fire. Impacts would be mostly minor and both long and short term Cumulative effects could also occur as a result of oil and gas activity in degraded upland areas as described for Alternative B.
			Alternative D1 (NSO in IRAs) NSO would prevent most direct disturbance in 41 percent of the buffered areas. Direct disturbance could occur in the remainder of the buffered areas under CSU. NSO would prevent impacts to lava fields over sensitive aquifers.	Cumulative effects would be the same as described for Alternative C.
			Alternative D2 (CSU in IRAs) Direct disturbance could occur in all but 13% of the buffered areas. NSO would prevent impacts to lava fields over sensitive aquifers	Cumulative effects would be the same as described for Alternative D2.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative E1 (NSO in IRAs) NSO would prevent most direct disturbance in 36 percent of the buffered areas. Direct disturbance could occur in the remainder of the buffered areas available for leasing.	Cumulative effects could occur both as result of direct disturbance in wetlands, stream channels, floodplains, and riparian areas, but also from disturbance in adjacent areas. The impacts would range from minor to major. Cumulative effects could also occur as a result of oil and gas activity in degraded upland areas as described for Alternative B.
			Alternative E2 (SLT in IRAs) Direct disturbance could occur in all buffered areas available for leasing.	Cumulative effects would be the same as described for Alternative E1.

5.8 Soils and Geologic Hazards

5.8.1 Description of Cumulative Effects Area

The CEA for soils resources is the Dixie National Forest boundary (see Figure 5.8-1).

5.8.1.1 Rationale

Impacts to soils and geology would not occur beyond the immediate area of disturbance (within the Dixie National Forest). Although hydrologic impacts to cave resources are possible outside the Dixie National Forest boundary, cumulative impacts to water resources are discussed in Section 5.7.

5.8.2 Past, Present, and Reasonably Foreseeable Future Actions

The CEA has been used for grazing, timber harvest, and small-scale mineral operations since the mid to late 1800s, while recreation is an increasingly popular use. Factors contributing to areas of soil resource degradation include poor grazing animal distribution, increased prevalence of noxious and undesirable plant species, fire suppression, activities related to road construction (both authorized and unauthorized), and drought. As these factors are described in Section 5.1.2.1, this section will only present the impacts of these activities relative to soils and geologic hazards.

ROADS

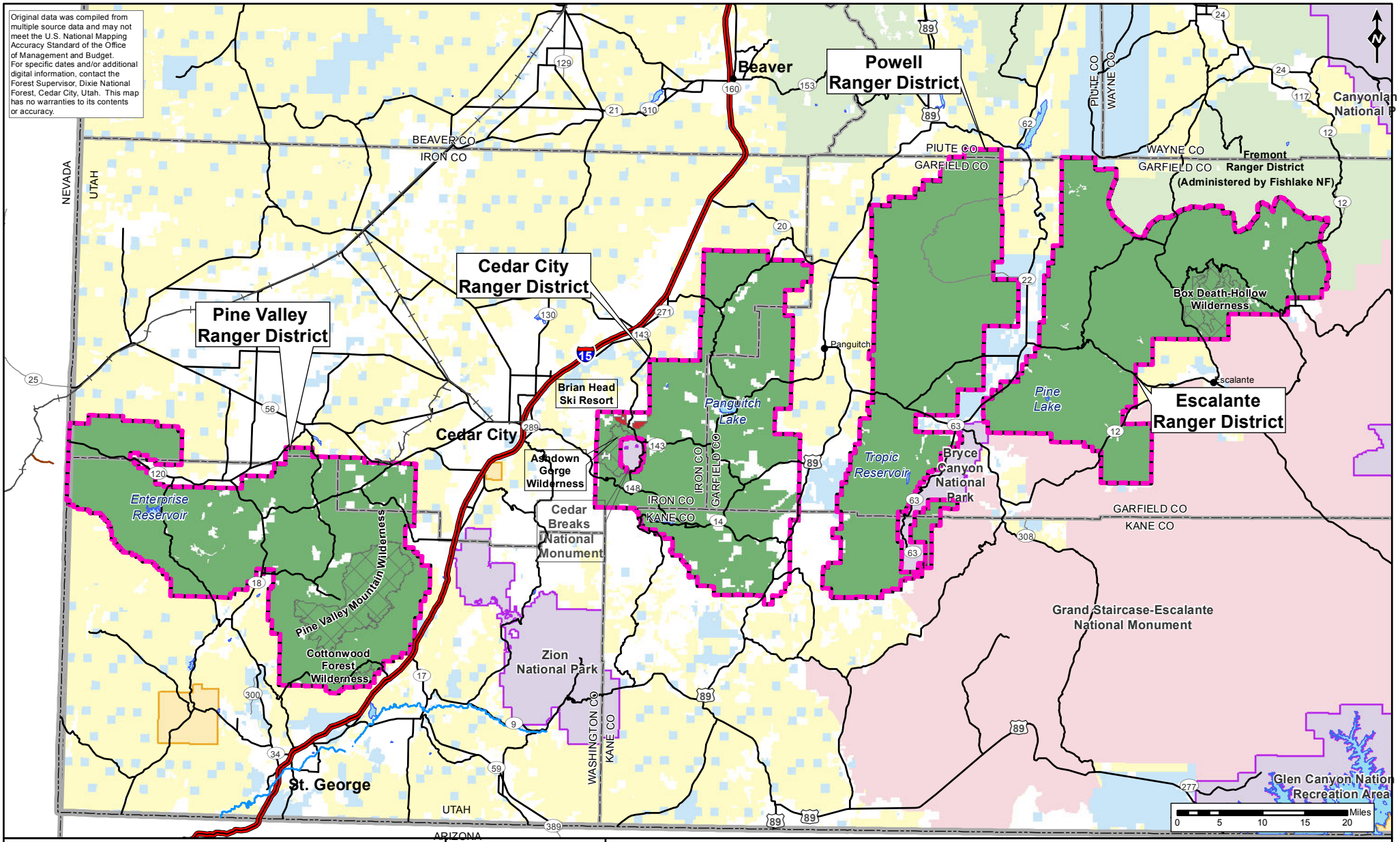
The construction of roads (described in Section 5.1.2.1) in close proximity to streams and riparian areas leads to increased erosion on sensitive and productive soils as described in Section 4.7.4.6 and 4.8.4.6. In addition, roads constructed in inherently unstable areas, such as on the North Horn or Claron formations, can increase the potential for mass failure. Roads also cause mass wasting by undercutting natural slopes where material is removed to build the road, or by overburdening slopes with heavy or overly steep road fills. Table 5.8-1 shows the miles of Forest Service routes that have the potential to, or are, impacting soil resources.

Table 5.8-1 Forest Service routes Impacting Soil Resources

Route Impacts[1]	Miles of Forest Service Routes			
	Pine Valley	Cedar City	Powell	Escalante
Routes have Soil compaction concerns				1
Routes are on areas of Erosive Soils		18		
Routes have Known Erosion Scars	30	195		
Routes Subject to Erosion Concerns	429	553	752	640
Route presents a moderate risk to soil & water resources	136	329	361	362
Route presents a high risk to soil and water resources	207	46	66	189

Source: Dixie National Forest Route Analysis Database

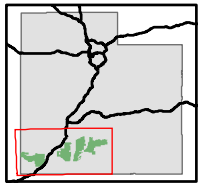
[1] Motorized Travel Plan implementation (see USFS 2009c) will close some routes that are negatively impacting soil, water, and wildlife resources, and/or are not needed for future resource management activities.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 5.8-1
Cumulative Effects Area for Soils & Geologic Resources

1 in = 15 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands

- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration

- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Includes Dixie National Forest Boundary

LIVESTOCK GRAZING

Overgrazing, as discussed in Section 5.1.2.1, led to changes in vegetation composition and erosion of soil resources on the Dixie National Forest.

FIRE

The fire regime on the Dixie National Forest is discussed in Section 5.1.2.1. As was noted in that section, the number of uncharacteristically large and severe wildfires is expected to increase. Large, severe fires remove vegetation, seal the soil surface in some cases, and increase overland flow and soil transport.

TIMBER HARVESTING

Timber harvest on the Dixie National Forest, as discussed in Section 5.1.2.1, has the potential to impact soils resources. Timber harvests expose forest soils to higher rain drop impact, reduce litter cover, increase soil temperature, often result in the construction of new roads, and skidding and transporting logs can create compacted paths and trails. These decrease soil productivity and can result in soil loss due to erosion.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Projects in the official planning stages on the Forest are listed in Table 5.1-1. Table 5.8-2 re-lists the projects with the greatest potential to impact soils and geologic hazards and describes the potential impacts from each.

Table 5.8-2 Potential Impacts to Soils and Geologic Hazards from Projects listed in Table 5.1-1

Project	Potential Impacts to Soil Resources
Dipping Vat Habitat Improvement Project	Surface disturbance, road construction, and cutting activities can cause soil compaction, increasing overland flow and erosion, leading to soil loss. Mechanical sagebrush treatment may open the vegetative canopy and increase erosion rates in the short term.
Duck Creek Fuels Treatment	Timber harvest could increase erosion rates due to road construction. Soil compaction occurs on road and staging areas, breaks down soil structure, and reduces natural infiltration. This can lead to erosion and soil loss. Constructed roads channelize overland flow and, where flow drains off of the road, lead to rilling of the soil surface or gullying if channelized flow is substantial.
Edward Spring Vegetation Treatment	Surface disturbance, road construction, and prescribed burning can cause soil compaction, increasing overland flow and erosion, leading to soil loss.
Midway-Deer Valley Scenery Enhancement and Vegetation Treatment	Surface disturbance and prescribed burning of riparian meadows can alter natural water infiltration rates, increase overland flow and erosion rates.
Mt. Dutton Vegetation Management Project	Soil compaction occurs on road and staging areas, breaks down soil structure, and reduces natural infiltration. This can lead to erosion and soil loss. Constructed roads channelize overland flow and, where flow drains off of the road, lead to rilling of the soil surface or gullying if channelized flow is substantial. Road de-commissioning would cause temporary impacts to soil during these activities, but would decrease soil effects once work was completed and vegetation was established.

Project	Potential Impacts to Soil Resources
Pine Valley Fuels Treatments	Surface disturbance, road construction, and cutting activities can increase overland flow and erosion, leading to soil loss.
Pockets Vegetation Management	Soil compaction occurs on road and staging areas, breaks down soil structure, and reduces natural infiltration. This can lead to erosion and soil loss. Constructed roads channelize overland flow, and, where flow drains off of the road, lead to rilling of the soil surface or gullying if channelized flow is substantial.
Upper Santa Clara River Vegetation and Fuels Project	Soil compaction occurs on road and staging areas, breaks down soil structure, and reduces natural infiltration. This can lead to erosion and soil loss. Constructed roads channelize overland flow, and, where flow drains off of the road, lead to rilling of the soil surface or gullying if channelized flow is substantial.

5.8.3 Cumulative Effects by Alternative

5.8.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects from new oil and gas leases.

5.8.3.2 Alternative B

Under Alternative B, NA (6 percent) and NL (70 percent) leasing options would prevent direct disturbance on 76 percent of the Dixie National Forest. Further 20 percent of the Forest would only be eligible for seismic exploration due to NSO leasing options. Adverse cumulative effects to soils and geologic hazards would be unlikely to occur under these restrictive leasing options. Cumulative effects to soils and geologic hazards would be more likely to occur on the remaining 4 percent of Forest lands that are open to full field development, including road and well pad construction.

Adverse effects of wells and pads located on sensitive soils/geologic hazards would be more likely to have cumulative effects if other past or planned activities were to occur in the same area. This would include past wildfires, future timber harvests, or other vegetation management. Areas infested with noxious weeds, or replaced by non-native vegetation, such as cheatgrass, would also be more vulnerable to cumulative effects due to poor vegetation cover, increased soil temperatures, decreased soil moisture levels, and decreased plant litter. Large fires can reduce the ability of precipitation to infiltrate and increase the rate of surface water runoff and soil loss. Building roads, well pads, and production fields in areas recently cleared of vegetation from fire, timber harvest, or other means would also increase erosion rates, compact soils, and break down soil structure.

Areas that may be susceptible to these types of cumulative effects are the Cottonwood, Deep, and Deer creek watersheds (Powell Ranger District) that were impacted by the Sanford Fire in 2002; the 13,700 acre Duck creek Fuels Treatment area (Cedar City District); the area to be affected by the Clayton Salvage Project (Escalante Ranger District); the Antimony Creek Watershed that will be affected by the Pockets Vegetation Management Project (Escalante Ranger District); the area affected by the Dipping Vat Habitat Improvement Project (Powell Ranger District); and the area to be affected by the Midway-Deer Valley Scenery Enhancement and Vegetation Treatment Program (Cedar City Ranger District). Other projects are listed in Table 5.1-1. Overall, due to the restrictions on locating oil and gas activity, the level of cumulative impact is probably minimal.

5.8.3.3 Alternative C

In regards to sensitive soils/geologic hazards, and as a result of the leasing options being assigned to these resource components being the same for both alternatives, cumulative effects under Alternative C would be the same as that described under Alternative B.

5.8.3.4 Alternative D1 (NSO in IRAs)

Cumulative effects under Alternative D with NSO in IRAs would be similar to those described under Alternative B, except that only 33 percent of the Dixie National Forest would be covered by the NSO leasing option and another 6 percent would by NA. The remaining 61 percent of the Forest would be subject to less restrictive leasing options. On these lands, 46 percent of areas with high erosion potential, 50 percent of marginally unstable soils, and all areas identified as having cave resources would be open to exploratory drilling and full-field development under the CSU leasing option. Potential cumulative effects would be as described for Alternative B. These impacts could be long term and minor in rockfall areas and on steep slopes, and could be long term and moderate on areas with high erosion potential, unstable soils, or cave resources.

5.8.3.5 Alternative D2 (CSU in IRAs)

Under this alternative, only eight percent of the Dixie National Forest would be protected under NSO; all rockfall areas and steep slopes fall under NSO. Six percent of the Forest would be NA. The remaining 86 percent of the Forest would be open to oil and gas exploration under less restrictive leasing options. Overall, the cumulative effects that could occur under this alternative would be similar to those described under Alternative B; however, given the decreased acreage of sensitive soils that would be covered by restrictive leasing options, the potential for cumulative effects would be increased. These impacts could be long term and minor in rockfall areas and on steep slopes, and could be long term and moderate on areas with high erosion potential, unstable soils, or cave resources.

5.8.3.6 Alternative E1 (NSO in IRAs)

Under this alternative, 33 percent of the Dixie National Forest is protected under NSO in IRAs. However, all sensitive soils/geologic features have some acreage open to oil and gas exploration and development. Approximately 20 percent of rockfall areas, 39 percent of steep slopes, 48 percent of areas with high erosion potential, and 53 percent of unstable soils are covered by SLT and open to full field development. Cave resources outside of IRAs are also covered by SLT. The cumulative effects that could occur under this alternative would be similar to those described under Alternative B but because there are fewer acres covered by restrictive leasing options, the potential for cumulative effects is larger than that described in Alternative D with CSU in IRAs. These impacts could be long term and moderate.

5.8.3.7 Alternative E2 (SLT in IRAs)

With the exception of steep slopes, no restrictive leasing options would be used to protect sensitive soils or geologic resources from cumulative effects. Further, the majority of the Dixie National Forest would be open to lease under SLT. Cumulative effects are thus more likely to occur under this alternative and would be similar to those described under Alternative B. These impacts could be long term and moderate in all soil types/geologic resources.

Table 5.8-3 Summary of Cumulative Effects for Soils and Geologic Hazards

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Past grazing has changed vegetation composition, compacted soils, increased overland flow, and decreased soil stability. Fire suppression has led to a buildup of fuels and the increased frequency of catastrophic fire that exposes the soil surface, allowing erosion and soil loss, and invasion of noxious weeds. Road construction in riparian areas leads to erosion and/or mass wasting when roadways are flooded.	Timber harvest, thinning, and range treatments are on-going to improve ecosystem health and reduce risks of fire and insect outbreaks. Healthy vegetation protects the soil surface from erosion. The impacts of roads and dispersed recreation continue to occur in many areas across the Forest Forests in the Escalante Ranger District are currently at risk of fire and noxious or undesirable weed infestations. AUMs were decreased from an average of 87,824 to 68,684 in 2003 due to drought	Population growth, housing and commercial development and the spread of invasive plants are expected to increase in the foreseeable future. Timber harvests, chaining of shrubs and pinyon/juniper, and prescribed fires are expected to continue at current levels in the foreseeable future. The impacts of roads and dispersed recreation (OHV use) should decrease with implementation of the Motorized Travel Planning Project. Grazing is expected to continue at current	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts to soil resources as a result of oil and gas activity.	There would be no cumulative effects under Alternative A.
			Alternative B Overlapping NL options prevent direct disturbance on 70 percent of the forest. NSO would prevent permanent disturbance to all soil types on 20 percent of the forest. Connected actions could still occur on CSU lands (4 percent). All rockfall areas, slopes greater than 35 percent, and areas with high erosion potential are NSO. Marginally unstable areas and cave resources would be CSU.	Cumulative effects could occur as a result of oil and gas activity other than seismic work in areas degraded by past and future management activities, but would be limited to marginally unstable areas or cave resources, which are CSU. Cumulative effects could occur on unstable soils or cave resource areas in burn areas or areas with significant noxious weed issues. These impacts would be long-term and moderate.
			Alternative C NSO would prevent permanent disturbance to all soil types in most areas (76 percent; includes areas within IRAs). Direct and indirect impacts from seismic activities could occur on NSO. All rockfall areas, slopes greater than 35 percent, and areas with high erosion potential would be NA, NL, or NSO. Marginally unstable areas and cave resources would be CSU in areas outside of IRAs. Within IRAs, all sensitive soils would be NSO.	Cumulative impacts to sensitive soils/geologic impacts would be same in duration and intensity as under Alternative B. These impacts could be long term and minor.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Noxious weeds do not protect the soil as effectively as native plants	conditions.	levels for the foreseeable future.	**Alternative D1 (NSO in IRAs)** NSO would prevent disturbance from connected actions (except seismic) in 33 percent of the forest, which includes all IRAs. Exploration and development could occur on the remainder of the forest, although 6 percent would be NA. All rockfall areas and slopes greater than 35 percent would be NA, NL, or NSO. Marginally unstable areas and cave resources would be CSU in areas outside of IRAs. Within IRAs, all sensitive soils would be NSO.	Cumulative impacts to sensitive soils/geologic hazards would be the same in duration and intensity as under Alternative B and C although, in addition to unstable soils and cave resources, areas with high erosion potential would also be susceptible to cumulative effects in Alternative D. These impacts could be long term and minor in rockfall areas and on steep slopes, and could be long term and moderate on areas with high erosion potential, unstable soils, or cave resources.
			Alternative D2 (CSU in IRAs) NSO would cover 8 percent of the Forest, including rockfall areas and steep slopes. Other areas of the forest would be largely available for lease and impacts from connected actions: 80 percent of the forest is CSU. Marginally unstable areas and cave resources would be CSU	Cumulative impacts to sensitive soils/geologic hazards would be similar to Alternative D with NSO in IRAs except that more areas of high erosion potential and unstable soils would be under CSU and thus more area would be susceptible to cumulative effects. Since the location of cave resources is unknown at this time it is not possible to determine if these areas would be more at risk than under previous Alternatives. These impacts could be long term and minor in rockfall areas and on steep slopes, and could be long term and moderate on areas with high erosion potential, unstable soils, or cave resources.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative E1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 33 percent of the forest in areas designated as IRAs. Connected actions could occur elsewhere, including all sensitive soils/geologic features.	Cumulative effects to sensitive soils/geologic hazards would include those that may occur under Alternatives B, C, and D (both alternatives), and in addition would include areas of rockfall and steep slopes because 71 percent and 56 percent of the acres open to SLT leasing in these soil types. These impacts could be long term and moderate in all soil types/geologic resources.
			Alternative E2 (SLT in IRAs) Direct disturbance from connected actions could occur anywhere on the forest, including within RNAs and on all sensitive soils/geologic hazards.	Cumulative effects to sensitive soils/geologic hazards could occur on all acres of these sensitive areas. Up to 17,206 acres of rockfall areas, 382,441 acres of steep slopes, 96,638 acres of high erosion potential, and 45,358 acres of unstable soils areas would be SLT. This increases the chance that fire, weed infestation, or poorly planned or routed roads would be located on sensitive soils where oil and gas development was proposed. These impacts could be long term and moderate in all soil types/geologic resources.

5.9 Vegetation

5.9.1 Description of Cumulative Effects Area

The CEA for vegetation is the Dixie National Forest (see Section 5.8, Figure 5.8-1).

5.9.1.1 Rationale

The Dixie National Forest was selected as the CEA because vegetation impacts from the RFDS are not expected to be of a sufficient magnitude to extend beyond the Dixie National Forest.

5.9.2 Past, Present, and Reasonably Foreseeable Future Actions

Vegetation communities are always changing due to succession as well as natural and human-caused disturbance. The current distribution of vegetation on the Dixie National Forest has been shaped by both active management and natural disturbance cycles, such as fire, insect outbreaks, and climate change since the end of the Little Ice Age (mid-1800s). Natural disturbance cycles have served important functions within vegetation communities; however, due to fire suppression, development, and management activities such as grazing, these processes are cycling at a greater intensity and with lower frequency than they have in the past. The current state of vegetation on the Dixie National Forest is characterized by forest overstocking, layering, and a steady encroachment of shade-tolerant climax tree species.

Compared to historic conditions (late 1800s and early 1900s), most vegetation communities on the Dixie National Forest have changed in relative abundance. Grasslands and aspen communities have declined, having been replaced by dense coniferous forest in many areas (Kay 2002). Current vegetation trends include spruce fir and mixed conifer forests overtaking aspen, and pinyon-juniper vegetation invading grass, forb, and sagebrush communities. In general, late successional species have invaded areas where early successional species once prevailed.

Past and present management activities continue to impact vegetation resources by removing vegetation and altering communities by changing species composition. The following management activities have the largest impacts on vegetation: livestock grazing, development, uncharacteristic fire, insect outbreaks, timber harvests, and invasive plant infestations. While impacts in the CEA continue to occur, many of the activities listed have decreased or become better managed in recent years as the importance of overall ecosystem health has been recognized. The past and present levels of each type of activity on the Dixie National Forest and the expected level of future activity are presented in Section 5.1.2.1. This section described the general impacts resulting from these activities.

LIVESTOCK GRAZING

See Section 5.1.2.1.

DEVELOPMENT AND POPULATION GROWTH

Developments within and adjacent to the Forest (see Section 5.1.2.1) remove vegetation permanently, modify vegetation community composition, and increase the extent of urban-wildland interface which must be managed more intensely for fuels (e.g., Duck Creek and Pine Valley Fuels Treatments; see Table 5.1-1). Development is expected to increase and impact vegetation communities in the foreseeable future by permanently removing vegetation on private lands and increasing the wildland-urban interface.

FIRE

The impacts of fire to vegetation are discussed in Section 5.1.2.1. Regarding the impact of prescribed fires on vegetation, because of the low intensity, and the ability of vegetation to recover quickly following fire, most prescribed burns have very minor and short-term effects on vegetation resources.

SPRUCE BEETLE OUTBREAKS

See Section 5.1.2.1.

TIMBER HARVEST

See Section 5.1.2.1.

INVASIVE AND NONNATIVE PLANTS

See Section 5.1.2.1.

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Focus areas for management in the near future include Mount Dutton, East Fork Sevier River (John's Valley), Deer Valley and Duck Creek, Griffin Top, and the spruce fir forests on the Escalante Ranger District. Within the foreseeable future, thinning and salvage projects are planned on School Wash, Henrie Knolls, and Willis Creek (Cedar City Ranger District); Griffin Springs and Iron Springs (Escalante Ranger District); and East Fork, Robinson Meadow, and Kanab Creek (Powell Ranger District). Other projects in official planning stages are listed in Table 5.1-1. Table 5.9-1 re-lists the projects with the greatest potential to impact vegetation and describes the potential impacts from each on vegetation resources in the CEA.

Table 5.9-1 Potential Impacts to Vegetation from Projects listed in Table 5.1-1

Project	Potential Impacts to Vegetation Resources
Upper Santa Clara River Vegetation and Fuels Project	Some vegetation removal: 1,662 total treatment acres, of which 352 acres will be treated in 2008, and 596 acres will be treated in 2009; decreased risk of uncharacteristic wildfire.
Pine Valley Fuels Treatments	Some vegetation removal: treatments include 217 acres in 2011; decreased risk of uncharacteristic wildfire.
Duck Creek Fuels Treatment	Some vegetation removal; Phase II will treat 600 acres and Phase III 2,800 acres in 2008, 10,000+ acres in 2009, 5,000 acres 2010, and 1,500+ acres in 2011; decreased risk of uncharacteristic wildfire.
Edward Spring Vegetation Treatment	Vegetation removal and increase in early succession species: 1,108 acres to be treated in 2008.
Midway-Deer Valley Scenery Enhancement and Vegetation Treatment	Vegetation removal, including spruce, aspen, and meadow; treatments include 600 acres in 2008, 400 acres in 2009, and 200 acres in 2010.
Little Creek-Red Creek Vegetation Treatment	Removal of conifers and pinyon-juniper; long-term increase in sagebrush and aspen.
Navajo Basin Forest and Scenic Recovery	Removal of dead conifers; long-term increase in aspen and healthy conifer stands.
Red Desert	Long-term increase in aspen.

Project	Potential Impacts to Vegetation Resources
Vegetation Treatment	
Tippets Salvage	Removal of conifers.
Mt. Dutton Vegetation Management Project	Vegetation removal on approximately 870 acres, including approximately 620 acres in 2009, 200 acres in 2010, and 50 acres in 2011. Conifer and aspen trees would be established, thus creating a more diverse vegetation community than what existed before the outbreak.
Dipping Vat Habitat Improvement Project	Removal of pine stands and sagebrush: 1,132 acres in 2008.
Toad Salvage	Removal of ponderosa pine trees; improvement of stand health.
Pockets Vegetation Management	Vegetation removal, including 4,721 acres of conifers and 2,647 acres of aspen.
Bridge Fire Salvage and Restoration Project	Removal of dead conifers; long-term increase in healthy conifer stands.
Iron Springs Improvement and Salvage Project	Removal of spruce-fir; long-term increase in aspen.
Road Draw Salvage and Reforestation Project	Removal of conifers.

5.9.3 Cumulative Effects by Alternative

5.9.3.1 Alternative A

Under Alternative A, no new oil and gas activity would occur and there would be no cumulative effects.

5.9.3.2 Alternative B

Under Alternative B, the potential for cumulative effects to vegetation resources would be slight. Ninety six percent of the forest would be either legally unavailable (6%), not available for lease (70%), or not available for surface occupancy (20%). Connected actions, such as the construction of roads, exploratory well pads, or production field, occurring on the remaining 4 percent of the Forest, may lead to cumulative impacts to major vegetation types that are not protected by leasing options, in certain areas that have been impacted by past disturbance or in areas that may be impacted by future management and vegetation trends. The Pockets Vegetation Management area in the Escalante Ranger District contains old, overstocked spruce fir stands that are vulnerable to bark beetle infestations and fire. This area is largely available for leasing (CSU) under Alternative B. Despite being actively managed for timber over the next five years to reduce risks of fire and outbreaks, oil and gas activities in these areas may lead to cumulative impacts if disturbances increase the risk of fire ignition. Operating procedures would require precautionary measures such as burning only during low to moderate fire risk and having fire suppression equipment on hand. However, oil and gas activities occurring in these areas still may lead to cumulative impacts if an accident occurs. An uncharacteristic wildfire in any of these areas would be a measurable cumulative impact that would be long term, due to

the typically long recovery time from such fires, and minor to moderate, depending on the severity. Oil and gas disturbances within major vegetation types in other available areas of the Forest would not lead to cumulative impacts because other available vegetation is comprised mainly of pinyon-juniper, mountain brush, and sagebrush in locations that are not particularly sensitive.

Under Alternative B, cumulative impacts to biological soil crusts and invasive plant levels could occur within the Pine Valley Ranger District due to seismic activities allowed under NSO. Seismic activities, relative to other connected actions, have a relatively high probability of introducing invasive plants, which also leads to diminished surface area available for biological soil crusts that enhance soil conditions for native plant growth. Buggy travel for seismic activities may also directly damage soil crusts. Invasive plant levels are currently high in many areas of the Pine Valley Ranger District and further infestations caused by oil and gas activities could push these infestations closer to an epidemic that would be more difficult and costly to control. Developments in the Pine Valley Ranger District (Washington County) that are expected to increase in the foreseeable future may also increase the risk of weed infestation as more ground is disturbed on private lands.

Several fuels treatments are expected to be implemented in the foreseeable future (Table 5.1-1) around communities at risk of fire in the Pine Valley Ranger District. Cheatgrass frequency has increased along the I-15 corridor due to fire, and these areas would be highly susceptible to fire from oil and gas activities during the summer in addition to further cheatgrass invasion if a fire occurred. Cumulative impacts would result from oil and gas activities that increased the risk of fire, the spread of invasive plants, and the possible associated reduction of biological soil crusts in the Pine Valley Ranger District, where impacts have already occurred and are expected to continue in the foreseeable future; these cumulative impacts would be long term and minor.

With the exception of Red Canyon Botanical Area, which is 39 percent NL and 61 percent NSO under Alternative B, there would be no cumulative impacts within any Research Natural Area or Special Area because all areas are covered by NL stipulations under Alternative B. Buggy travel for seismic activities is not likely to lead to cumulative impacts within the Red Canyon Botanical Area because this area is not impacted by current management or actions in the foreseeable future.

5.9.3.3 Alternative C

The potential for cumulative impacts to major vegetation types in the vicinity of the Pockets Vegetation area in the Escalante Ranger District (spruce fir) would be the same as under Alternative B. Under Alternative C, more of these and surrounding areas are available for leasing, which increases the chances that the sensitive areas can be accessed and disturbed. However, if cumulative impacts occurred, they would still be short term and minor to moderate as described under Alternative B.

Cumulative impacts related to biological soil crusts, invasive plants, and fire in the Pine Valley Ranger District from seismic (buggy) travel activities would be long term and minor, as under Alternative B, although more area is available for lease so infestations could be possible in more locations than under Alternative B.

Seismic activities allowed by NSO under Alternative C could not lead to measurable cumulative impacts within Special Areas because these areas are not impacted by current management or

actions in the foreseeable future. Research Natural Areas under Alternative C are covered by NL stipulations, thus cumulative impacts in these areas would not occur

5.9.3.4 Alternative D1 (NSO in IRAs)

The potential for cumulative impacts to major vegetation types would be slightly higher under Alternative D with NSO in IRAs, relative to Alternative C, because more of these and surrounding areas are available for leasing, including the Sanford Fire area in the Powell Ranger District. Cumulative impacts to vegetation are unlikely in the Sanford Fire area, however, because most of this area is revegetated. Cumulative impacts in previously impacted areas described under Alternative B, if they occurred, would still be short term and minor to moderate as described under Alternative B.

Cumulative impacts to biological soil crusts and noxious weeds in the Pine Valley Ranger District from seismic (buggy) travel activities would be the same as under Alternative C because a similar amount of area in this Ranger District would be NSO under both alternatives, due to Inventoried Roadless Areas, and thus open to the risk of invasion.

There would be no cumulative impacts to Research Natural Areas or Special Areas from seismic activities under Alternative D, with the possible exception of noxious weed invasion within the Browse Research Natural Area. Thirty-nine acres within this Research Natural Area (2% of its area) are currently infested with scotch cottonthistle and new infestations or further spread of this noxious weed could cause a measurable cumulative impact in the area. This cumulative impact would be long term and moderate.

5.9.3.5 Alternative D2 (CSU in IRAs)

Cumulative impacts to major vegetation types, biological soil crusts, and noxious weeds would be the same duration and intensity as under Alternative B, C, and D with NSO in IRAs, although cumulative impacts would be possible over a greater area (than Alternative D with NSO in IRAs) due to the availability of Inventoried Roadless Areas for lease.

Cumulative impacts to the Browse Research Natural Area would also be the same as described under Alternative D with NSO in IRAs, although less likely to occur because all Research Natural Areas would be among the most restricted areas on the forest (i.e., NSO) and would likely be avoided. If cumulative impacts occurred with regard to noxious weeds invading the Browse Research Natural Area they would be long term and moderate.

5.9.3.6 Alternative E1 (NSO in IRAs)

The potential for cumulative impacts to major vegetation types would be slightly higher under Alternative E with NSO in IRAs relative to Alternative D (both alternatives) because more of these and surrounding areas are available for leasing, including the Duck Creek area in the Cedar City Ranger District under this alternative. Cumulative impacts are possible if a fire were to occur in this area as a result of oil and gas activities, because this area is currently at risk of fire due to fuel loads.

As under Alternatives C and D with NSO in IRAs, cumulative impacts to biological soil crusts and noxious weeds in the Pine Valley Ranger District would be the same duration and intensity as under Alternative B and would be possible over an area of similar size, due to NSO stipulations in Inventoried Roadless Areas.

Cumulative impacts to the Browse Research Natural Area would be the same as described under Alternative D with NSO in IRAs; impacts could be long term and moderate.

5.9.3.7 Alternative E2 (SLT in IRAs)

The potential for cumulative impacts to major vegetation types would be slightly higher than under Alternative E with NSO in IRAs because the entire Forest, with the exception of Wilderness and other NA lands, would be available for leasing. If impacts such as a fire occurred within major vegetation types in sensitive areas, cumulative impacts to vegetation would be short term and could be moderate.

As under Alternatives C, D (both alternatives), and E with NSO in IRAs, cumulative impacts to biological soil crusts and noxious weeds in the Pine Valley Ranger District would be the same duration and intensity as under Alternative B, but would be possible throughout the ranger district outside of the Pine Valley Mountain Wilderness Area.

Cumulative impacts to the Browse Research Natural Area would be the same as described under Alternative D with NSO in IRAs; impacts could be long term and moderate.

Table 5.9-2 Summary of Cumulative Effects for Vegetation

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
Past grazing, fire suppression, and spruce beetle outbreaks have led to a buildup of fuels and the death of large stands of spruce fir. The greatest impacts have occurred in forests on the Cedar City and Powell Ranger Districts. Development on private lands, fires, and the spread of invasive plants has occurred on the Pine Valley Ranger District.	Vegetation treatments are in progress to improve ecosystem health, increase diversity of vegetation communities, and reduce the risks of fire and insect outbreaks. Forests in the Escalante Ranger District are currently at risk of fire and insect outbreak. Cheatgrass-infested areas in the Pine Valley Ranger District are also at risk of fire.	Population growth (and development) and the spread of invasive plants are expected to increase in the foreseeable future. Vegetation treatments including timber harvests, chaining of shrubs and pinyon/juniper, and prescribed fires are expected to continue at current levels in the foreseeable future.	**Alternative A** No new leases would be authorized and there would no direct or indirect impacts to vegetation resources as a result of oil and gas activity.	There would be no cumulative effects under Alternative A.
			Alternative B Overlapping NL options would prevent direct disturbance to vegetation resources in most areas (70%). NSO would prevent permanent disturbance to major vegetation types on (20%) of the forest. Connected actions could still occur on CSU lands (4%). All RNAs and Side Hollow Study Area would be NL. Red Canyon Botanical Area would be 39% NL and 61% NSO.	Cumulative effects could occur as a result of oil and gas activity in areas degraded by past and future management activities. Regarding major vegetation types, spruce fir in the Pockets area on the Escalante Ranger District is susceptible to fire and insect outbreaks. Cumulative impacts from fire would be short term and minor to moderate. Cumulative impacts could also result from noxious weed infestations or fire on the Pine Valley Ranger District; these impacts could be long term and minor. No cumulative impacts to RNAs or Special Areas.
			Alternative C NSO would prevent permanent disturbance to major vegetation types in most areas (76%; includes areas within IRAs). Direct and indirect impacts from seismic activities could occur on NSO within Special Areas. All RNAs are covered by NL.	Cumulative impacts to major vegetation types and with regard to soil crusts and noxious weeds in the Pine Valley Ranger District would be the same in duration and intensity as under Alternative B although the area over which they could occur would be slightly larger. No cumulative impacts to RNAs or Special Areas.
			Alternative D1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 33% of the forest, which includes all IRAs. Seismic disturbance could occur in any RNA or Special Area.	Cumulative impacts to major vegetation types would be the same in duration and intensity as under Alternative B and C although the area over which they could occur would be larger. The Sanford Fire area would largely be available for lease under this alternative but cumulative impacts to vegetation there are unlikely because the area is largely revegetated. Cumulative impacts with regard to noxious weeds and soil crusts in the Pine Valley Ranger District would be the same as under Alternative C. Cumulative impacts in the Browse RNA from noxious weed invasion could be long term and moderate.

Past Actions	Present Actions	Future Actions	Alternative	Cumulative Effect
			Alternative D2 (CSU in IRAs) NSO would cover 8% of the Forest, including RNAs and Special Areas. Other areas of the forest would be largely available for lease and impacts from connected actions: 80% of the forest is CSU or TL.	Cumulative impacts to major vegetation types would be the same in duration and intensity as under Alternatives B, C, and D with NSO in IRAs although the likelihood that they would occur would be slightly higher. The Sanford Fire area would largely be available for lease under this alternative but cumulative impacts to vegetation are unlikely because the area is largely revegetated. Cumulative impacts in the Browse RNA from noxious weed invasion could be long term and moderate.
			Alternative E1 (NSO in IRAs) NSO would prevent disturbance from connected actions (except seismic) in 33% of the forest. Connected actions could occur elsewhere, including parts of the Timbered Cinder Cone, Browse, and Table Cliff RNAs; and in the Red Canyon Botanical Area.	Cumulative impacts to major vegetation types would include those that may occur under Alternatives B, C, and D (both alternatives), and in addition would include the Duck Creek area in the Cedar City Ranger District that is at risk of fire. Cumulative impacts in the Browse RNA from noxious weed invasion could be long term and moderate.
			Alternative E2 (SLT in IRAs) Direct disturbance from connected actions could occur anywhere on the forest, including within RNAs and Special Areas.	Cumulative impacts to major vegetation types would include those that may occur under Alternatives B, C, D (both alternatives), and E with NSO in IRAs. The possible area over which cumulative impacts could occur would be the greatest of any alternative because the largest area is available for lease. Cumulative impacts in the Browse RNA from noxious weed invasion could be long term and moderate.

5.10 Transportation

5.10.1 Description of Cumulative Effects Area

The CEA for Transportation would be the same as described for Recreation Resources in Section 5.4.1 (see Figure 5.4-1).

The lands within the CEA are mostly (79 percent) administered by federal agencies (49 percent US Forest Service, 29 percent BLM, and 1 percent NPS) and actions on these lands were, are, or will be subject to NEPA. The remaining lands (21 percent) are either privately owned (16 percent) or administered by the State of Utah (5 percent).

5.10.1.1 Rationale

The CEA covers all major transportation corridors accessing the Dixie National Forest.

5.10.2 Past, Present, and Reasonably Foreseeable Future Actions

ROADS

Existing miles of Forest System roads are discussed in Section 5.1.2.1. Miles of existing roads within the CEA and off the Dixie National Forest has not been calculated, but is likely higher than on the Forest. State Route 22 occurs within the CEA, but entirely off the Dixie National Forest. On BLM administered land, the Grand Staircase-Escalante National Monument predicts 3.5 miles of new road construction over the next 15 years (BLM 1999a). No planned, new road construction projects within the CEA on lands administered by the National Park Service, Cedar City Field Office, or Richfield Field Office are known.

The CEA also includes private and State of Utah lands and 28 municipalities within 5 counties. It is reasonably foreseeable that future road construction will continue on these lands and that traffic volume will increase as a result of population growth in at least some of these areas.

MINERALS ACTIVITY

Past oil and gas activity on the Forest (as discussed in Section 5.1.2.1) primarily includes the Upper Valley oil field, which is located on the southern edge of the Escalante Ranger District and occurs both on the Dixie National Forest as well as on adjacent portions of the Grand Staircase-Escalante National Monument. The field has producing wells (USFS 2006c), with total production to date of over 22 million barrels of oil. As there are no oil or gas pipelines in the region, all of the oil is trucked (3 -5 trips/week) 300 miles to refineries in Salt Lake City (UGS 1997).

In the past few years there has been a renewed interest in oil and gas within the CEA and there are currently 122 authorized leases and 14 pending leases, with a combined total lease area of 101,682 acres (BLM 2008). While these leases occur throughout the CEA, they tend to occur in clusters. Some of the larger clusters are to the south and north of the Cedar City Ranger District, in between the Cedar City and Powell Ranger Districts, and off the southeast corner of the Escalante District (an extension of the Upper Valley Field). Only the Upper Valley Field is currently active. Oil and gas potential on BLM lands in the CEA are described in Section 5.5.2. The only other recent activity on these leases has been the drilling of a few (5) wildcat wells on state and private land, all of which have been capped and abandoned (UDNR 2008a). Also, there is the possibility of unquantified drilling for coal bed methane on SITLA land within the

John's Valley area within the next 15 years. This would likely involve not only drilling but also establishment of a gas delivery system to market the gas if it occurred in paying quantities. Production would most likely be gas rather than oil. One of the 5 wells that were capped and abandoned was a coal bed methane well in this area.

In addition to oil and gas activity, there are currently 25 separate minerals activities, more than half of which are on BLM land surrounding the Pine Valley Ranger District. These mineral activities are all very small operations (less than 5 acres) and primarily target materials such as sandstone, limestone, silica, rhyolite, alabaster, and travertine (UDNR 2008b). There are a few larger mines for iron, gold, and silver; however, all of these are inactive or in some stage of reclamation.

The Coal Hollow Mine, described in Section 5.5.2, will operate 5 days per week (Monday-Friday). Coal would be transported from the mine via 43-ton coal trucks. Trucks would travel from Alton to Highway 89, north to US 20, west to I-15, south on I-15 to Cedar City and from Cedar City west 10 miles to a proposed rail loadout. The initial stages of mining will slowly roll out a smaller number of highway-approved tractor-trailers transporting coal from Alton to Intermountain Power Agency's plant near Delta. The number of trucks could eventually expand to as many as 300 coal trucks per day passing through Panguitch and other towns on state Route 89 (St. George Spectrum 09/20/2010).

ADDITIONAL REASONABLY FORESEEABLE FUTURE ACTIONS

Other projects in official planning stages are listed in Table 5.1-1. Of these projects, there are four on the Dixie National Forest that involve some level of road construction On the Pine Valley Ranger District, the Upper Santa Clara River Vegetation and Fuels Project would involve approximately 3.3 miles of temporary road construction, with 1.2 miles becoming part of the Forest System used to access existing campgrounds after Project completion. On the Powell Ranger District, the Mt Dutton Vegetation Management Project would improve approximately 5 miles of unauthorized roads and designate them as NFS roads. Lastly, on the Escalante Ranger District, the Pockets Vegetation Management Project would require nine miles of new roads, seven miles of unauthorized roads would be designated NFS roads, and 13.4 miles of existing NFS roads would be improved. No other new road construction projects are planned on the Dixie National Forest

5.10.3 Cumulative Effects by Alternative

Connected actions under the RFDS could result in cumulative effects related to road maintenance costs and public safety if an oil field were developed and resulted in adding additional truck traffic to those routes currently used to transport oil from the Upper Valley oil field. This impact would be long term and moderate. Similarly, cumulative effects could occur if both a production field and the potential Coal Hollow Mine were to transport product on the same routes. This impact would be long term and, given the large number of estimated trips associated with the Coal Hollow Mine, major. These impacts would also be common to all alternatives. No other transportation-related cumulative effects are expected from implementation of the RFDS.

5.11 Socioeconomic Resources

5.11.1 Description of Cumulative Effects Area

The CEA for socioeconomics is the Dixie National Forest and an eight-mile buffer around the Forest (Figure 5.11-1). This buffer contains the communities within the six-county area (Garfield, Iron, Kane, Piute, Washington, and Wayne) that are closest to the Forest boundary and most likely to be affected by the oil and gas activities within the Forest

5.11.1.1 Rationale

This area encompasses the Dixie National Forest and most of the cities and towns in the six-county area. Personnel, goods, and services associated with post-leasing activities would come from these areas.

5.11.2 Past, Present, and Reasonably Foreseeable Future Actions

PAST AND PRESENT ACTIONS

The economy of the six-county area has been mixed. As measured by percentage increase, Washington, and Iron, Counties have experienced strong employment growth over the past decade. Employment growth in Kane County has been modest in comparison, while the economies of Garfield, Piute and Wayne Counties have grown very slowly. Washington County and, to a lesser extent, Iron County have consistently exceeded growth forecasts for several decades, while employment in the remaining counties is more seasonal and dependent upon tourism and agriculture.

There are 20 active mineral sites on or near the Dixie National Forest. Despite this, the mining industry has little economic impact on the area at the present time. Total mining employment in the six-county area was 323 in 2006 compared to total employment in the area of 87,527. Of these 323 jobs, 246 were in Washington County compared to total employment in the county of 59,369. The most significant mineral activity in Washington County is in the construction aggregate industry that supplies the local construction industry.

Many of the existing mineral sites within the CEA are for landscaping and decorative materials such as sandstone, alabaster, and cinder. Mineral operations targeting such materials are often operated intermittently and seasonally as demand warrants. As such, they will have little economic impact in terms of employment and wages.

REASONABLE FORESEEABLE FUTURE ACTIONS

The proposed Alton Coal Hollow Coal Mine (discussed in Section 5.5.2 and Section 5.10.2) would be located near the town of the same name.

Other future projects with potential impacts on the social and economic resources of the Dixie National Forest are listed in Table 5.1-1. Many of these projects involve current Forest Service personnel and have no net impact on employment and wages in the area. Other projects would likely involve contract construction companies. This spending of federal resources in the area would have a positive economic impact on the six-county area. Most of the actual work associated with these projects is short term and the associated economic impacts would also be short term.

5.11.3 Cumulative Effects by Alternative

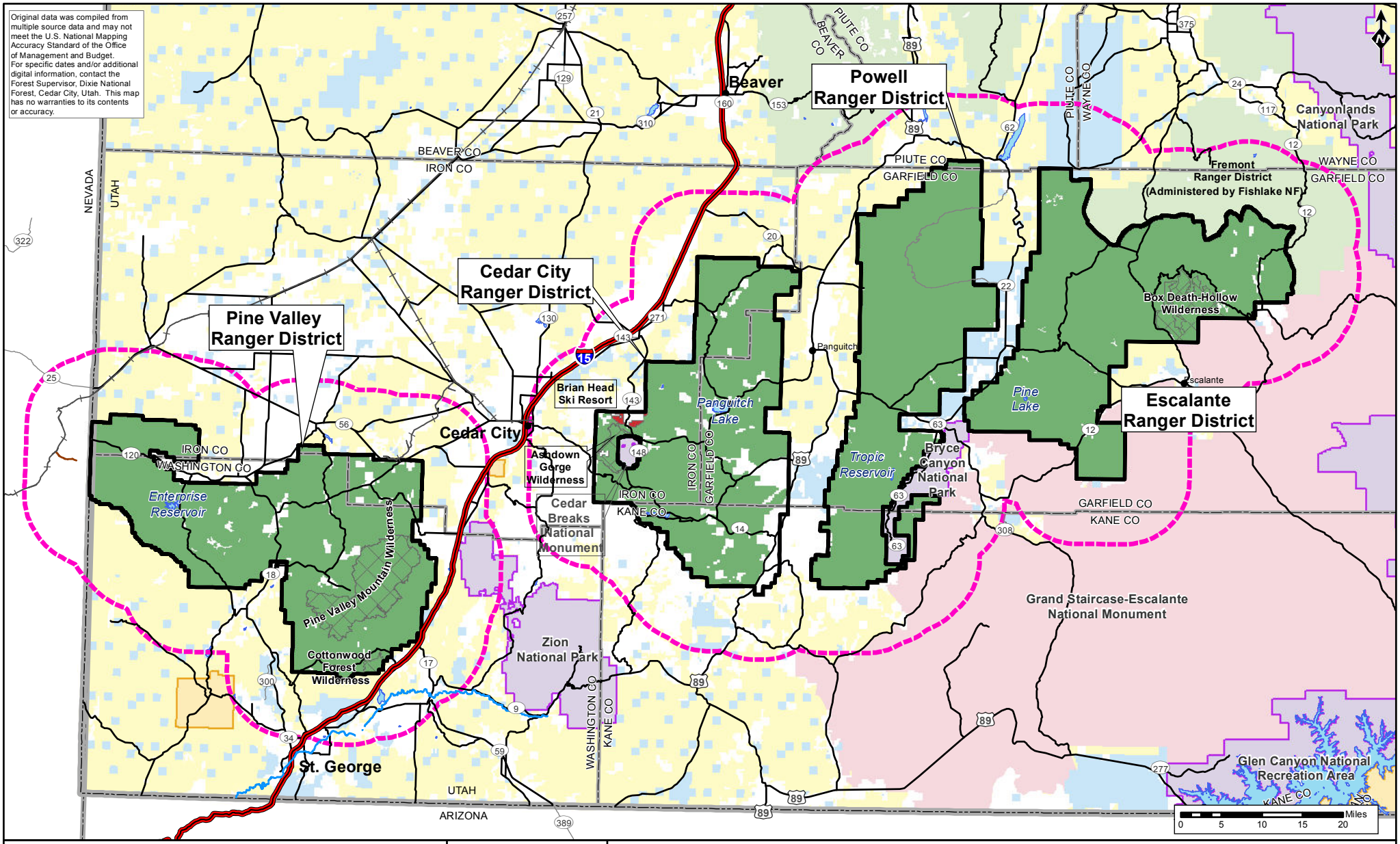
Depending on the viability of the production field, oil and gas operations on the Dixie National Forest could be long term. The associated economic impacts would also be long term. Depending on the location of the production field, the magnitude of these impacts ranges from negligible to moderate. The foreseeable future project in the CEA with the greatest potential for social and economic impacts is the Alton Coal Hollow Mine.

Employment estimates for the Alton Coal Hollow Mine were provided by Chris McCourt, project manager for Alton Coal Development. The annual production of 2 million tons of coal would require 100 miners. The operation will start up on privately owned coal and then transition onto the federal lease for which Alton Coal Development has applied. A total of 60 workers would be involved in trucking the coal to the railhead outside of Cedar City, Iron County. Wages associated with the coal mining and trucking operations were calculated using the average of the first three quarters of 2007 wage data; this yielded $58,688 for coal mining (NAICS 2121) and $39,812 for truck transportation (NAICS 484, Utah Department of Workforce Services 2008). The cumulative effect of oil and gas development on the Dixie National Forest and the Alton Coal Hollow Mine is estimated at 203 jobs and $9.6 million in annual wages for the six-county area (Table 5.11-1). These impacts would be common to all alternatives. Compared to the six-county area employment in 2006 (87,527), these employment impacts would be minor.

Table 5.11-1 Cumulative Economic Impact

	Employment	Annual Wages
Dixie NF Oil & Gas Development	43	$1,314,754
Alton Coal Mine		
Mining Jobs	100	$5,868,800
Truck Jobs	60	$2,388,720
Total Effects	203	$9,572,274

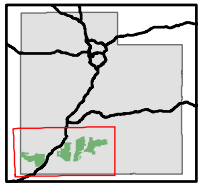
Many of the existing mineral sites in the CEA are for landscaping and decorative materials such as sandstone, alabaster, and cinder. Mineral operations targeting such materials are often operated intermittently and seasonally as demand warrants. As such, they will have little economic impact in terms of employment and wages and cumulative effects would be negligible.



Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 5.11-1
Cumulative Effects Area for Socioeconomic Resources

1 in = 16 miles	1:1,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



- Cities
- Railroad
- Minor Roads*
- Major Roads
- Freeways
- Virgin River
- Water Bodies
- County Boundaries
- State Lines

National Forest System Lands
- Dixie National Forest
- Wilderness Areas
- Fishlake National Forest
- Brian Head Ski Resort

Other Land Administration
- Bureau of Land Management
- GSENM**
- National Park Service
- Private
- State of Utah
- Tribal
- Cumulative Effects Area***

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
***Includes 8-mile buffer of Dixie National Forest Boundary.

5.12 Air Resources

5.12.1 Description of Cumulative Effects Area

The Cumulative Effects Area (CEA) for air resources is the Dixie National Forest boundary and the Dixie National Forest airsheds as described by the UDAQ, EPA, and Utah SMP as airsheds 2, 3, 4, 12, and 13 within Utah (Figure 5.12-1). Within the CEA are three Class 1 Areas (Bryce, Zion, and Capitol Reef National Parks) and 6 sensitive Class II areas (designated by the Forest Service only) that would be impacted by connected actions to leasing. Climate change effects are discussed on national, regional, and state levels (by reference, in Appendix SIR-2), although climate change effects are actually global in nature.

5.12.1.1 Rationale

Impacts to air quality would be within the immediate area of the Dixie National Forest and the Forest designated airsheds. Air Quality impacts could extend past the borders of the Forest and designated airsheds impacting regional haze and visibility.

5.12.2 Past, Present, and Reasonably Foreseeable Future Actions

The lands within the CEA are mostly (79 percent) administered by federal agencies (49 percent USFS, 29 percent BLM, and 1 percent National Park Service) and actions on these lands were, are, or will be subject to NEPA. The remaining lands (21 percent) are either privately owned (16 percent) or administered by the State of Utah (5 percent).

Existing activities on the Dixie National Forest that contribute to air quality emissions include recreational vehicle use, residential heating sources, propane-combustion electrical generators for remote cell towers, timber harvesting, and wildfires as well as prescribed burns. The residential heating sources and cell tower generators are considered minor and insignificant sources. The past, present, and reasonably foreseeable future levels of recreational vehicle use, timber harvesting, and fires (wild and prescribed) are described in Section 5.1.2.1. These activities result in emissions of NO_x, CO, VOCs, $PM_{2.5}$, and PM_{10}. Activities on the Dixie National Forest that are assumed to be contributing to emissions of GHGs, including the heating and powering of Forest buildings and facilities as well as operation of on- and off-road vehicles and equipment, also have occurred, are occurring, and will continue to occur into the foreseeable future. Foreseeable future responses to climate change are discussed Section 5 of Appendix SIR-2.

Past oil and gas activity within the CEA has been relatively low, with the Upper Valley Field being the only producing oil field. The Upper Valley oil field is described in further detail in Section 5.1.2.1 and Section 3.12.13. There has been a renewed interest in oil and gas within the CEA with the exploration and production field located north of the Dixie National Forest in the Covenant Field. As of 2008, there were 122 authorized leases and 14 pending leases, with a combined total lease area of 101,682 acres (BLM 2008). While these leases occur throughout the CEA, they tend to occur in clusters. Some of the larger clusters are to the south and north of the Cedar City Ranger District, in between the Cedar City and Powell Ranger Districts, and off the southeast corner of the Escalante Ranger District (an extension of the Upper Valley Field). Only the Upper Valley Field is currently active.

As of 2008, other recent activity on these leases has been the drilling of a few wildcat wells on state and private land, including one coalbed methane well, all of which had been capped and abandoned (UDNR 2008a). Current oil and gas activities result in NO_2, SO_2, $PM_{2.5}$, PM_{10}, and CO emissions. The Upper Valley Oil Field is predominately electrified.

In addition to oil and gas activity, there are numerous small minerals activities managed on public lands; more than half are on BLM land surrounding the Pine Valley Ranger District. These mineral activities are usually small operations (less than 5 acres) and primarily target materials such as sandstone, limestone, silica, rhyolite, alabaster, and travertine (UDNR 2008b). There are a few larger mines for iron, gold, and silver; however, most of these are inactive or in some stage of reclamation. Mining activities result in PM_{10} emissions with lesser amounts of NO_x and CO.

All of the above types of activities and development are expected to continue to some degree on the Forest and within the CEA into the foreseeable future. ATV use will continue to trend upward. The use of prescribed fire and mechanical fuel treatments are also anticipated to increase over the next 5 to 10 years. The amount burned by prescribed fires will likely increase to over 10,000 acres per year in the near future. Most prescribed burns have minor and short-term effects on air resources in the CEA. Further, an increase in the number of prescribed fires and mechanical fuel treatments should ultimately lead to a decrease in the number of large, catastrophic fires, thus reducing the resulting PM, $PM_{2.5}$, and PM_{10} emissions associated with those fires. Wildfires may increase in frequency in the CEA, however, due in part to climate change (discussed in Section 5.12.3).

In addition, there is the possibility of unquantified drilling for coal bed methane on State land within the John's Valley area within the next 15 years. This could involve not only drilling but also establishing a gas delivery system to market the gas if it occurred in paying quantities. Production would most likely be gas rather than oil.

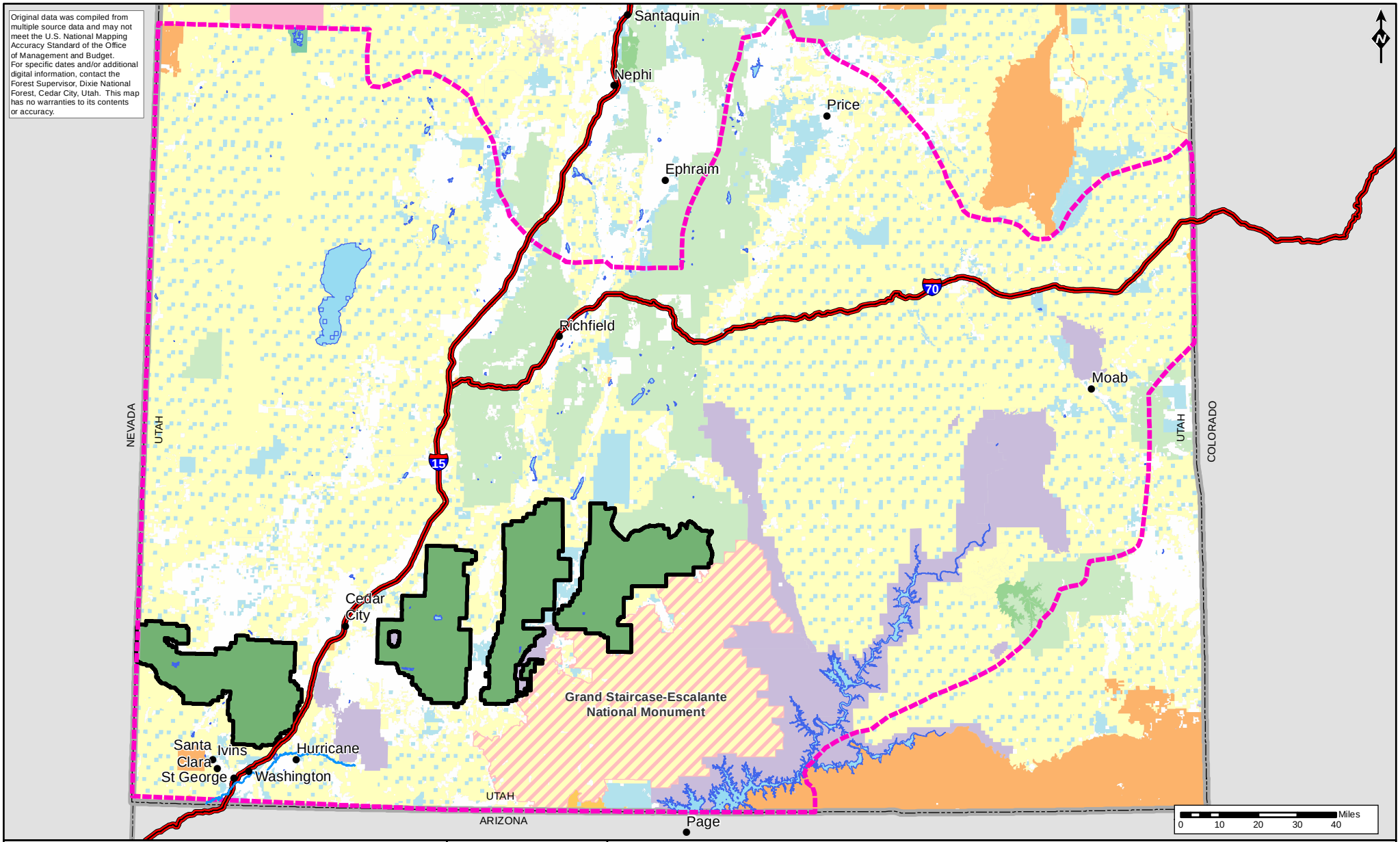
Timber harvesting will continue to be a part of the management goals of the forest. The existing mining activities are expected to continue and more exploratory wells may be drilled. Existing forests in the CEA will continue to serve as carbon dioxide sinks/storage.

Currently, there are several proposed or existing power plants or large industrial facilities within and surrounding the CEA. Multi-source, short, and long range, multi-pollutant air dispersion modeling would have to be conducted to determine cumulative effects and intensity associated with the measurement indicators. With the information provided we cannot make assumptions about existing and preexisting sources in the CEA. The proposed Intermountain Power Plant third unit and Rocky Mountain Power's Unit 4 at the Hunter Plant have been cancelled. NEVCO's Sevier Power Plant, located north of the Dixie National Forest, experienced difficulties in obtaining the necessary permits to construct and may be delayed or cancelled.

5.12.3 Cumulative Effects

Under any alternative, surrounding sources, population growth, vehicular traffic, and proposed coal-fired power plants in the general area could affect the Forest air resources now and in the foreseeable future.

Cumulative effects to air resources would not vary by alternative, except for Alternative A. Alternative A would not result in oil and gas-related emissions on the Forest. Thus, the



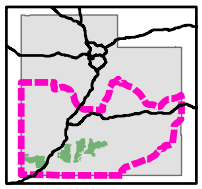
Oil and Gas Leasing EIS on Lands Administered by the Dixie National Forest

FIGURE 5.12-1

Air Cumulative Effects Area

Utah Airsheds

1 in = 34 miles	1:2,000,000	Horizontal Datum = NAD 83 Coordinate System = Zone 12N



Legend

- Cities
- Freeways
- Water Bodies
- State Lines
- Dixie National Forest
- GSENM**
- Bureau of Land Management (BLM)
- BLM Wilderness Area
- US Forest Service (USFS)
- USFS Wilderness Area
- National Park Service (NPS)
- US Fish & Wildlife (USFW) National Wildlife Refuge
- Indian Reservation (IR)
- Military Reservations and Corps of Engineers
- State of Utah
- Private
- Cumulative Effects Area***

*Grand Staircase-Escalante National Monument. Managed by the Bureau of Land Management.
**Includes Utah Smoke Management Airsheds 2, 3, 12, 13, & 14. Digitized from http://www.wrh.noaa.gov/slc/projects/ifp/images/UTsheds.gif

remaining cumulative effects discussion pertains to all action alternatives (Alternatives B, C, D, and E).

Impacts of oil field development and sustainable production, if these activities occurred as predicted in the RFDS, would be long term and would vary greatly depending on how many fields are developed, the density of the field, and oil productivity. Presumably, with current air quality regulations, permitting, and periodic testing requirements, the impacts would be controlled if a source emits more than five tons per year of any Criteria Pollutant. The Modeling Report (Appendix SIR-1) is a proportional-based estimate of emission and visibility impacts that can be applied to a variety of scenarios using the tables in Appendix SIR-1A. Emissions from a proposed well field development would have to be modeled during the pre-construction permitting phase to show that all the emissions would comply with applicable regulatory standards. Air dispersion modeling, using an approved EPA model and protocol, would be used to determine whether the allowable emissions result in NAAQS or Class I visibility exceedances.

In addition, increased NO_2 and SO_2 emissions from both the predicted oil field-related activities and nearby permitted sources could contribute to acid rain deposition. Based on the emission estimates, an individual well field would not cause acid range deposition. However, numerous well fields along with regional coal-fired power plants could cumulatively impact the forests, mountain lakes, and vegetation with acid rain. Emissions from well field production also include ozone precursors ($PM_{2.5}$, PM_{10}, VOC, and NO_x) and could cumulatively contribute to regional haze and visibility issues within the Forest boundaries and Class I areas.

5.12.3.1 Ozone

Unlike other atmospheric pollutants, ozone is not primarily emitted into the atmosphere. Ozone is produced in the atmosphere as a result of combining precursor pollutants with solar radiation. These precursor pollutants can reside in the atmosphere for significant amounts of time and travel over significant distances. As a result, ozone impacts are best assessed on a regional scale, accounting for the precursor pollutant emissions from all available sources within a reasonable distance. Such an analysis should account for the emission and modeled transport of ozone and its precursors as well as the modeled atmospheric chemistry that would result from their interaction.

To complete a modeling analysis of this complexity was found to be beyond the economic limitations of this leasing EIS project. As a result, the USFS has developed an ozone analysis based on the best currently available "scientifically credible" evidence. The analysis, which was based on existing regional modeling simulations, also describes the relative completeness of the information available as well as the potential shortcomings of the available modeling data. To ensure that the requisite "hard look" was completed under NEPA, the analysis was completed in keeping with 40 CFR Section 1502.22 which reads:

"When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking...

> (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:

1. a statement that such information is incomplete or unavailable;
2. a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
3. a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
4. the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."

Given that a novel photochemical modeling analysis could not be reasonably completed for a cost that would not be considered exorbitant, the USFS acknowledges that the assessments of ozone impacts on both a direct and cumulative level are potentially incomplete.

With ambient ozone data indicating that regional ozone has been increasing throughout the State of Utah, particularly in regions with oil and gas development, the issue of ozone impacts is important to the determination of overall adverse impacts associated with this EIS.

As a result, the USFS has undertaken an assessment of existing scientifically credible evidence that would be able to bound the potential regional impacts associated with ozone concentrations. Given that potential future ozone impacts are best predicted by the use of a photochemical modeling analysis, the initial assessment focused on the availability of such modeling analyses. The assessment concluded that the most recent, peer-reviewed, photochemical modeling analysis which included the project area within its modeled domain was the Uinta Basin Air Quality Study. As a result, this modeling simulation was selected for use in assessing total ozone impacts for this EIS leasing project.

The Uinta Basin Air Quality Study (UBAQS) was initiated in 2008 and was completed in June 2009 (IPAMS 2009). The study, funded by the Independent Petroleum Association of the Mountain States (IPAMS), sought to assess the regional air quality impacts of oil and gas production on the Uinta Basin in Utah. Although the study was targeted to assess impacts in the Uinta Basin, the domain of the project was sufficiently large to allow assessments of air quality in regions throughout much of Utah.

UBAQS sought to assess the cumulative change in air quality from the regional expansion of oil and gas resources. In order to develop this assessment, primary and precursor emissions were developed for two modeled scenarios. These scenarios, occurring in model year 2005/2006 and 2012, included recorded (for 2005/2006) and reasonably foreseeable (for 2012) emissions from all sources that resided or would reside within the model domain. Proposed oil and gas-related sources for both modeled scenarios were sourced from regional and sub-regional emissions assessments. They utilized best available information to determine spatially representative oil and gas emissions. These emissions were then extrapolated forward in time to account for growth of oil and gas production throughout the domain for the 2012 scenario.

Emissions developed for both the base year (2005/2006) and future year (2012) were modeled utilizing the Community Multi-Scale Air Quality Model (CMAQ). EPA guidance for projecting

future 8-hour ozone concentrations recommends using the model in a relative sense to scale current observed 8-hour ozone Design Values. In order to perform this scaling operation EPA developed the Modeled Attainment Test Software (MATS) tool that uses modeling results, observed 8-hour ozone Design Values to project 8-hour ozone concentrations that reflect the change in emissions from a base case to an alternative emissions scenario.

For the UBAQS, the MATS tool was used to assess the effects of oil and gas development activities as well as regional emissions in the modeling domain on 8-hour ozone. The MATS tool performs 8-hour ozone Design Value projections at existing monitoring sites for comparison with the 8-hour ozone NAAQS. Additionally, the MATS tool has a capability to perform an Unmonitored Area Analysis (UAA) that performs a spatial interpolation of the current year observed 8-hour ozone Design Values using the ozone concentration gradients calculated from the gridded model base year outputs.

Because the nearest existing ozone monitoring location to the Dixie National Forrest is located in Canyonlands National Park, approximately 150 miles to the east, the UAA developed in the UBAQS was used to provide an assessment of impacts associated with this EIS.

Figures 5.12-2, 5.12-3, 5.12-4, and 5.12-5 below present the current and future year predicted 8-hour ozone design values for the entire UBAQS modeling domain when using modeled meteorological conditions from base years 2005 and 2006 respectively. Figures 5.12-6 and 5.12-7 present the projected increase or decrease in design value from the base to the future projection year.

Depending on the current year meteorological inputs used for the modeling simulation, the area-weighted average for the regions managed by the Dixie National Forest indicate current and future year 8-hour ozone design values that are at or near the existing 8-hour ozone NAAQS. Specifically, for the 2005 meteorological inputs, the current and future year 8-hour design values range from 70-86ppb depending on the sub-region of the forest that is analyzed. For the 2006 meteorological inputs, the current and future year 8-hour design values range from 70-75ppb depending on the sub-region of the forest that is analyzed. Given the diversity in predicted impacts associated with meteorological inputs the predicted impacts are best reviewed in relative terms, i.e. one should review the predicted change in ozone concentrations due to emissions increases rather than due to meteorological inputs. Figures 5.12-6 and 5.12-7 below quantify just such and analysis. Depending on the particular sub-region of the forest, design values associated with the impact of potential future oil and gas development, as well as regional growth, is forecast to remain stagnant for much of the Forest with only a slight increase or decrease in some regions. Both growth and contraction of the region's projected 8-hour ozone design values are constrained to less than one part per billion in ambient air.

As a result, the predicted impacts from the UBAQS suggest that regional ozone in the project area is unlikely to vary significantly from its current monitored conditions. When combined with monitored ambient ozone data from Washington County, UT. The UBAQS study suggest that the ozone impacts in the region are likely to remain below the existing ozone NAAQS. Specifically, when the most recent official annual ozone data (observation year 2008) was released for the UDEQ ozone monitoring station at 1215 N. Lava Flow Drive, Santa Clara, Washington County, UT, the closest FRM-certified monitor to the project region, the maximum 8-hour average for the entire reporting year was 68ppb. Although the monitoring station has not been in place for three years and therefore a formal design value cannot be calculated, the level of maximum 8-hour ozone would suggest that a shift of only 1ppb, as predicted by the UBAQS study would not be likely to produce ozone levels that would even approach the existing ozone

NAAQS. In addition, when data from the nearby Zion National Park ozone monitoring site is used for a similar analysis, the most recent design value (2006-2008) of 72ppb suggests that a increase or decrease of 1ppb would be unlikely to produce exceedances of the ozone NAAQS. These findings support that the connected actions to leasing described in this EIS will not result in a significant impact on regional cumulative ozone concentrations.

Although the UBAQS represents the best available peer-reviewed photochemical modeling simulation which includes the EIS project region, it should be noted that the UBAQS does have potential shortcomings that are recognized by the USFS. To ensure that all available information is provided with regard to the existing scientific evidence available for review, the following items should be noted in regards to the use of the UBAQS.

1. There is not sufficient air monitoring data in the UBAQS modeling study, because at the time the study was performed, this data was not available for the area.
2. The UBAQS primary modeling domain was subdivided into 12-km grid squares, instead of the preferred 4-km grids, for a large portion of central and eastern Utah and western Colorado. The accuracy of modeled predictions from a 12-km or greater grid spacing for areas of complex terrain has tended to be suspect.
3. The UBAQS oil and gas focus area, and associated emission inventory within that area, comprised the six-counties of the Uintah Basin. The Dixie National Forest occurs outside this focus area, but was covered within the overall UBAQS statewide modeling domain.
4. The modeling domain was subdivided into 12-km grid squares to provide additional detail on the locations of existing oil and gas emission sources. It is not clear how hypothetical emissions from the Dixie National Forest oil and gas leasing scenarios were reflected in the UBAQS study.
5. The UBAQS future modeled predictions for year 2012 are not particularly useful for project development activities occurring beyond the year 2012.

Given that the UBAQS does contain shortcomings, the USFS feels that its use is appropriate only in the limited exploration and development scenarios inherent to this EIS. Should proposed oil and gas activity exceed the bounds of the scenarios reviewed in this analysis additional ozone analyses need to be completed to affirmatively defend the finding of this EIS. The specific requirements for additional analysis are included in Appendix C of the EIS.

Figure 5.12-2 Current year 8-hour ozone Design Values (DVC) from the enhanced MATS unmonitored area analysis for the 2005 meteorological year.

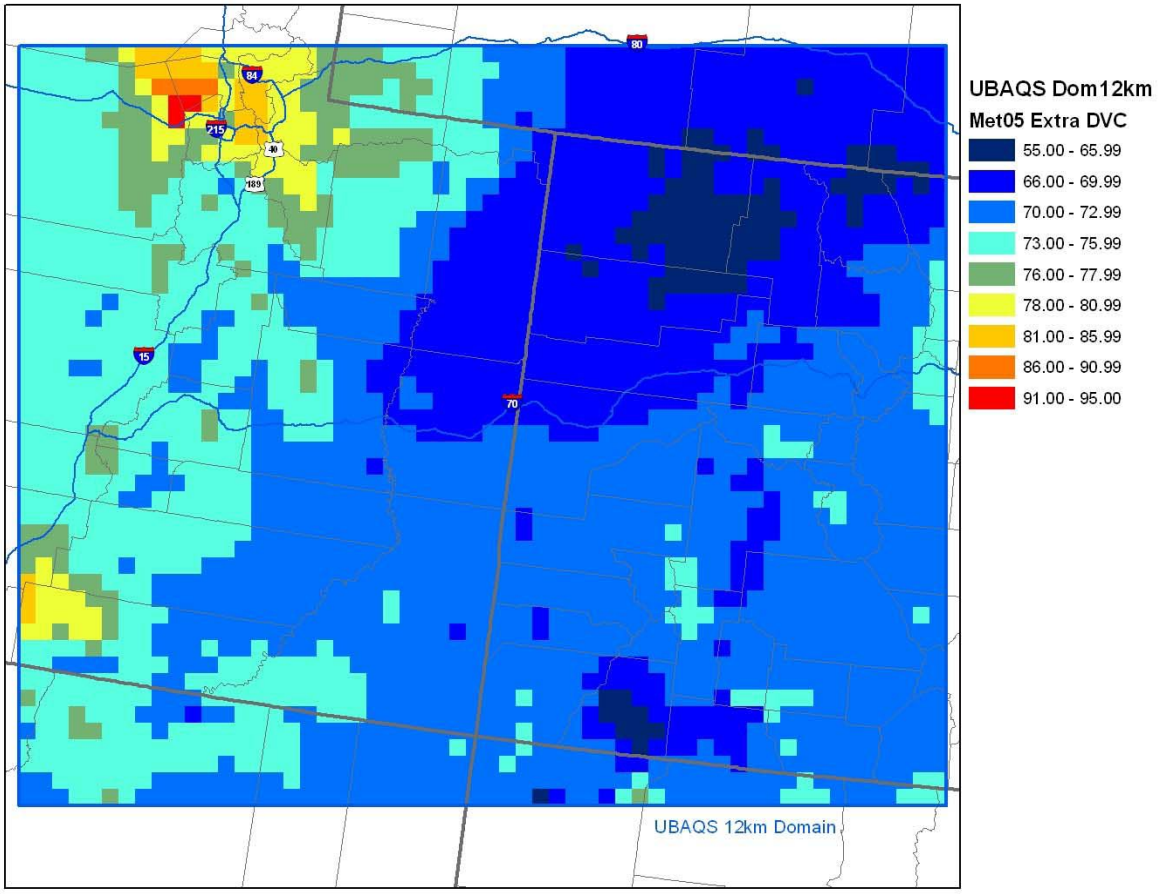


Figure 5.12-3 Current year 8-hour ozone Design Values (DVC) from the enhanced MATS unmonitored area analysis for the 2006 meteorological year.

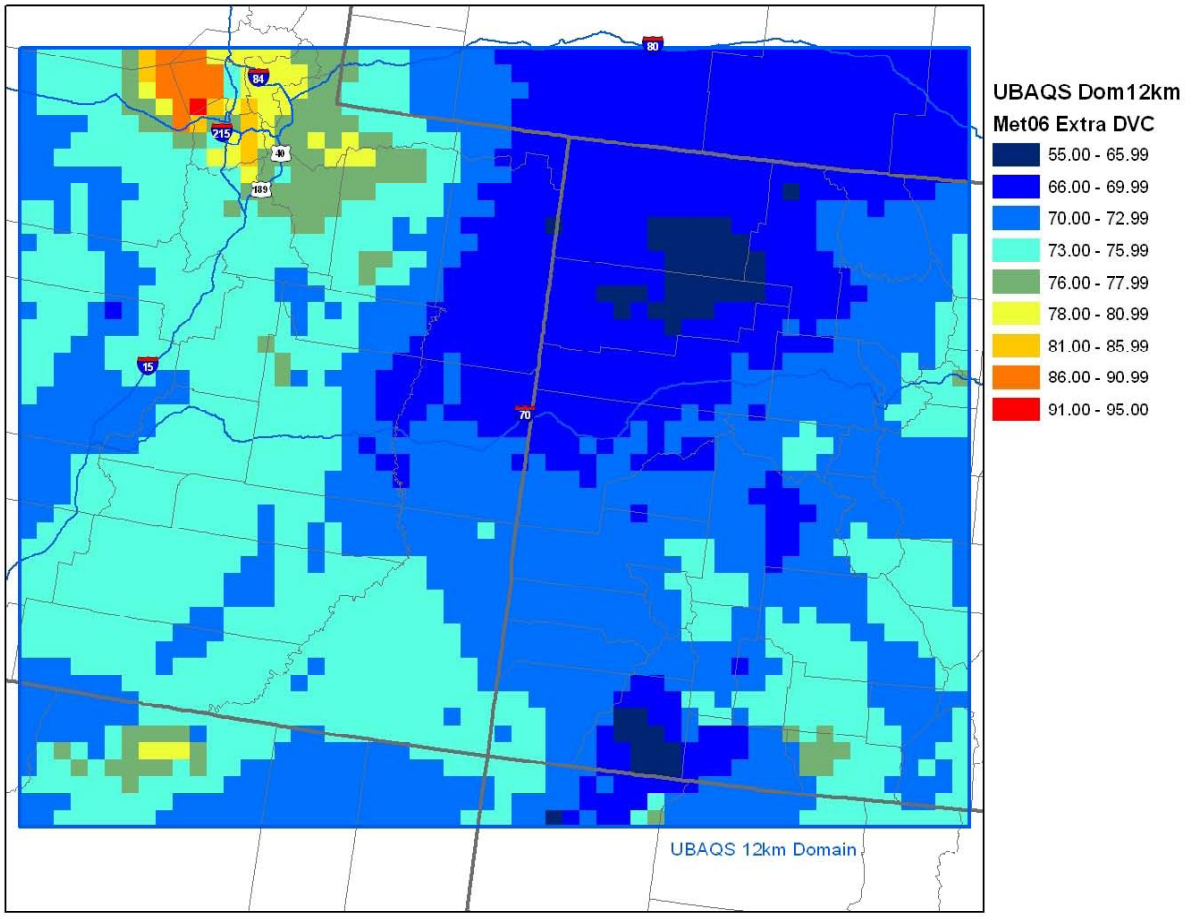


Figure 5.12-4 Projected 2012 8-hour ozone Design Values (DVF) from the enhanced MATS unmonitored area analysis for the 2005 meteorological year.

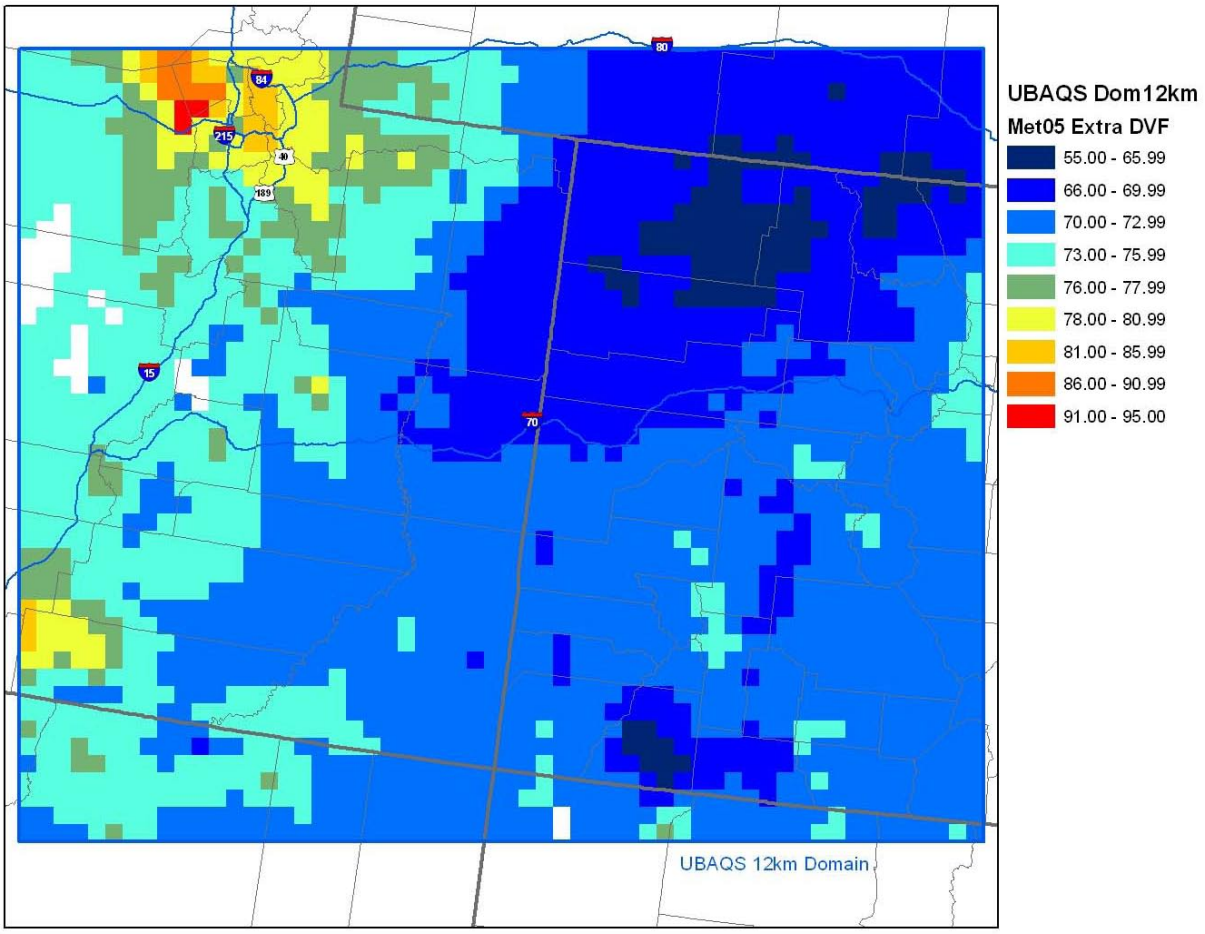


Figure 5.12-5 Projected 2012 8-hour ozone Design Values (DVF) from the enhanced MATS unmonitored area analysis for the 2006 meteorological year.

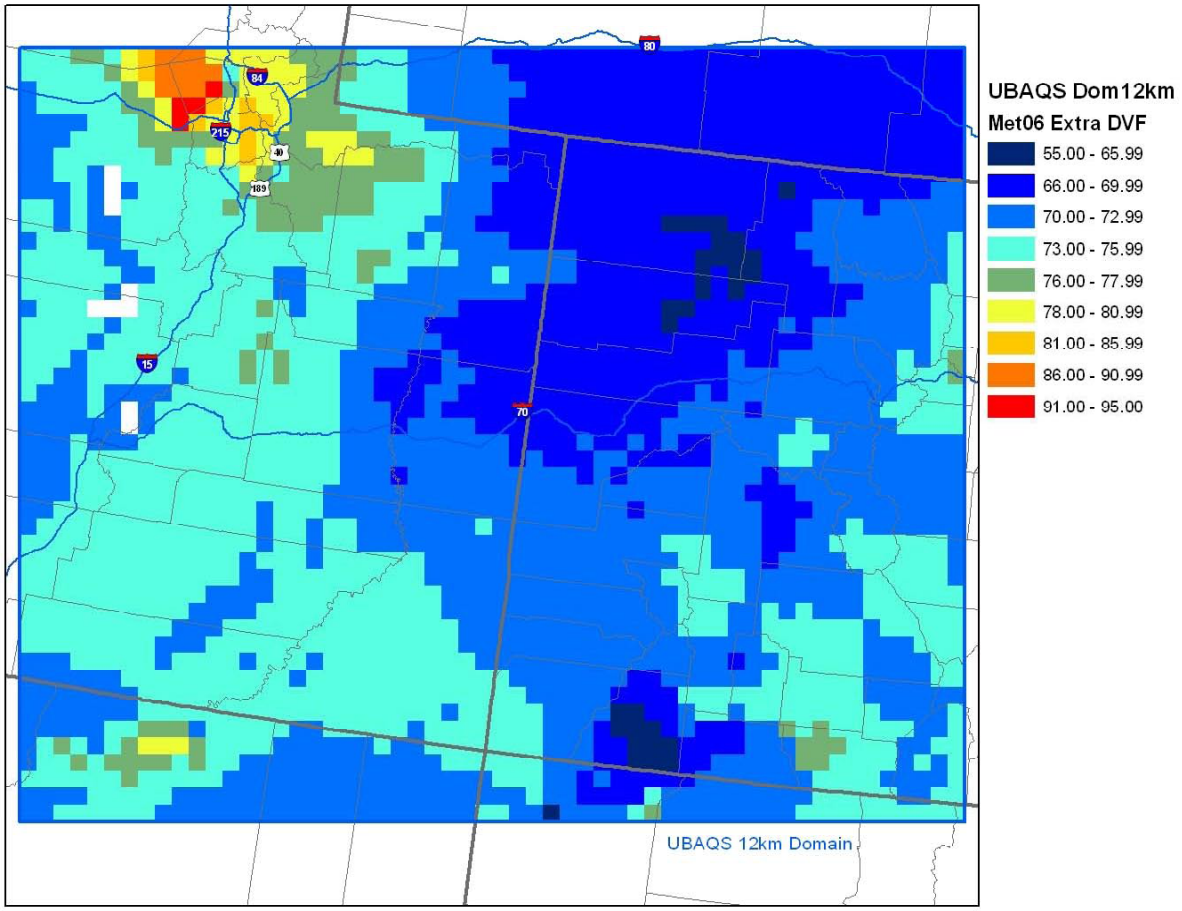


Figure 5.12-6 Differences in the projected 2012 (DVF) and current year (DVC) 8-hour ozone Design Values from the enhanced MATS unmonitored area analysis for the 2005 meteorological year (DVF-DVC).

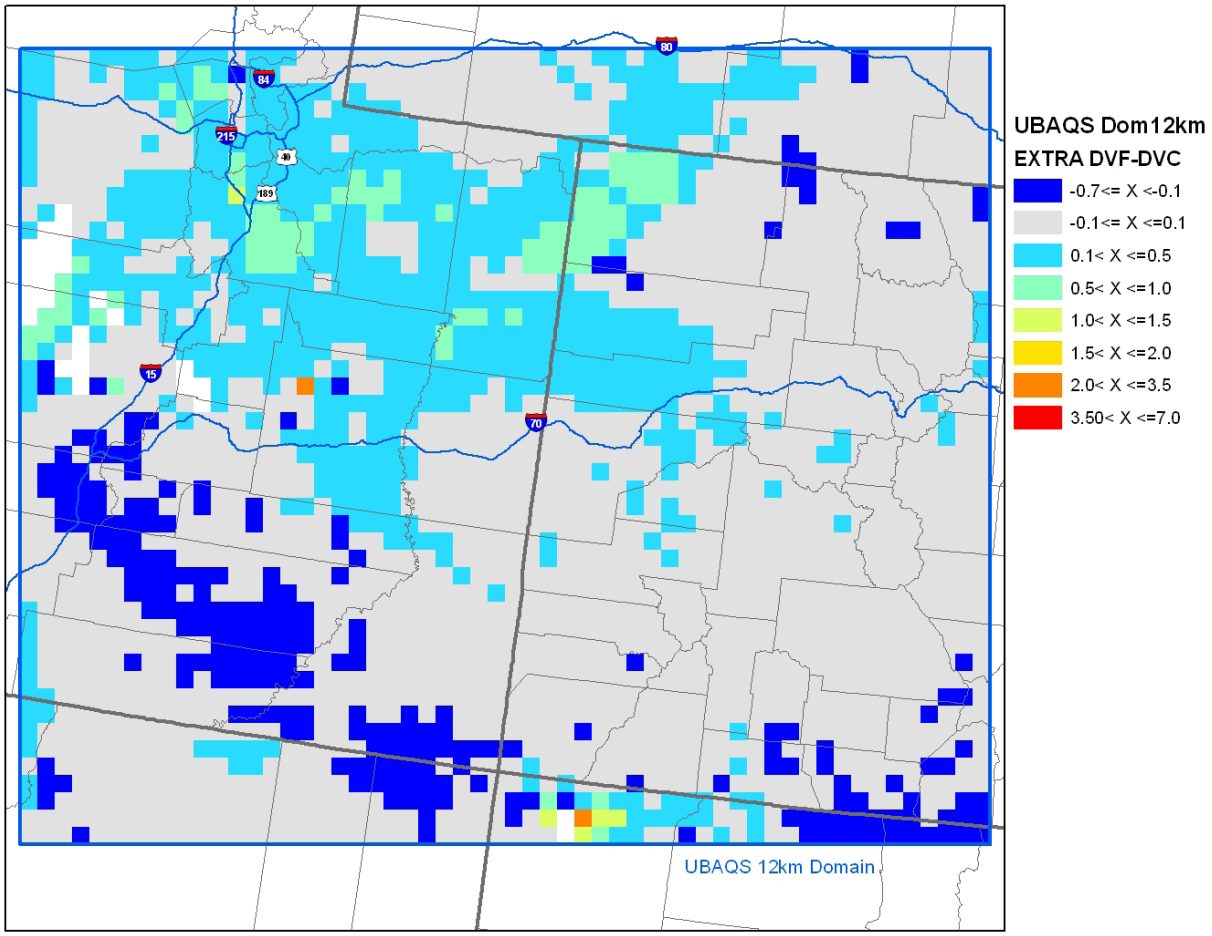
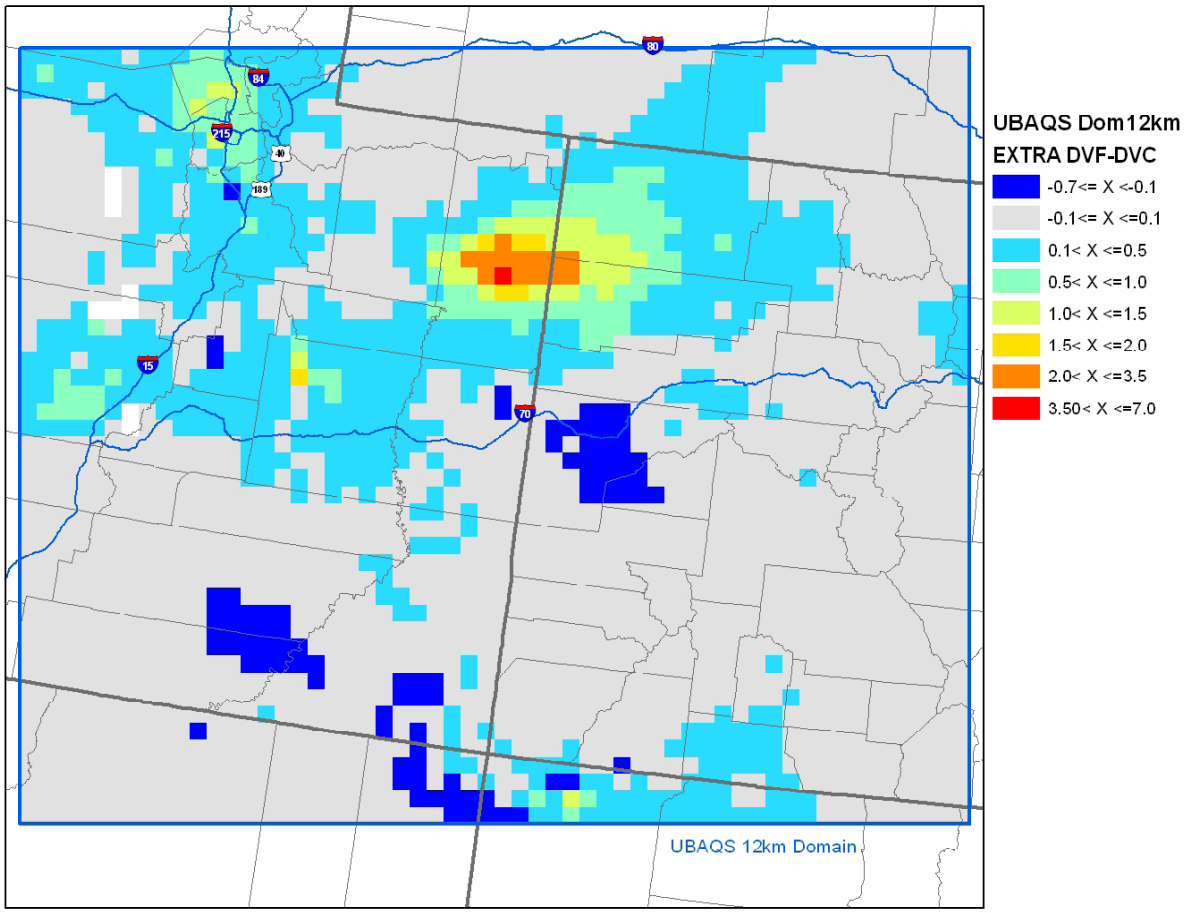


Figure 5.12-7 Differences in the projected 2012 (DVF) and current year (DVC) 8-hour ozone Design Values from the enhanced MATS unmonitored area analysis for the 2006 meteorological year (DVF-DVC).



5.12.3.2 Secondary $PM_{2.5}$

As with ozone, secondary $PM_{2.5}$ is not directly emitted into the atmosphere. Instead, secondary $PM_{2.5}$ is formed through the chemical combination of precursor pollutants that have been released into the ambient atmosphere. As a result, $PM_{2.5}$ must be assessed utilizing a regional photochemical modeling simulation. As with ozone, based on a review of the costs associated with completing such an analysis, the USFS was compelled to develop the secondary $PM_{2.5}$ analysis utilizing existing scientifically credible information. Based on the reliance on the Uinta Basin Air Quality Study (UBAQS) for the ozone portion of this EIS, that study was once again selected as the most representative and recently produced assessment of $PM_{2.5}$ for the Dixie EIS region.

Although the UBAQS contains the shortcoming previously mentioned in Section 5.12.3.1, it remains the most recently developed and technically defensible assessment of region-wide total (primary and secondary) $PM_{2.5}$ impacts for the Dixie National Forest region.

The UBAQS produced an assessment of absolute modeled $PM_{2.5}$ concentrations. These values were generated for the entire 12km modeling domain and can be used for direct comparison to the NAAQS, which are 35 µg/m^3 for the 24-hour average and 15 µg/m^3 for the annual average. As with the ozone modeling described in Section 5.12.3.1, the absolute modeled $PM_{2.5}$ concentrations were calculated based upon "current" and "future" year emissions assessments. The current year emissions were based on assessments of emissions as they occurred during calendar year 2006 while the future year emissions where based on forecasted emissions growth for all emissions sources to the future year of 2012. Each of these emissions scenarios were modeled utilizing two sets of meteorological conditions. Those observed in calendar year 2005 and those observed in calendar year 2006. These simulations were then used to calculate the absolute modeled $PM_{2.5}$ impacts.

Annual average and 24-hour average $PM_{2.5}$ plots for both meteorological years are shown below in Figures 5.12-8 and 5.12-9, respectively.

For the 2005 meteorological year, the current and future year emissions scenarios show $PM_{2.5}$ annual average values that are less than 15 µg/m^3 everywhere in the 12 km domain including throughout the entire Dixie EIS study region, indicating compliance with the NAAQS. In both the current and future year emissions scenarios, the maximum annual average $PM_{2.5}$ value within the 12 km domain is 14 µg/m^3 which occurs in the Salt Lake City region. Values within the Dixie EIS study region are not predicted to exceed approximately 6 µg m-3.

For the 2006, meteorological year, the annual $PM_{2.5}$ is within the NAAQS everywhere within the 12 km domain except in the Salt Lake City area, where the maximum value is 17 µg/m^3 in both the current and future year emissions scenarios. In both the 2005 and 2006 meteorological years, there is a secondary $PM_{2.5}$ maximum extending from the center of the modeling domain southwest toward the Utah-Arizona border, but this region of elevated PM2.5 does not exceed the annual average standard. The annual average $PM_{2.5}$, impacts are greater in the 2006 meteorological year than in 2005, however in no modeled scenario does absolute $PM_{2.5}$ impacts exceed 9 µg/m^3 in the Dixie EIS study region

5.12-9 shows that the 98th percentile of the 24-hour $PM_{2.5}$ (8th highest 24-hour average) is less than the 35 µg/m^3 standard over much the domain for both the current and future year emissions scenario, but exceeds 35 µg/m^3 in the Salt Lake City area and in the Uinta/Pinceance Basin in east-central Utah/west-central Colorado for both meteorological years. However, in

both meteorological years, the Dixie EIS study region is predicted to remain below the 35 μg/m^3 standard, and in most locations of the forest the impacts are predicted to be significantly below that value.

The pattern of changes in annual and 24-hour average $PM_{2.5}$ going from current to the future year emissions scenarios are similar in the 2005 and 2006 meteorological years. Maximum increases occur in northeastern Utah in the Uinta Basin and along the Arizona-Utah border and maximum decreases occur in western Colorado in the Piceance Basin, in Southwest Wyoming, and around Salt Lake City. In the Dixie EIS study region, $PM_{2.5}$ impacts are projected to remain relatively constant and will not posed a threat to exiting $PM_{2.5}$ NAAQS on either an annual or 24-hr timescale.

Figure 5.12-8 Modeled annual average PM2.5 for comparison to NAAQS for the 2005 meteorological year (left column) and 2006 meteorological year (right column).

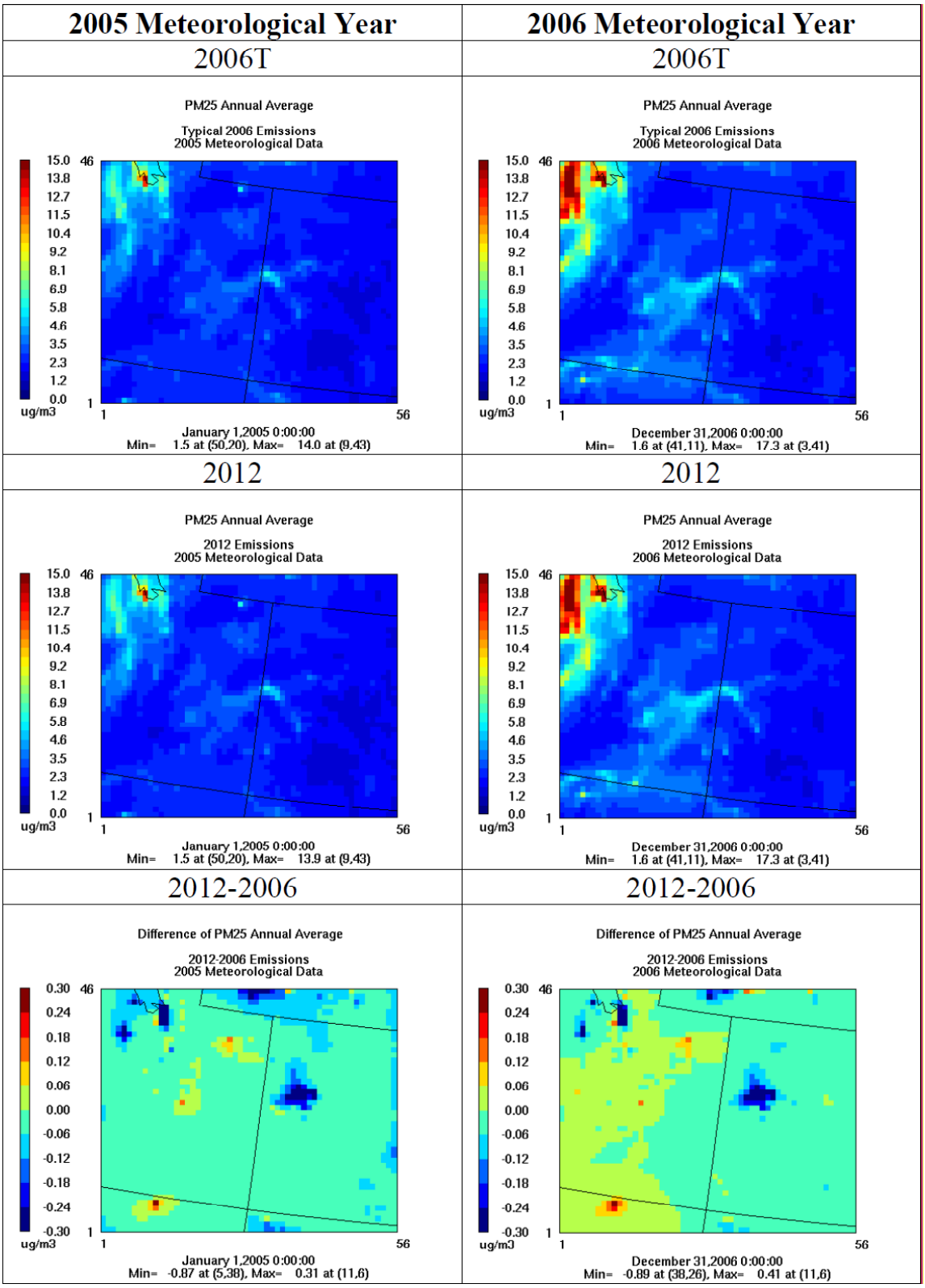
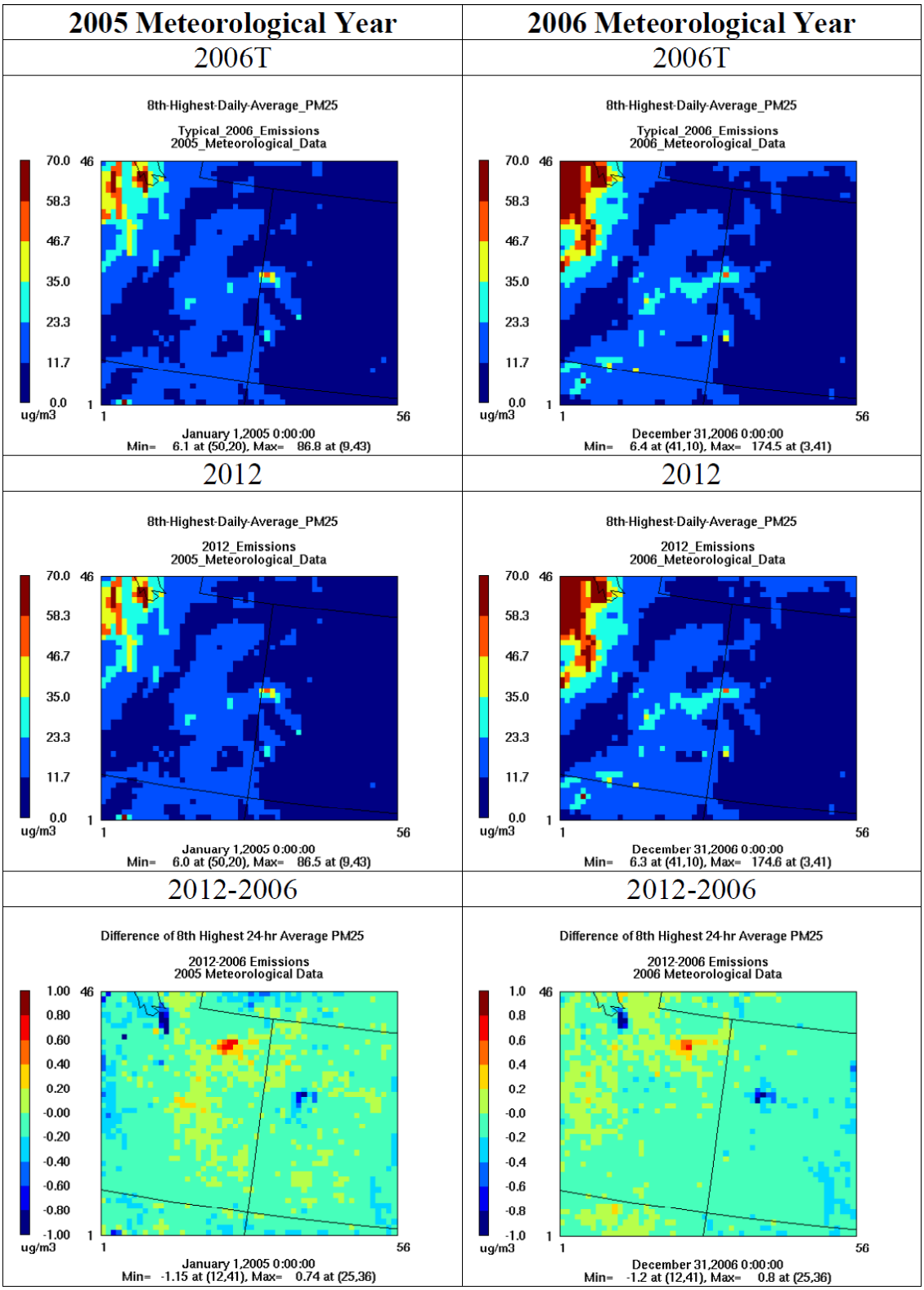


Figure 5.12-9 Modeled 24-hour average PM2.5 for comparison to NAAQS for the 2005 meteorological year (left column) and 2006 meteorological year (right column).



5.12.3.3 Climate Change

Climatic conditions described in Section 3.12.1 have, to some degree, already been affected by climate change and thus these past and current climate change effects are already included in the impact analysis of the EIS. Future climate change has the potential to further impact many of the same environmental resources in ways that are described in Appendix SIR-2 (Section 2). It is difficult to predict with any certainty the cumulative effects of future climate change along with the environmental impacts already described in the EIS.

The IPCC continental-scale modeling conducted for North America indicates warmer temperatures and generally less precipitation in the southwest U.S. on an annual basis (Christensen et al. 2007, p.850, p.887-888). For the western U.S., the IPCC modeling suggests modest changes in average annual precipitation ranging from slightly less than normal in the south to slightly greater than normal in the north. Change in winter precipitation is predicted to be variable with more winter precipitation in the northern part of the western U.S. and less in the Southwest. Summer precipitation is predicted to be less throughout the West. However, it is also noted that the continental-scale regions encompass a broad range of climates and are too large to be used as a basis for conveying quantitative regional climate change information.

The IPCC projection of less warming over the ocean than the land, and amplification and northward displacement of the subtropical anticyclone is likely to cause a decrease in annual precipitation in the southwestern U.S. (Christensen et al. 2007). According to the Fourth Assessment Report of the IPCC (Christensen et al. 2007), the following general climate change projections were made for the southwest U.S.:

- Seasonally, warming is *likely* to be largest in summer.
- Maximum summer temperatures are *likely* to increase more than the average summer temperature.
- Annual mean precipitation is *likely* to decrease.
- Snow season length and snow depth are *very likely* to decrease.

Wagner et al. (2003) reviewed the work of a number of climatologists, evaluated 20th century climate records for trends, and conducted two large computer models with the assumption that CO_2 concentrations would double in the 21st century to predict climate change effects in the Great Basin/Rocky Mountain region. They noted that use of global-scale models cannot be expected to project climate changes at localized areas with highly variable climates and great topographic variation like the Great Basin/Rocky Mountain area. Their modeling results showed year-round increases in temperature with the greatest increases occurring in winter. They also showed that annual precipitation was predicted to increase with the greatest increase occurring in winter.

Most of Utah's water resources originate in mountainous areas above 6,500 feet in elevation, which cover about 19 percent of the state (BRAC 2007). The primary source of this water is snowpack, which releases months of stored precipitation in about 4 to 8 weeks during spring and summer, as described in Section 2.3.2 of Appendix SIR-2. Clear and robust long-term snowpack declines have yet to emerge in Utah's mountains, as they have in low-elevation mountains in other states (i.e., in the Pacific Northwest and California). In addition, recent temperature increases in Utah appear to have had little impact on snowpack in the high mountains of the Intermountain West. However, studies of precipitation and runoff over the past

several centuries and climate model projections for the next century indicate that ongoing GHG emissions at or above current levels will likely result in a decline in Utah's mountain snowpack, thus the threat of severe and prolonged episodic drought in Utah is real (BRAC 2007). In addition, changes in snowpack will result in a declining water supply. Current climate models project a decline in summer precipitation across all of Utah (BRAC 2007).

The population of the Intermountain West (eight states including Utah) is projected to increase by 65 percent from 2000 to 2030, representing one-third of all U.S. population growth (USGCRP 2009). Between 2000 and 2005, Utah was among the five fastest growing states in the U.S. (US GCRP 2008). Projections of decreased snowpack and earlier spring melting suggest lower stream flows in the future, particularly during the high-demand period of summer (USGCRP 2008). There is a high likelihood that water shortages will limit power plant electricity production in many regions, and constraints in production by 2025 are projected in ten states including Utah (USGCRP 2009).

Forests are generally adapted to recent climatic conditions and variability (Hamrick 2004), but the rate of temperature change expected during the next century will greatly exceed that produced naturally over the past several thousand years. Apart from other human-related factors such as forest management practices and land-use changes, future climate change is likely to contribute to drier conditions in Utah forests as well as increased wildfire intensity, more insect outbreaks, and reduced forest health.

Droughts in Utah have exacerbated declining forest health across the state, and consequently Utah's forests have become more susceptible to intense wildfire, insects, and disease (UDNR 2003). The ecological impacts of wildfires as well as forest pests and diseases are expected to rise with climate warming, with extended periods of high fire risk and large increases in area burned (IPCC 2007b; USGCRP 2009). A study of historical spruce beetle outbreaks on the Markagunt Plateau revealed that small-scale disturbances have been the norm over the past century, and that large-scale outbreaks occurring in recent history (in the early 1990s, in this study) are an unprecedented phenomenon (DeRose and Long 2007).

The extent of sagebrush habitat is expected to decline in the future due to climate change, if current predictions are realized, due in large part to the expansion of cheatgrass (*Bromus tectorum)* under increased carbon dioxide conditions, which would fragment sagebrush habitat and lead to more frequent wildfires (FR 75(55):13910-14014, published 23 March 2010). A decline in sagebrush would indirectly affect wildlife, including special status species that depend on sagebrush, such as greater sage-grouse (Candidate) and pygmy rabbit (Sensitive).

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6.1 Preparers and Contributors

Lead Agency: US Department of Agriculture, Forest Service (USFS), Dixie National Forest

Cooperating Agencies: US Department of the Interior, Bureau of Land Management (BLM), Cedar City Field Office; State of Utah

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Keith Harris	NEPA Coordinator	USFS
Kenton Call	Public Affairs Officer	USFS
Laurie Parry	GIS Management Specialist	USFS
Marian Jacklin	Forest Archeologist	USFS
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Mark Madsen	Botanist	USFS
Jeff Sorkin	Air Specialist	USFS
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Rich Jaros	Soil and Water Program Manager	USFS
Sue Baughman	EIS Project Manager	USFS

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Claudia Gallegos	GIS	BS Environmental Science 8 Years Experience
Linda Matthews	Visual Resources	BS Environmental Studies 30 Years Experience
Dave Kikkert	IRAs and Wild and Scenic Rivers, Watershed Resources	MS Ecology BS Fisheries and Wildlife 8 Years Experience
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6.2 Distribution of the Final Environmental Impact Statement

This section lists those individuals, organizations, and agencies who received hard copies or CDs of this FEIS by the date this document was prepared for printing. We will continue to provide CDs to those who request them. This FEIS is also available online on the Dixie National Forest's website at http://www.fs.usda.gov/goto/dixie/projects.

Federal Agencies:

US Environmental Protection Agency - Office of Federal Activities

US Environmental Protection Agency - Region 8, EPR-N, EIS Review Coordinator

US Department of the Interior - Director, Office of Environmental Policy and Compliance

US Department of Interior Natural Resources Library

Bureau of Land Management – Washington DC Office

Bureau of Land Management – Juan Palma, Director, Utah State Office

Bureau of Land Management – Jimmy Tyree, St. George Field Office

Bureau of Land Management – Todd Christensen, Color Country District Office

Bureau of Land Management – Randy Trujillo, Cedar City Field Office

US Forest Service – Washington DC Office

US Forest Service – Terry Delay, Escalante Ranger District

US Forest Service – Bevan Killpack, Pine Valley Ranger District

US Forest Service – Veronica Magnuson, Cedar City Ranger District

US Forest Service – Lori Wood, Powell Ranger District

National Park Service – Air Resources Division

Bryce Canyon National Park

US Fish and Wildlife Service

Army Corps of Engineers

Advisory Council on Historic Preservation

USDA Animal and Plant Health Inspection Service, Policy Program Development

National Resource Conservation Service

National Agriculture Library

Chief of Naval Operations

Organization of the Petroleum Exporting Countries

Federal Aviation Administration

Federal Highway Administration

National Oceanic and Atmospheric Administration

Department of Energy – Office of Environmental Compliance and NEPA Policy and Compliance

Bureau of Reclamation

Minerals Management Service

US Geological Survey

Office of Surface Mining

Federal Depository Library System – Government Printing Office

Bureau of Indian Affairs – Don Sutherland

State, County, and Local Officials:

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Utah State Historic Preservation Office

Utah Division of Wildlife Resources

Five County Association of Governments - Ken Sizemore, Executive Director

Kane County Commission

Piute County Commission

Iron County Commission

Washington County Commission – Alan Gardner

Garfield County Commission

Wayne County Commission

US Senator Hatch's Office – Mareen Casper

US Senator Mike Lee

US Congressman Jim Matheson's Office – Mike Empey

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UT Representative Mike Noel

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Paiute Indian Tribe of Utah - Jeanine Borchardt , Chairwoman

Navajo Nation - President Joe Shirley, Jr.

Hopi Tribal Council – Leroy Ned Shingoitewa, Chairman

Kaibab Paiute Tribal Council - Timothy Rodgers, Tribal Chairperson

Pueblo of Zuni - Norman Cooeyate, Governor

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Utah Chapter of the Sierra Club – Mark Clemens

Red Rock Forests - Harold Shepherd, Executive Director

Forest Service Employees for Environmental Ethics – James Johnson, Policy Analyst

Theodore Roosevelt Conservation Partnership – Joel Webster

Center for Biological Diversity – Marc Fink

Public Lands Director, Blue Ribbon Coalition – Brian Hawthorne

Great Old Broads for Wilderness – Veronica Egan, Executive Director

Wild Utah Project – Allison Jones

Boulder Community Alliance – Tim Clarke

Grand Canyon Trust – Mary O'Brien, Utah Forest Project Manager

Grand Canyon Wilderness Council – Kim Crumbo, Director of Conservation

Trout Unlimited – Corey Fisher, Energy Field Coordinator

The Wilderness Society, Four Corner States – Steve Smith

National Resources Defense Council - Western Lands and Forests

WildEarth Guardians – Jeremy Nichols, Climate and Energy Program Director

Californians for Western Wilderness – Michael J. Painter

Approximately 100 Notice of Availability letters will be sent out to key contacts that have expressed an interest in the project.

Hard copies of the FEIS are available for review at the Dixie National Forest Supervisor's office and the Cedar City BLM Field Office.

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7.1 Introduction

7.1.1 DEIS Public Involvement

On October 17, 2008, a Notice of Availability (NOA) announcing the availability the DEIS for a 60-day public comment period was published in the Federal Register (http://www.gpoaccess.gov/fr/) and on the EPA's Federal Register of Environmental Documents (http://www.epa.gov/fedrgstr/). Letters were mailed to all parties that provided scoping comments, along with CDs containing an electronic copy of the DEIS if requested. These letters described the public comment period; and how, where, and when to submit comments. Paper copies of the DEIS were distributed to all cooperating agencies and any requesting interested organization or individual. An electronic copy of the DEIS was also made available for download on the Dixie National Forest website. Additional paper and CD copies were made available for the public at the Cedar City BLM Office and Dixie National Forest Supervisor's Office.

Public meetings for the DEIS were held on November 5 in Cedar City, Utah (2 attendees); November 6 in Boulder, Utah (9 attendees); and November 13 in Panguitch, Utah (0 attendees). The public comment period officially closed on December 15, 2008.

Only those who commented during the 60-day DEIS comment period (17 October to 15 December 2008) are eligible to appeal the decision.

In January 2009, the U.S. Forest Service (USFS) issued guidance on including climate change in the environmental analyses for future planning decisions. In accordance with this direction and in response to public comment, the Forest has prepared a new appendix to the EIS that considers the effects of the proposed oil and gas leasing on climate change and the effects of climate change on the proposed action. This appendix was made available for public review as **Appendix SIR-2**.

7.1.2 Supplemental Information Report

During the 60-day DEIS comment period a number of comments were received relative to the impact analysis for air resources. The Environmental Protection Agency (EPA) provided their comments on the DEIS with the exception of comments on the air quality analysis, with the understanding that an updated air quality analysis would be released as a SIR to the DEIS. They recommended that this study use different air emission factors for the subject facilities-based emission limitations, which would become effective in the future. This revised modeling was conducted in collaboration with the EPA and the Utah Division of Air Quality (UDAQ). The report on this modeling was revised and was made available for public review as **Appendix SIR-1**.

A Supplemental Information Report (SIR) was published in the Federal Register on February 19, 2010. The SIR disclosed additional information prepared in response to comments received on the air resources sections of the Oil & Gas Leasing Draft EIS (DEIS) for the Dixie National Forest. This information was released for public review and comment prior to preparation of the Final EIS.

As a result of the two new sources of information described above, the Dixie National Forest has modified the Air Resources sections of the FEIS to incorporate the revised air quality impact

modeling results and the evaluation of climate change. These modified sections of the FEIS (Sections 3.12, 4.12, and 5.12) were made available for public review as the main body of the SIR.

7.2 Content Analysis

The Dixie NF received approximately 10,000 comment letters from other Federal agencies, State and local governments, Indian Tribes, and the interested public. Of these comments received, 9,707 were form letters generated by the Natural Resources Defense Council (NRDC), 284 letters were either unique letters from individuals or contained unique language in addition to the form letter, and 11 were letters from Federal, State, or local Governments or Agencies. All public comments were tracked in a database and the comments that met the criteria in 40 CFR 1503.4 were categorized by resource concern. A number of comments were received that were general in nature and did not meet the criteria in 40 CFR 1503.4. These comments did not:

- Modify an alternative, including the proposed action,
- Develop and evaluate alternatives not previously given serious consideration by the Agency,
- Supplement, improve, or modify its analyses, or
- Make factual corrections.

The Content Analysis Team processed all of the DEIS and SIR comments received by the close of each respective comment period. Public input was documented and analyzed using a process called content analysis, which is a systematic method of compiling and categorizing the full range of public viewpoints and concerns regarding a plan or project. This process has been used in a number of other federal NEPA projects. Content analysis is intended to facilitate good decision-making by helping the planning team clarify, adjust, or incorporate information into preparation of the Final EIS for a project. All responses (i.e., letters, emails, faxes, and other types of input) are included in this analysis.

In the content analysis process, each response was given a unique identifying number, which allows analysts to link specific comments to original letters. Respondents' names and addresses are then entered into a project-specific database program, enabling creation of a complete mailing list of all respondents. The database is also used to track pertinent demographic information such as responses from groups of commenters or federal, state, tribal, county, and local governments. Letters from groups of persons are given unique identifying numbers even if they are form letters; although the associated comments from form letters are processed only once under the master letter (first of that form letter processed).

All input is considered and reviewed by analysts. Each response is first read by one analyst and sorted into comments addressing various concerns and themes. A second analyst reviews the sorted comments to ensure accuracy and consistency. Comments are then entered by number and type (e.g., "watershed resources") into the database. Next, based on comments of each type received, analysts identified a wide range of public concerns which address the comments received. The purpose of identifying public concerns is to combine comments that address similar issues. The final product includes a list of public concerns, each of which addresses all comments that relate to that public concern.

It is important for the public to understand that this process makes no attempt to treat comments as votes. In no way does content analysis attempt to sway decision makers toward the will of any majority. Content analysis provides the means to ensure that every original comment is considered at some point in the decision process.

The content analysis method employs both qualitative and quantitative approaches. It is a systematic process designed to provide specific demographic information, a mailing list of respondents, identification of individual comments by topic in each response, evaluation of similar comments from different responses, and to summarize like comments as specific public concern statements. The breadth, depth, and rationale of each comment are especially important. In addition to capturing relevant factual input, analysts try to capture the relative emotion and strength of public sentiment behind particular viewpoints in order to represent the public's values and concerns as fairly as possible. Analysts then organize the concern statements to facilitate systematic review and response by decision makers.

Each statement of public concern is an analyst's succinct rephrasing of one or more comments expressing similar views of what management action the agency should take. Each public concern statement is assigned a unique number. Organized by topic, chapter or resource, the public concern statements and responses appear in Section 7.4. Under each public concern statement, a response is given. For readers having specific interest in how all their comments were coded into the data base, copies of the comment database are available on CD by requesting same from the USFS EIS project manager.

7.3 Changes between Draft and Final EIS

A number of changes were made to the DEIS in preparing the FEIS. Several changes were made to the action alternatives, and specifically leasing options, in response to public comments on the DEIS. Other changes to leasing options reflect Forest or other Agency decisions made since the DEIS that have bearing on the resources analyzed. Table 7.3-1 summarizes the major changes to leasing options since the DEIS.

Table 7.3-1 Major changes to leasing options since the DEIS

Resource	DEIS Leasing Option	FEIS Leasing Option	Alternatives Affected
Inventoried Roadless Areas	NSO (mod*)	NSO	C, D1, and E1
NPS Protective Measure (new)	n/a	NL	B
	n/a	NSO	C
ROS Primitive	NL	NSO	C
Sage-Grouse Leks	1-mile buffer	2-mile buffer	B and C
Fisheries Habitat	300-foot buffer	500-foot buffer	C
Boreal Toad Habitat (new)	n/a	Added to "Forest Service-Sensitive Species and Suitable Habitat"	A-E
Lava Fields over Sensitive Aquifers	NSO	NL	B and C
Class I Airsheds – 60 km buffer (new)	n/a	CSU	A-E
Drinking Water Source Protection Zones	n/a	Lease Notice	A-E

*Actual leasing option CSU but called a "modified NSO."

Incorporating revised leasing options and new resources necessitated re-running the GIS model. The new model output, or the number of acres under each leasing option across the Forest, and revised baseline acres where appropriate, is reflected in each resource section in the FEIS.

7.4 Comments and Responses

7.4.1 General Preservation

Public Concern ID 1.01

The Dixie National Forest attracts more than half a million visitors each year, and the Forest Service should be protecting its spectacular wildlands and wildlife, not allowing their destruction by commercial and industrial interests. [Cmt 42.009, 44.004, 46.010, 47.010, 48.011, 49.001, 50.011, 51.010, 52.009, 53.007, 54.010, 55.007, 56.007, 57.009, 59.009, 60.009, 61.008, 65.009, 66.009, 67.010, 68.013, 69.010, 70.009, 71.010, 72.012, 73.009, 74.010, 76.004, 78.010, 80.009, 81.004, 83.002, 84.006, 85.009, 86.010, 87.012, 88.010, 89.010, 90.009, 91.009, 92.011, 93.001, 94.010, 95.009, 97.010, 98.012, 99.003, 99.009, 100.010, 101.009, 102.009, 104.001, 105.004, 106.009, 107.009, 108.009, 109.009, 110.012, 111.010, 112.001, 113.010, 114.010, 115.009, 116.006, 118.001, 119.012, 120.010, 121.010, 122.010, 123.009, 124.010, 125.010, 126.009, 127.009, 128.009, 129.009, 130.009, 131.009, 132.009, 133.012, 134.010, 135.011, 136.010, 138.009, 139.010, 140.010, 141.010, 142.009, 144.009, 145.009, 146.011, 147.012, 148.009, 149.010, 150.010, 151.013, 152.010, 153.009, 154.012, 155.009, 156.014, 157.009, 158.005, 159.009, 160.010, 161.013, 162.009, 164.010, 165.010, 167.010, 168.010, 169.010, 170.009, 171.015, 172.014, 173.008, 174.002, 175.012, 177.009, 178.011, 179.011, 180.013, 181.011, 182.011, 183.005, 184.010, 185.009, 186.009, 187.010, 188.010, 190.005, 191.010, 192.009, 193.009, 194.009, 195.009, 196.008, 197.011, 198.010, 199.008, 200.010, 201.012, 202.001, 203.009, 204.010, 205.010, 206.010, 207.009, 208.010, 209.010, 210.012, 211.012, 212.010, 213.011, 214.009, 215.009, 216.002, 216.010, 217.010, 219.009, 220.009, 221.004, 222.009, 223.009, 224.010, 225.010, 226.010, 227.009, 229.010, 230.009, 232.009, 233.011, 234.009, 235.009, 236.002, 237.010, 238.009, 239.009, 240.010, 241.011, 242.005, 245.010, 247.009, 248.009, 250.014, 251.009, 252.009, 253.011, 254.012, 255.010, 256.009, 257.002, 258.010, 259.011, 260.011, 261.008, 262.011, 263.009, 264.010, 265.009, 266.011, 267.001, 269.009, 270.009, 272.009, 274.009, 275.009, 276.010, 277.009, 278.009, 279.011]

Response: The Forest Service utilizes multiple-use sustained yield management principles, and will make a decision based on the understanding of environmental consequences of the project. Environmental consequences are disclosed in Chapter 4 of the EIS.

Public Concern ID 1.02

The Forest Service should acknowledge in its leasing decisions that natural resources are more enduring and sustainable than energy resources, which are finite and ephemeral, and leasing decisions should retain and enhance the natural values. [Cmt 1.001, 6.002]

Response: The relationship between short-term uses and long-term productivity is discussed in **Section 4.14** of the **DEIS**, following 40 CFR 1502.16. As defined by NEPA, short-term use is equated with exploration activities, including seismic activities and exploratory drilling. Exploration activities are discussed in terms of their potential to impact long-term productivity, such as that of wildlife habitat, water quality, and mature vegetation communities.

Public Concern ID 1.03

The main uses and values for the Forest are preservation and stewardship, and these values should be protected against private development. The Forest Service should fulfill its duty to protect these values rather than exploiting them for short-term gain. [Cmt 3.002, 3.069, 3.073, 3.078, 40.001, 51.001, 70.011, 96.002, 98.011, 124.012, 154.001, 154.003, 156.007, 168.001, 170.012, 171.004, 172.005, 192.011, 199.001, 202.010, 226.001, 231.001, 256.011, 264.001, 278.011, 279.002, 281.001]

Response: See **Public Concern ID 1.01** response regarding multiple-use. The Forest Service "advocates a conservation ethic in promoting the health, productivity, diversity, and beauty of forests and associated lands" (Forest Service Mission Statement; FSM 1020). Wilderness Areas on the Dixie National Forest were established to preserve the wilderness characteristic of the areas and to restrain human influences. These areas are not available for leasing (**Section 1.5.1** of the **DEIS**). Consideration of short-term uses vs. long-term productivity is discussed in **Section 4.14**. See **Public Concern ID 1.02** response.

Public Concern ID 1.04
Allowing oil and gas leasing will severely disadvantage the public because public lands are scarce and provide resources that private lands cannot. Oil and gas leasing under Alternative C will compromise the unique values, public benefits, and resources of the Dixie without any substantial benefit to the public. [Cmt 3.005, 3.009, 3.064, 34.002, 68.001, 96.004, 156.006]

Response: The Forest Service manages its lands under multiple-use approaches that support uses of the resources the public lands provide. Commodities extracted in the development of domestic resources help assure satisfaction of industrial, security, and environmental needs. This provides a benefit to the public.

Public Concern ID 1.05
The Forest Service should protect the Forest for future generations. Drilling is not a viable future for the ecosystem or the nation, and leaves future generations less chance of achieving a balance between the economy and the environment. The Forest belongs to our children and grandchildren and should be left for them. [Cmt 3.007, 3.065, 14.002, 14.004, 15.002, 16.001, 18.001, 23.001, 24.001, 24.002, 29.003, 29.005, 30.004, 31.001, 53.002, 60.011, 67.001, 68.002, 68.003, 68.004, 84.001, 91.011, 92.002, 102.011, 120.001, 124.001, 126.011, 128.011, 135.001, 140.001, 151.012, 154.002, 161.004, 182.002, 186.011, 192.012, 201.002, 219.011, 228.006, 266.002, 277.011]

Response: As stated in **Section 1.1** of the **DEIS**, the Forest Service's national policy on minerals (USFS 2007a) indicates that the Forest Service will balance the need to provide commodities for current and future generations with the need to sustain the long-term health and biological diversity of ecosystems. Under NEPA, the decision maker will choose the alternative that meets the needs of future generations, in both commodities and in the long-term health of the ecosystem. See **Public Concern ID 1.01** response for purpose and need.

Public Concern ID 1.06
The Forest Service should exercise caution in offering any oil or gas leases at the eastern end of the system (i.e., Boulder Mountain). [Cmt 6.014, 12.057]

Response: The general discussion of impacts from leasing (i.e., connected actions; Chapter 4 of the EIS) can be applied to the eastern end of the Dixie, including the Boulder Mountain area (the Aquarius Plateau between Highway 24 and Highway 12). Additional NEPA analysis would take place to analyze the site-specific development plans on any Dixie National Forest lease.

Public Concern ID 1.07
Do not drill in the Dixie National Forest. Oil and gas leasing should not be allowed on the Dixie National Forest. [Cmt 21.001, 23.003, 40.004, 48.001, 58.007, 60.013, 74.001, 90.011, 100.001, 116.001, 116.007, 118.003, 134.002, 149.001, 150.001, 156.001, 156.015, 173.006, 180.001, 184.001, 191.002, 203.011, 213.001, 213.002, 247.011, 254.003, 262.001, 266.001, 268.009, 281.003]

Response: The purpose and need of the leasing EIS (**Sections 1.3** and **1.4** of the **DEIS**) is to analyze the lands under Forest Service jurisdiction that are legally available for leasing. A No Lease Alternative (Alternative A) has been analyzed. The Forest Supervisor must make administrative lease availability decisions in order to process lease requests by the oil and gas industry in accordance with the Energy Security Act, Leasing Reform Act, Energy Policy Act, federal regulations 36 CFR 228 (E) and 43 CFR 3100, and other decisions, policy, and legislation (**Section 1.8** of the **DEIS**).

Public Concern ID 1.08
The Dixie National Forest should not be developed in order to preserve its intrinsic [wild/beautiful/pristine/sacred/natural] characteristics. [Cmt 24.002, 25.003, 33.002, 41.010, 44.002, 46.001, 47.001, 58.006, 62.001, 75.002, 97.001, 119.003, 122.001, 125.001, 132.010, 133.001, 139.001, 145.011, 152.008, 161.003, 162.011, 169.008, 172.001, 174.001, 175.001, 175.003, 179.002, 208.001, 212.001, 221.003, 280.001]

Response: See **Public Concern ID 1.01** for Forest Service mission, **Public Concern ID 1.05 and1.07** response for purpose and need, and **Section 1.5** of the **DEIS** for lands involved in the decision.

Public Concern ID 1.09
If there has to be drilling, it should be minimal and should be done in the least destructive way possible. Oil and gas leasing should be reasonable. [Cmt 48.002, 63.005, 63.007, 69.001, 179.001]

Response: Alternatives A, B, C, and D also contain specific protective stipulations for various resources (see **Table 2.5-1** in the **DEIS**). **Appendix C** of the **DEIS** contains construction and operating standards and well site design requirements for the Dixie National Forest. These requirements are applicable to all drilling and production operations, and will ensure that oil and gas disturbances are minimized and that management objectives for the Forest are met. See **Public Concern ID 1.01** response for multiple use. In addition, all operators are subject to requirements of the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (BLM and USFS 2007) and Best Management Practices of all responsible agencies at the time of approval.

Public Concern ID 1.10
Oil and gas leasing involves too much exploitation and unnecessary destruction and degradation, and therefore should not be allowed. The impacts from oil and gas development on natural resources are large and irreversible and these resources cannot be replaced. [Cmt 43.001, 43.007, 50.001, 52.011, 58.004, 66.011, 72.001, 88.001, 94.001, 113.001, 114.012, 119.001, 125.012, 128.012, 129.011, 147.003, 151.009, 170.011, 180.007, 189.007, 190.003, 198.001, 200.001, 206.001, 210.001, 218.001, 221.001, 223.011, 259.002, 273.002, 275.012, 278.012]

Response: Construction and operating standards have been developed for the Dixie National Forest to eliminate unnecessary degradation of natural resources (**Appendix C**; **Public Concern ID 1.09** response). Irreversible commitments of resources occur if the commitment is permanent and cannot be changed once made. Irretrievable commitments of resources occur when resources are used, consumed, destroyed, or degraded during oil and gas activities and cannot be reused or recovered for the life of the activity (temporary) or beyond (permanent). Using disturbances predicted by the RFDS, irreversible impacts that may occur to watershed and soil resources are disclosed in **Section 4.15** of the **DEIS**. Temporary and permanent irretrievable commitments of resources are also discussed in this section.

Public Concern ID 1.11
The Forest Service has a moral imperative to protect natural resources. Conservation is an important part of our national ethos. [Cmt 62.004, 99.001, 195.011, 259.001]

Response: In the development of alternatives, consideration was given to protecting sensitive resources on the Dixie National Forest. The analysis of alternatives in the **DEIS** gives the Forest Service decision maker an opportunity to choose among alternatives that provide varying levels of protection to natural resources. See **Public Concern ID 1.01** response.

Public Concern ID 1.12
Wilderness and wildlife are critical parts of America's natural heritage and what is left should be preserved. [Cmt 103.001, 137.005, 141.001, 164.009, 178.001, 194.012, 211.002, 214.011, 225.002, 260.001]

Response: Wilderness Areas are not administratively available for leasing. Impacts to wildlife are disclosed in **Section 4.5** of the **DEIS**. See **Public Concern ID 1.01** response for multiple use.

Public Concern ID 1.13
Oil and gas leasing will leave a legacy of death and destruction. [Cmt 114.001, 217.001, 230.011, 255.001, 270.011]

Response See responses to **Public Concern ID 1.01**, **1.05**, and **1.07**.

Public Concern ID 1.14
Save the Dixie National Forest/Earth/humans! [Cmt 146.002, 224.001, 240.001, 272.011]

Response: See **Public Concern ID 1.07** response regarding purpose and need.

Public Concern ID 1.15
Corporations currently have enough access to public lands. Most leased lands are not even being used. [Cmt 156.002, 173.004]

Response: **Section 1.8.4** of the **DEIS** contains a summary of legislation and policy related to oil and gas. Under the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (**Section 1.8.4.6** of the **DEIS**), Forest Service decisions for leasing with certain stipulations are binding on the BLM (who has the authority to issue leases) for National Forest System lands offered by the BLM for lease. Also see **Public Concern ID 3.04** response. The Forest Service is required to complete the analysis in the **DEIS** in order to process lease requests by the oil and gas industry (see **Public Concern ID 1.07** response for purpose and need).

Public Concern ID 1.16
The Forest should be preserved because it makes good economic sense (i.e., tourism). [Cmt 157.011, 253.010]

Response: See **Public Concern ID 1.01** response regarding multiple use. Indirect adverse impacts to tourism are discussed in **Section 4.11** of the **DEIS** (Socioeconomics), under *Management Indicator #6* (Potential Relocation of Recreation Outside/Away from Leasing Areas).

Public Concern ID 1.17
Mankind needs the natural environment to survive. The Forest should preserve the Dixie for its natural services, such as filtration of air and water, and flood prevention. [Cmt 45.002, 157.012, 176.002, 210.003]

Response: Ecosystem capabilities and processes are addressed in the Forest's Properly Functioning Condition system of evaluating vegetation communities. Acceptable ranges are developed for ecosystems using historical information and landscape ecology principles under the assumption that ecosystem processes (such as filtration of air and water) were at or near a stable equilibrium before Euro-American settlement. The Forest Service thus regularly tracks the capability of forest types to provide natural services.

7.4.2 General Development

Public Concern ID 2.01
The Dixie National Forest should not place restrictions on energy exploration and development because these lands can make significant contributions to US energy needs. The US needs gas and less dependence on foreign oil. [Cmt 10.006, 36.001, 39.001, 39.004]

Response: See **Public Concern ID 1.05 and 1.07**

Public Concern ID 2.02
The DEIS is biased against development because Alternative C prevents access necessary for reasonable exploration. [Cmt 10.009]

Response: The required analysis in the EIS is of a range of alternatives that are reasonable. Reasonable alternatives meet the purpose and need of the project (**Section 1.4** of the **DEIS**), are technically and economically feasible, and protect the environment to an acceptable level. The preferred alternative (Alternative C), as modified in the Record of Decision, is the alternative that the Forest Service believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. See **Public Concern ID 1.01** response regarding multiple use.

Public Concern ID 2.03
Alternatives A-C would create a de-facto wilderness when lands are supposed to be multiple-use. Exploration and development would be temporary uses of public lands. [Cmt 10.006, 10.009]

Response: A range of alternatives were considered and analyzed in the **DEIS** (see **Public Concern ID 4.03**). The decision to be made is which federal lands on the Dixie National Forest will be available for oil and gas leasing (**Section 1.6** of the **DEIS**). Designated wilderness areas

(**Section 1.5.2.1** of the **DEIS**) are not legally available for leasing, and no decisions would be made in this FEIS concerning wilderness areas on the Dixie National Forest. NEPA and CEQ regulations require that all federal actions and decision-making take into consideration effects on the human environment (NEPA Section 102(2) and §1500.2). The impact analyses in the EIS are a necessary step to comply with applicable statutes and provide the necessary hard look at the potential environmental effects of connected actions. See **Public Concern ID 1.01** and **2.02** responses.

Public Concern ID 2.04
Potential oil and gas can be developed rationally if adequate restrictions are in place, unlike the Green River Basin in Wyoming. Modern drilling technology allows for environmentally friendly drilling, and thus allows a balance between natural resources extraction and the environment. [Cmt 12.058, 17.002]

Response: See **Public Concern ID 1.07** and **1.09** responses.

Public Concern ID 2.05
Commenter supports drilling in the Dixie National Forest. [Cmt 35.001, 37.001, 38.001]

Response: This does not address any specific concern related to the proposed leasing or the DEIS. Comment noted. See **Public Concern ID 1.07** response regarding purpose and need.

7.4.3 Chapter 1

Public Concern ID 3.01
The DEIS needs to discuss areas with a split estate consisting of private surface rights and a federal mineral estate. The DEIS needs to clarify whether the areas of private lands mentioned in the DEIS include such split estate lands. [Cmt 2.071, 2.074]

Response: Split estate lands are discussed in **Sections 1.5.1** and **1.5.2.4** of the **DEIS**. Clarification was added to **Section 1.5.2.4** of the **FEIS** that there are 108 acres within the Dixie National Forest boundary that have private surface rights and federal oil and gas rights. There are also 85 acres that have state surface rights and federal oil and gas rights. The Forest Service does not have the authority to make private or state lands with federal oil and gas rights available for leasing, rather, only the BLM has that authority. As a result, these lands were not included in the analysis. However, the Forest Service would recommend stipulations for surface use similar to the Dixie National Forest lands surrounding any split estate parcel.

Public Concern ID 3.02
Sites listed on the National Register of Historic Places and other designated areas of concern are inappropriately considered a non-key issue. [Cmt 3.043, 3.074]

Response: Under the Law sites listed on and those eligible for listing on the National Register of Historic Places would be protected regardless of the alternative chosen.

Public Concern ID 3.03
The DEIS does not include an analysis of the opportunities that would be lost by limiting oil and gas activity on the Dixie National Forest. Rather, the analysis is limited to the potential impacts to resource values from oil and gas activity. As a result, the DEIS fails to balance the opportunities for oil and gas activity with the public concerns. [Cmt 10.001, 10.002]

Response: See **Public Concern ID 1.07** response regarding purpose and need. Beneficial socioeconomic impacts, including lease payments, royalties, and jobs generated, would be the same under all the action alternatives (B, C, D, and E; **Section 4.11.5** of the **DEIS**). The alternatives analyzed in the DEIS do not limit the potential for reaching the RFDS (**Appendix A**) by limiting the areas where impacts are allowed.

Public Concern ID 3.04
Diluting the analysis over the entire Dixie National Forest is inefficient and creates the potential for oil and gas exploration to occur without site-specific environmental review. The analysis of impacts in the DEIS would be more focused and site specific if it was focused on the petroleum plays outlined in the RFDS or focused on the areas with high or moderate hydrocarbon potential. [Cmt 12.002, 12.003, 12.005]

Response: The Federal Onshore Oil and Gas Leasing Reform Act of 1987 and the associated Forest Service regulations require the Forest Service to determine the availability of lands for oil and gas leasing, as well as the conditions under which leases will be issued. This requires the Dixie National Forest to analyze all lands under its jurisdiction and not just those with high or moderate hydrocarbon potential. Despite the expansiveness of analyzing the entire Dixie National Forest, it does not create the potential for oil and gas exploration to occur without site-specific review. As stated in **Section 1.1** of the **DEIS**, "This EIS is not a decision document to grant the right to explore for and develop oil and gas." "Rather, it is a document disclosing the environmental consequences of implementing various alternatives on the potential oil and gas leasing of lands that could be offered for lease in the future. Actual surface disturbing activities for oil and gas exploration and development would undergo future, project-specific environmental analyses."

Public Concern ID 3.05
Considering the entire Dixie National Forest in a single document creates the appearance of the public being railroaded by industry during the closing days of the Bush administration. [Cmt 12.004]

Response: See **Public Concern ID 3.05**, **Public Concern ID 25.16**, and **Public Concern 25.30** responses.

Public Concern ID 3.06
The DEIS should contain background on how existing leases were approved under the current or former land or resource management plan(s) without a previous availability or suitability decision. [Cmt 282.001]

Response:
Since the approval of the 1986 Land and Resource Management Plan, no leases have been issued on the Dixie National Forest. Prior to the Leasing Reform Act of 1987, the Forest Service was not required to analyze lands under its jurisdiction to determine their availability for oil and gas leasing. Parcels leased prior to the 1986 Land and Resource Management Plan and the Leasing Reform Act of 1987 were either drilled and held by production, closed, or suspended. Leases adjacent to the Box Death Hollow Wilderness Area were suspended during the Wilderness Review and signing of the Utah Wilderness Act of 1984. This information has been added to **Sections 1.3, 1.5.2.1, and 1.5.2.3** of the **FEIS**.

Public Concern ID 3.07

In Section 1.8.3, the FEIS should incorporate results of the Wild and Scenic River Suitability Study EIS/DR (2008) that found Death Hollow Creek, Mamie Creek, North Fork Virgin River, and Pine Creek eligible. [Cmt 282.002]

Response: The results of the Wild and Scenic Rivers Suitability Study for National Forest System Lands in Utah have been included **Sections 1.8.3**, **3.3**, and **4.3** of the **FEIS**.

7.4.4 Chapter 2

Public Concern ID 4.01
The legends for the figures in Chapter 2 report percentages that do not match with the corresponding figures. [Cmt 2.075]

Response: The figures in **Chapter 2** of the **DEIS** show the amount of each Ranger District under each leasing option, by alternative. The legends in each figure present the percentage of the total Dixie National Forest under each leasing option.

Public Concern ID 4.02
The maps for Alternative E2 contain cross-hatching that does not appear applicable and is not referenced in the map legends. [Cmt 2.076]

Response: In the maps for Alternative E2, the cross-hatching represents IRAs and is referenced as such in the map legends. Although IRAs were not depicted on the maps for Alternative A or B, they are depicted on the maps for Alternatives C, D, and E, as these alternatives underwent a dual analysis. Although a leasing option is not applied to IRAs under Alternative E2, the cross-hatching was left in to be consistent with the maps for Alternative E2 (which has an NSO leasing option applied to IRAs), and clearly show the difference between the two alternatives.

Public Concern ID 4.03
The DEIS fails to provide a sufficient range of alternatives as most of the alternatives have the same or similar impacts for many of the resources discussed. [Cmt 3.017, 3.023, 3.026, 284.054]

Response: As stated in CEQ regulations (Sec 1502.12 (a)), EISs must, "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." As explained further in CEQ's *NEPA's Forty Most Asked Questions*, "for some proposals there may exist a very large or even infinite number of possible reasonable alternatives." "When there are potentially a very large number of alternatives, only a reasonable number of examples, covering the full spectrum of alternatives, must be analyzed and compared in the EIS."

The alternatives in the DEIS were developed by 1) determining which areas should be unavailable for leasing due to other land use designations (e.g., wilderness), and 2) assigning one of five leasing options (NL, NSO, CSU, TL, or SLT) to the spatial distribution of various resources of concern. Leasing options were assigned based on requirements of laws and regulations, recommendations from Dixie National Forest resource specialists, and public comments made during scoping. Due to the number of resource components identified, assigning a different leasing stipulation to each one could result in a large number of alternatives. As a result, the Forest Service made every effort to choose a reasonable number of examples that would cover the spectrum of alternatives that could be developed. The result was five primary alternatives that ranged from no leasing to leasing without protective leasing

options. Three of the alternatives then underwent a dual analysis to take into account possible legal changes to the 2001 RACR, resulting in 8 distinct alternatives. As mentioned, these alternatives provide a range of protection to all resource components.

Public Concern ID 4.04
The terminology used to describe the quality, magnitude, and duration of impacts to the human environment are vague and does not disclose the information essential for the reader to discern the context and intensity of the impacts or for the Forest Service to make a suitable decision. [Cmt 3.017, 3.027, 3.028, 3.042]

Response: NEPA requires that effects be discussed in terms of context and intensity. Terms used to describe context and intensity are uniformly used throughout the EIS and are clearly defined at the beginning of Chapter 4. Context is referred to throughout the EIS as the location, type, or size of the area to be affected relative to each resource component. The intensity of effects is defined as Major, Moderate, Minor, or Negligible. In addition, the duration of effects can be temporary, short term, or long term (**Table 4.1-1**). For each resource, management indicators were developed and these indicators were evaluated as a means to describe impacts. Using the environmental conditions described in Chapter 3 as a baseline, indicators are used to predict or measure change in a resource related to effects of the alternatives. Some indicators are quantitative and measure effects based on numerical thresholds, while other indicators involve a narrative to qualitatively describe any changes relevant to baseline conditions. Quantitative measurements were used whenever possible in order to make impacts as clear and comparable as was allowed by available baseline data. Ultimately indicators give the Decision maker the information necessary to make an informed decision (see **Table 2.7-4**).

Public Concern ID 4.05
In Section 2.2.2.2, language should be added to specify holding operators to meeting interim reclamation standards (in addition to final reclamation standards) before additional surface disturbance is authorized. [Cmt 282.004]

Response: See **Public Concern ID 1.09** response. All leases would be subject to construction and operating standards developed by the Dixie National Forest (**Appendix C**).

Public Concern ID 4.06
In order to assure adequate protection of resource values, leasing options should be reviewed when better GIS data becomes available to the Dixie National Forest (e.g., wetland surveys). [Cmt 282.005]

Response: The DEIS used GIS data to approximate the distribution of each identified resource on the Dixie National Forest. This was necessary in order to approximate the amount of the Dixie National Forest that would be under each respective leasing option and to determine the potential environmental impacts under the proposed alternatives. The GIS data used in the DEIS was the best data available and accurately portrayed the spatial distribution of some resources (e.g., IRAs, eligible Wild and Scenic Rivers, Research Natural Areas). However, for other resources that have not been thoroughly mapped (e.g., wetlands) spatial distribution was approximated in the GIS data used for the DEIS. As explained in **Section 1.8.5.1** of the **DEIS**, once the Records of Decision identifying which lands on the Dixie National Forest will be administratively available for oil and gas leasing along with the associated conditions and lease stipulations have been signed, the BLM may offer for lease a parcel of land on the Dixie National Forest. The lease would include the associated conditions and lease stipulations identified for that parcel in the FEIS. However, before a lessee's SUPO would be approved, site

specific analysis would identify if additional surveys would be needed. If resources were identified that were not mapped and included in the FEIS, these resources would have the appropriate leasing options applied at that time. This is explained in **Section 2.3.1** of the **DEIS**, "leasing options are applied to the resource component and not simply to specific geographic areas." "If unmapped resource components are identified in the future, they would be protected by the same leasing option." By applying the leasing option to the actual resource component and not just to the mapped areas used in the DEIS, the Dixie National Forest assures that each resource is afforded the level of protection specified by the leasing option applied in the DEIS.

Public Concern ID 4.07
Footnote 4 on Table 2.5-1 needs further explanation to clarify the difference between CSU and NSO for IRAs. The current explanation is unnecessarily misleading. [Cmt 282.006]

Response: The misleading CSU leasing option for IRAs has been changed to NSO. This should eliminate the confusion.

Public Concern ID 4.08
Section 2.5.3.1 needs further explanation of how the preferred alternative was developed and chosen because the decision process and rationale are not clear. Section 2.8 should start with evidence, continue with a statement of basic conclusions, and then summarize the analysis of the impacts (i.e., context and intensity) that supported the ultimate conclusion. [Cmt 282.007, 282.014]

Response: CEQ regulations 1502.14 requires identification of the agency preferred alternative in the DEIS; however, it does not require an explanation of the development or decision process. The rationale for the selected alternative will be described in the Records of Decision.

Public Concern ID 4.09
In Section 2.5.4.2, additional explanations should be provided for why the five resource components available for lease under SLT do not require environmental protections provided by CSU. [Cmt 282.008]

Response: Alternative D was developed to be less restrictive to oil and gas leasing activity than Alternative C. SLT was considered the least restrictive leasing option necessary to protect these five resource components.

Public Concern ID 4.10
A No Lease buffer should be established around the perimeter of every national park in the cumulative effects area, because exploration and development are in conflict with the mission and purpose of NPS. [Cmt 282.009, 282.010]

Response: A 60-km CSU buffer surrounding all Class I areas (includes Bryce NP, Zion NP, Capitol Reef NP, and the Grand Canyon) has been developed to prevent impacts to air quality (CSU-29). In addition, an NSO stipulation will be implemented in areas surrounding Bryce Canyon National Park. The Forest Service will work with NPS in the event activities are proposed adjacent to a National Park to achieve objectives for NPS lands. Potential impacts to visual resources, including night skies, as well as noise, would be mitigated at the site-specific development stage through coordination with NPS (also see relevant Best Management Practices contained in Appendix C of the FEIS).

Public Concern ID 4.11

Impacts in Table 2.7-4 should be expressed as a binary function after appropriate analysis, not a continuum, because connected actions will either have an effect or they will not. [Cmt 282.011]

Response: **Table 2.7-4** in the **FEIS** accurately summarizes the analysis of impacts done in Chapter 4. Where no impacts are expected to occur, a no effect determination was included. Where impacts are expected to occur, the expected range (intensity) and duration of impacts (from the Chapter 4 analysis) was included, for several reasons. The impact intensity is often expressed as a range due to uncertainty in the physical location of where impacts would occur, and the uncertainty as to what particular oil and gas activity would occur (e.g., temporary seismic vs. long-term production development). In addition, impacts across a range of measurement indicators were summarized for most resources.

Public Concern ID 4.12
The impacts section should provide analysis to answer the question "why is the impact of this size not significant to this resource component?" [Cmt 282.012]

Response: Determinations of significance are explained by the Decision Maker in the Record of Decision. The EIS provides an analysis with context and intensity determinations for each resource that the Decision Maker uses to determine the "significance" of impacts to various resources (see NEPA Part 1508.27).

Public Concern ID 4.13
The USFS failed to consider a reasonable range of alternatives to address and minimize air quality impacts, such as haze, PSD increment, ozone, and PM2.5 impacts, as well as related climate impacts. The USFS should both develop and adopt alternatives that ensure any oil and gas leases control emissions of air pollution, including greenhouse gases. [Cmt 284.054, 284.055, 284.059, 284.062, 284.064]

Response: The purpose of this leasing action EIS was to determine the potential impacts of a theoretical development that may or may not result from the leasing decision. As a result, it would be premature to develop project-specific, requirement-based alternatives. These alternatives would best be developed once oil and gas development has been proposed. At that time, additional analyses (which are already stipulated in the FEIS Appendix C) would allow for accurate and targeted alternatives to be developed to minimize air impacts.

Public Concern ID 4.14
An alternatives analysis and development of appropriate lease stipulations should be based on the methods of reducing NOx and VOC emissions detailed in the 2007 WRAP report, such as post-combustion controls. [Cmt 284.057]

Response: See **Public Concern ID 4.13** response. The USFS has been proactive in requiring that broad based emissions controls measures that can be enforced for all proposed developments have been included. Specifically, Appendix C of the FEIS details equipment requirements for on-site engines including both well pumps and drill rig engines.

Public Concern ID 4.15
An alternatives analysis and development of appropriate lease stipulations could be based on limiting development on new leases and/or adopting timing stipulations, such as during the smog season (May through October). [Cmt 284.058]

Response: See **Public Concern ID 4.13** response.

7.4.5 Alternative A

Public Concern ID 5.01
The no action and no lease alternatives have distinct implications that warrant being analyzed separately in the FEIS rather than as one alternative. [Cmt 3.024, 3.025]

Response: As explained in **Section 2.5.1.1** of the **DEIS**, if the no action alternative was selected as a result of this EIS, no leasing would be authorized because the current Dixie National Forest Land and Resource Management Plan and its supporting NEPA documentation do not authorize or analyze the connected impacts from oil and gas leasing. Although choosing a no lease alternative would be different from the no action in that it would actually make a decision to not allow leasing on the Dixie National Forest, as far as impacts to the human environment are concerned, the results would be the same (no new leasing).

Public Concern ID 5.02
Commenter supports Alternative A. [Cmt 3.003, 3.070, 3.071, 12.042, 12.059, 34.001]

Response: Each of the alternatives represents a course of action that addresses issues and concerns to varying degree. The Forest Service will select an alternative based on an overall analysis of environmental impacts, other relevant factors (i.e. economic considerations), and agency statutory missions. The basis for alternative selection will be specified in the Record of Decision.

Section 101 (b) of the National Environmental Policy Act outlines the six substantive elements of NEPA which include attaining "the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences" (Section 101 (b) (3)) and "…approach the maximum attainable recycling of depleteable resources" (Section 101 (b) (6)). In order to comply with NEPA, the Forest Service must evaluate which alternative best meets the needs of the public, the environment, and the recovery of oil and gas resources as required by law (see legislation in **Section 1.8.4** of the **DEIS**).

7.4.6 Alternative B

Public Concern ID 6.01
Commenter supports Alternative B. [Cmt 1.007, 1.010, 2.048, 6.015, 8.005, 12.023, 12.043, 12.060, 12.064, 14.001, 16.003, 19.001, 20.001, 22.002, 25.001, 27.001, 28.001, 30.001, 30.005, 40.002, 40.003, 45.001, 50.002, 60.012, 71.001, 137.001, 137.006, 154.014, 156.004, 156.016, 181.001, 183.006, 197.001, 231.003, 235.011, 241.009, 258.009, 278.013]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 6.02
Commenter does not support Alternative B. [Cmt 17.001]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 6.03
No Lease stipulations within IRAs under Alternative B are too restrictive. [Cmt 8.068]

Response: See **Public Concern ID 5.02** response. Alternative C, D, and E contain less restrictive stipulations for IRAs.

Public Concern ID 6.04
Alternative B would strike the right balance between protection and development. [Cmt 1.007, 1.010, 30.002, 42.001, 46.002, 47.002, 48.003, 50.003, 51.002, 52.001, 53.001, 54.002, 55.001, 57.001, 58.001, 59.001, 60.001, 61.001, 62.006, 63.001, 64.001, 65.001, 66.001, 67.002, 68.005, 69.002, 70.001, 71.002, 72.004, 73.001, 74.002, 75.001, 76.001, 77.001, 78.002, 79.001, 80.001, 81.001, 82.001, 83.001, 85.001, 86.002, 87.001, 88.002, 89.001, 89.002, 90.001, 91.001, 92.003, 94.002, 95.001, 97.002, 98.001, 98.003, 100.002, 101.001, 102.001, 103.002, 105.001, 106.001, 107.001,108.001, 109.001, 110.004, 111.002, 113.002, 114.002, 115.001, 117.001, 119.004, 120.002, 121.001, 122.002, 123.001, 124.002, 125.002, 126.001, 127.001, 128.001, 129.001, 130.001, 131.001, 132.001, 133.004, 134.001, 135.003, 136.002, 138.001, 139.002, 140.002, 141.002, 142.001, 143.001, 144.001, 145.001, 146.003, 147.004, 148.001, 149.002, 150.002, 151.001, 152.001, 153.001, 154.004,155.001, 156.003, 157.001, 158.001, 159.001, 160.002, 161.005, 162.001, 163.001, 164.001, 165.002,166.001, 167.001, 168.002, 169.001, 170.001, 171.007, 172.006, 173.001, 175.004, 176.001, 177.001,178.003, 179.003, 180.003, 181.003, 182.003, 183.001, 184.002, 185.001, 186.001, 187.001, 188.002, 189.005, 190.001, 191.001, 192.001, 193.001, 194.001, 195.001, 196.001, 197.003, 198.002, 199.002,200.002, 201.004, 202.003, 203.001, 204.002, 205.002, 206.002, 207.001, 208.002, 209.001, 210.004, 211.004, 212.002, 213.003, 214.001, 215.001, 216.001, 217.002, 218.004, 219.001, 220.001, 221.002, 222.001, 223.001, 224.002, 225.001, 226.002, 227.001, 228.001, 229.001, 230.001, 231.002, 232.001, 233.003, 234.001, 235.001, 236.001, 237.001, 238.001, 239.001, 240.002, 241.001, 242.001, 243.001, 244.001, 245.002, 246.001, 247.001, 248.001, 249.001, 250.006, 251.001, 252.001, 253.001, 254.004, 255.002, 256.001, 257.001, 258.001, 259.003, 260.003, 261.001, 262.003, 263.001, 264.002, 265.001, 266.003, 268.001, 269.001, 270.001, 271.001, 272.001, 273.001, 274.001, 275.001, 276.001, 277.001, 278.001, 279.001]\

Response: See **Public Concern ID 5.02** response.

Public Concern ID 6.05
Alternative B would protect sensitive resources and preserve the southern Utah landscape. [Cmt 6.015, 8.005, 40.002, 42.008, 46.009, 47.009, 48.010, 50.010, 51.009, 52.008, 54.009, 55.006, 57.008, 59.008, 60.008, 63.006, 64.008, 65.008, 66.008, 67.009, 68.012, 69.009, 70.008, 71.009, 72.011, 73.008, 74.009, 76.002, 77.002, 78.009, 79.002, 80.008, 84.005, 85.008, 86.009, 87.011, 88.009, 89.009, 90.008, 91.008, 92.010, 94.009, 95.008, 97.009, 98.010, 100.009, 101.008, 102.008, 105.003, 106.008, 107.008, 108.008, 109.008, 110.011, 111.009, 113.009, 114.009, 115.008,119.011, 120.009, 121.009, 122.009, 123.008, 124.009, 125.009, 126.008, 127.008, 128.008, 129.008, 130.008, 131.008, 132.008, 133.011, 134.009, 135.010, 136.009, 137.004, 138.008,139.009, 140.009, 141.009, 142.008, 143.004, 144.008, 145.008, 146.010, 147.011, 148.008, 149.009, 150.009,151.008, 152.009, 153.008, 154.011, 155.008, 157.008, 158.004, 159.008, 160.009, 161.012, 162.008, 164.008, 165.009, 166.007, 167.008, 168.009, 169.009, 170.008,171.014, 172.013, 173.007, 175.011, 177.008, 178.010, 179.010, 180.012, 181.010, 182.010, 183.004, 184.009, 185.008, 186.008, 187.008, 188.009, 190.004, 191.009, 192.008, 193.008, 194.008, 195.008, 197.010, 198.009, 199.007, 200.009, 201.011, 203.008, 204.009, 205.009, 206.009, 207.008, 208.009, 209.009, 210.011, 211.011, 212.009, 213.010, 214.008, 215.008, 216.009, 217.009, 219.008, 220.008, 222.008, 223.008, 224.009, 225.009, 226.009, 227.008, 228.004, 229.009, 230.008, 232.008, 233.010, 234.008, 235.008, 237.009, 238.008, 239.008, 240.009, 241.010, 245.009, 247.008, 248.008, 249.008, 250.013, 251.008, 252.008, 253.008, 254.011, 255.009, 256.008, 258.008, 259.010, 260.010,

262.010, 263.008, 264.009, 265.008, 266.010, 268.008, 269.008, 270.008, 272.008, 274.008, 275.008, 276.009, 277.008, 278.008, 278.013, 279.010]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 6.06
Alternative B would give threatened and endangered species a chance at survival. [Cmt 42.010, 46.011, 47.011, 48.012, 49.002, 50.012, 51.011, 52.010, 53.008, 54.011, 55.012, 57.010, 59.010, 60.010, 61.009, 63.009, 64.009, 65.010, 66.010, 67.011, 68.014, 69.011, 70.010, 71.011, 72.013, 73.010, 74.011, 76.005, 77.009, 78.011, 79.009, 80.010, 81.005, 82.002, 83.003, 85.010, 86.011, 87.013, 88.011, 89.011, 90.010, 91.010, 92.012, 93.002, 94.011, 95.010, 97.011, 98.013, 100.011, 101.011, 102.010, 104.002, 105.005, 106.010, 107.010, 108.010, 109.010, 110.013, 111.011, 112.002, 113.011, 114.011, 115.010, 118.002, 119.013, 120.011, 121.011, 122.011, 123.010, 124.011, 125.011, 126.010, 127.010, 128.010, 129.010, 130.010, 131.010, 132.011, 133.013, 134.011, 135.012, 136.011, 138.010, 139.011, 140.011, 141.011, 142.010, 143.005, 144.010, 145.010, 146.012, 147.013, 148.010, 149.011, 150.011, 151.014, 152.011, 153.010, 154.013, 155.010, 157.010, 158.006, 159.010, 160.011, 161.014, 162.010, 163.002, 164.011, 165.011, 167.011, 168.011, 169.011, 170.010, 171.016, 172.015, 173.009, 174.003, 175.013, 177.010, 178.012, 179.012, 180.014, 181.012, 182.012, 184.011, 185.010, 186.010, 187.011, 188.011, 190.006, 191.011, 192.010, 193.010, 194.010, 195.010, 196.009, 197.012, 198.011, 199.009, 200.011, 201.013, 202.002, 203.010, 204.011, 205.011, 206.011, 207.010, 208.011, 209.011, 211.013, 212.011, 213.012, 214.010, 215.010, 216.011, 217.011, 219.010, 220.010, 221.005, 222.010, 223.010, 224.011, 225.011, 226.011, 227.010, 228.005, 229.011, 230.010, 232.010, 233.012, 234.010, 235.010, 236.003, 237.011, 238.010, 239.010, 240.011, 241.012, 242.006, 245.011, 247.010, 248.010, 250.015, 251.011, 252.010, 253.012, 254.013, 255.011, 256.010, 257.003, 258.011, 259.012, 260.012, 261.009, 262.012, 263.010, 264.011, 265.010, 266.012, 267.002, 269.010, 270.010, 272.010, 274.010, 275.010, 276.011, 277.010, 278.010, 279.012]

Response: See **Public Concern ID 5.02** response. Early consultation with USFWS occurred during preparation of the DEIS and a Biological Assessment was prepared and submitted to the USFWS for concurrence. A Biological Opinion was issued on January 21, 2011. Consultations with the USFWS ensures compliance with Section 7 of the Endangered Species Act, which directs all federal agencies to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. . See **Public Concern ID 15.22** response.

Public Concern ID 6.07
Any oil and gas leasing decision on the Dixie National Forest should include the following:

- Withdraw roadless and riparian areas, steep slopes, and sensitive soils from leasing;
- Close municipal watersheds, designated and recommended wilderness, all Designated Critical Habitat, roadless areas, sensitive archaeological areas, reference areas, Research Natural Areas, Special Interest Areas, eligible wild and scenic river corridors, and lava fields over sensitive aquifers;
- Areas open to leasing should be managed to protect sensitive resources, including wildlife habitat, soils, water quality, air quality, cultural resources, scenic resources, and other natural resource values;
- Disturbances should be minimized, and reclamation of disturbed lands should occur in a timely manner. [Cmt 1.008]

Response: Designated Wilderness Areas are not available for leasing. Alternative B Leasing options (see **Table 2.5-1** in the **DEIS**), including those for Inventoried Roadless Areas (NL), Streams/Lakes/Riparian Areas (NL/NSO), steep slopes (NSO), and sensitive soils (Active Rockfall/Landslide Areas and Areas of High Erosion Potential; NSO) were developed in response to early scoping requests. Under Alternative B, municipal watersheds, wild and scenic rivers, lava fields over sensitive aquifers, Designated Critical Habitat, and Research Natural Areas are closed to leasing (NL), as mentioned in the comment. Sensitive Archeological resources are protected by NSO stipulations under Alternative B and by law. A range of alternatives were considered and analyzed in the **DEIS** (see **Public Concern ID 4.03**). All alternatives and Appendix C contain standards for timely reclamation of explorations and producing well sites.

Stipulations to protect resources for each alternative are found in **Table 2.5-1** of the FEIS. Between the Draft EIS and Final EIS, changes were made to Alternative C that included designating "no lease" (NL) for lava fields over sensitive aquifers (see Section 7.3).

Public Concern ID 6.08
The Forest should choose Alternative B as the most protective alternative in order to minimize the possibility of an accidental spill into aquatic habitat, considering the unknowns that are involved and because the same level of development is expected regardless of the alternative chosen. [Cmt 7.011, 7.028, 7.032]

Response: Alternative B provides more protections to aquatic habitat from an accidental spill than Alternatives C, D, and E; however, all alternatives would meet Forest Plan standards and guidelines for protection of aquatic habitats (USFS 1986). The decision on which alternative to choose is a balance of multiple use mandates as described in the **Public Concern ID 5.02** response.

7.4.7 Alternative C

Public Concern ID 7.01
Alternative C would open up too much of the unique wildlands in Utah's largest national forest to unnecessary development. [Cmt 42.002, 46.003, 47.003, 48.004, 50.004, 51.003, 52.002, 54.003, 56.001, 57.002, 58.002, 59.002, 60.002, 61.002, 62.007, 64.002, 65.002, 66.002, 67.003, 68.006, 69.003, 70.002, 71.003, 72.005, 73.002, 74.003, 77.003, 78.003, 79.003, 80.002, 81.002, 85.002, 86.003, 87.005, 88.003, 89.003, 90.002, 91.002, 92.004, 94.003, 95.002, 97.003, 98.004, 100.003, 101.002, 102.002, 103.003, 106.002, 107.002, 108.002, 109.002, 110.005, 111.003, 113.003, 114.003, 115.002, 117.002, 119.005, 120.003, 121.003, 122.003, 123.002, 124.003, 125.003, 126.002, 127.002, 128.002, 129.002, 130.002, 131.002, 132.002, 133.005, 134.003, 135.004, 136.003, 138.002, 139.003, 140.003, 141.003, 142.002, 143.002, 144.002, 145.002, 146.004, 147.005, 148.002, 149.003, 150.003, 151.002, 152.002, 153.002, 154.005, 155.002, 156.008, 157.002, 158.002, 159.002, 160.003, 161.006, 162.002, 164.002, 165.003, 166.002, 167.002, 168.003, 169.002, 170.002, 171.008, 172.007, 173.002, 175.005, 177.002, 178.004, 179.004, 180.005, 181.004, 182.004, 183.002, 184.003, 185.002, 186.002, 187.002, 188.003, 191.003, 192.002, 193.002, 194.002, 195.002, 196.002, 197.004, 198.003, 199.003, 200.003, 201.005, 202.004, 203.002, 204.003, 205.003, 206.003, 207.002, 208.003, 209.002, 210.005, 211.005, 212.003, 213.004, 214.002, 215.002, 216.003, 217.003, 219.002, 220.002, 222.002, 223.002, 224.003, 225.003, 226.003, 227.002, 228.002, 229.003, 230.002, 232.002, 233.004, 234.002, 235.002, 237.003, 238.002, 239.002, 240.003, 241.003, 242.002, 245.003, 247.002, 248.002, 249.002, 250.007, 251.002, 252.002, 253.002, 254.005, 255.003, 256.002, 258.002, 259.004, 260.004, 261.002, 262.004, 263.002, 264.003, 265.002,

266.004, 268.002, 269.002, 270.002, 272.002, 274.002, 275.002, 276.003, 277.002, 278.002, 279.003]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 7.02
Commenter supports Alternative C. [Cmt 2.049, 32.001]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 7.03
Commenter does not support Alternative C. [Cmt 3.001, 3.004, 10.011, 12.044, 12.061, 19.003, 20.002, 22.001, 25.002, 55.005, 98.002, 99.004, 105.002, 110.001, 137.003, 156.005, 197.002]

Response: See **Public Concern ID 1.01, 1.05, and 5.02** responses.

Public Concern ID 7.04
Alternative C would inadequately conserve fish and wildlife habitat, and in choosing Alternative C the Dixie National Forest will sacrifice their ability to plan for and mitigate impacts to fish and wildlife. [Cmt 8.008, 8.034, 27.002, 279.009]

Response: See **Public Concern ID 5.02** response. Mitigation measures in fish and wildlife habitats will be implemented regardless of alternative and in accordance with Forest Service Policy on the reclamation of lands disturbed by mineral and associated activities (FSM 2840). Mitigation and design criteria for all alternatives contained in Appendix C would also be compliant with the Forest Plan standards and guidelines (USFS 1986). Additional measures have been added to Alternative C in the FEIS to protect fish and wildlife resources, including a 500-foot buffer in sensitive fisheries habitat and a 2-mile buffer around greater sage-grouse leks (see Section 7.3).

Public Concern ID 7.05
Alternative C will discourage companies from exploration due to the extent of NSO stipulations, and is debilitating to the petroleum industry. [Cmt 9.002, 10.010, 11.001, 11.002, 11.003, 40.005]

Response: See **Public Concern ID 5.02** and **Public Concern ID 1.01** responses.

Public Concern ID 7.06
Alternative C violates Forest Service policy by unnecessarily restricting exploration and development. This ignores the fact that impacts can be mitigated effectively with modern technology. [Cmt 10.003, 10.004]

Response: See **Public Concern ID 5.02** and **Public Concern ID 1.01** responses. Forest Service policy is to administer its minerals program within the overall context of the principles of ecosystem management. Modern technology and the Dixie National Forest Operating and Construction Standards (**Appendix C** of the **DEIS**) were applied before considering more restrictive lease stipulations. Lease stipulations were used where technology and the standards were not adequate to assure the needed protections. Alternative E was developed using Standard lease terms and conditions and the impacts were analyzed.

7.4.8 Alternative D

Public Concern ID 8.01
Commenter supports Alternative D. [Cmt 9.003, 9.008, 9.011, 10.012, 11.004, 11.005]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 8.02
Commenter does not support Alternative D. [Cmt 2.050, 8.009, 12.045, 12.062]

Response: See **Public Concern ID 5.02** response.

7.4.9 Alternative E

Public Concern ID 9.01
Commenter does not support Alternative E. [Cmt 2.051, 8.010, 12.046, 12.063]

Response: See **Public Concern ID 5.02** response.

7.4.10 Law

Public Concern ID 10.01
Federal laws and regulations require that decisions and actions related to oil and gas leasing must be consistent with land use plans, protective policies, and land designations. [Cmt1.002]

Response: Refer to **Section 4.16** (Compliance with other Laws and Regulations) and **4.17** of the **DEIS** (Forest Plan Consistency Determination).

Public Concern ID 10.02
The Dixie National Forest Land and Resource Management Plan is over 22 years old and out of date in many details. As a result, the Forest Service must preserve the opportunity to make major land use decisions as part of the Land and Resource Management Plan revision process and not have those decisions constrained by decisions concerning a single use such as oil and gas leasing. Major decisions that should be preserved include the evaluation of potential wilderness and the potential to degrade roadless areas and other areas in a relatively natural condition. [Cmt 1.005, 1.006]

Response: The Dixie National Forest Land and Resource Management Plan, Appendix C, will be amended to adopt the leasing decisions in this EIS (see **Section 4.17** of the **FEIS**). The Energy Security Act of 1980 (**Section 1.8.4.5** of the **DEIS**) requires the Forest Service to process applications for oil and gas exploration and production, "notwithstanding the current status of any management plan being prepared." This, combined with the requirements of the Leasing Reform Act of 1987, required the preparation of this EIS. However, this EIS merely identifies areas suitable for leasing, applies specific protections, and evaluates the effects to all resources. It does not constrain the decision space for other types of projects, including land management planning and evaluations for potential wilderness areas. Further, the preferred alternative (Alternative C) applies restrictions to those areas identified in the set of inventoried roadless area maps contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, (Volume 2, November 2000) in order to protect their roadless characteristics.

Public Concern ID 10.03

The DEIS violates NEPA regulation 1502.22 regarding incomplete or unavailable information because it fails to summarize existing scientific information regarding oil and gas impacts to wildlife and the existing conditions due to cumulative impacts. [Cmt 1.036]

Response: The DEIS considered Best Available Science regarding oil and gas impacts to wildlife and existing conditions on the Dixie National Forest. Updated information was added to the FEIS regarding greater sage-grouse, Utah prairie dog, bighorn sheep, and pygmy rabbit. The project record contains reports and other information on wildlife and existing conditions, and the impact determinations in the EIS were based on this science as well as the knowledge of Forest specialists. As specific well applications are received, resource specialists will determine the need for additional site specific surveys if baseline information at this scale is deemed incomplete. See **Public Concern ID 16.03**.

Public Concern ID 10.04
In failing to determine the direct, indirect, and cumulative impacts of the various alternatives, including the proposed action, on cultural resources, the Forest Service violated NEPA, the NHPA, and the Native American Graves Protections and Repatriation Act. [Cmt 1.142, 1.143, 1.144, 1.145, 1.146, 1.147, 1.148, 1.149, 1.150, 3.010, 2.042, 3.022, 3.075, 3.019, 3.039, 3.044, 3.045, 3.046, 3.047, 3.048, 3.050, 3.074]

Response: Federal Laws require that the Dixie National Forest must take into account all ground disturbing activities and the effects these activities will have on potential and known Historic Properties within the Forest. This EIS only identifies potential lease areas and there is no site specific ground disturbance authorized (see **Public Concern ID 1.07** regarding purpose and need). During the analysis of these potential lease areas, the Heritage Program Manager took into account (using the cultural resource record located in the Dixie National Forest Supervisors' Office) all the known potential of an area that was proposed for leasing and identified those areas within the Forest that have potential for major effects to known cultural resources. These areas were placed under specific stipulations (see **Table 2.5-1**), and as the drill sites and well locations are identified at a later stage (site-specific NEPA analysis), the Federal permitting process would require the permittee to conduct all necessary inventories and compliance with any mitigation required under Section 106 of the 36 CFR 800 Regulations prior to drilling.

Public Concern ID 10.05
If the Land and Resource Management Plan needs to be amended as a result of decisions made concerning oil and gas leasing, the Forest Service should incorporate the amendment process into the EIS for oil and gas leasing. [Cmt 2.072]

Response: The Record of Decision signed by the responsible official of the Forest Service at the end of the NEPA process will document the leasing decisions and any subsequent decisions to amend the 1986 Land and Resource Management Plan. If an amendment is required, the Record of Decision will also identify the sections of the Land and Resource Management Plan that will be modified and provide the proposed amendment language.

Public Concern ID 10.06
The Forest Service must comply with NEPA before a competent decision on the proposed action can be made. [Cmt 3.006]

Response: The Forest Service has made every effort to ensure than the DEIS is in full compliance with NEPA and the public comment period is part of this effort.

Public Concern ID 10.07
Due to the legal inadequacies of the DEIS, the Forest Service cannot make an informed decision on the proposed action and must exercise discretion by denying leasing, which ensures public benefits will be maintained. [Cmt 3.011, 3.016]

Response: As described for **Public Concern ID 10.06** and **10.04**, the Forest Service has made every effort to ensure the legal adequacy of the FEIS. The EIS analyses a full range of alternatives, from No Lease to leasing under standard lease terms and conditions (SLT). As a result, the FEIS provides sufficient information to make an informed decision. Part 1505.2(b) of NEPA (NEPA and Agency Decision Making – Record of Decision in cases requiring environmental impact statements) states that the project record shall:

> Identify all alternatives considered by the agency in reaching its decision, specifying the alternative or alternatives which were considered to be environmentally preferable. An agency may discuss preferences among alternatives based on relevant factors including economic and technical considerations and agency statutory missions. An agency shall identify and discuss all such factors including any essential considerations of national policy which were balanced by the agency in making its decision and state how those considerations entered into its decision.

Public Concern ID 10.08
The DEIS fails to provide a cost benefit analysis of the proposed action and should identify, quantify, and compare the costs and benefits to the public associated with the proposed action. [Cmt 3.059, 3.021]

Response: Refer to **Section 4.11** of the **DEIS** for analysis of the adverse and beneficial economic impacts to local economies. CEQ regulations (Sec 1502.23) states, "the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations." As it is difficult to attach monetary values to environmental benefits (e.g., visual resources, wilderness values, air quality, etc) a cost benefit analysis would be particularly difficult in this EIS.

Public Concern ID 10.09
The Forest Service must utilize its authority under the Federal Onshore Oil and Gas Leasing Reform Act to deny oil and gas leasing on the Dixie National Forest. [Cmt 3.063]

Response: Refer to **Public Concern ID 1.07** response regarding purpose and need, and **Public Concern ID 1.05** and **1.10** responses.

Public Concern ID 10.10
Due to the size and location of the Dixie National Forest, as well as the recreational opportunities and ecosystem services it provides, the Forest Service must account for its tremendous value of place and the psychological effects of the agency's decisions. [Cmt 3.067]

Response: Refer to **Public Concern ID 1.17** response for ecosystem services of the Forest. Recreational impacts are discussed in **Section 4.4** of the **DEIS**. The effects on users of the Dixie National Forest are addressed in **Sections 4.4.4** and **4.4.5** under *Measurement Indicator #2*, "Potential Decrease in Use and *Quality of the Recreation Experience*." (Italics added) Socioeconomic impacts are addressed in Section 4.11 of the DEIS. Evaluating the psychological effects of oil and gas developments on residents living near the Dixie National

Forest may be addressed in site specific NEPA analysis if the agencies determine that social effects merit analysis at the location where developments are proposed.

NEPA requires analysis of effects to the human environment and not necessarily the psychological effects to humans.

Public Concern ID 10.11
The DEIS indicates impacts may occur to endangered species and Endangered Species Act Consultation should be initiated. [Cmt 5.017]

Response: Refer to **Public Concern ID 15.22** response.

Public Concern ID 10.12
The Forest Service should fully address the concerns outlined in the Dixie National Forest Land and Resource Management Plan, specifically: visual integrity and quality of sites like Arches National Park; eligibility of Wild and Scenic Rivers; impacts to hunting, fishing, recreation, and tourism; and aquatic and terrestrial wildlife and habitat. [Cmt 41.004, 41.005, 41.006, 41.007, 41.008, 41.009]

Response: The Forest Service is exerting every effort to assure that the FEIS addresses all relevant concerns outlined in the Dixie National Forest Land and Resource Management Plan including visual integrity, wild and scenic rivers, wildlife and impacts to recreation and tourism. Areas where alternatives may be inconsistent with the Land and Resource Management Plan are discussed in **Section 4.17** of the **DEIS**. The DEIS does address concerns relative to National Park areas adjacent to the Dixie National Forest

Public Concern ID 10.13
The Forest Service should review other land management plans for adjacent BLM land. [Cmt 9.007]

Response: The BLM is a cooperating agency and has been involved in the process. The Forest Service has reviewed the Grand Staircase Escalante National Monument Management Plan as well as existing plans, and the recently prepared land management plans for the BLM field offices that border the Dixie National Forest. Information from these documents was used in the cumulative effects analysis.

7.4.11 Visual and Scenic

Public Concern ID 11.01
Oil and gas activity in areas adjacent to Bryce Canyon National Park, particularly along the parks western boundary, would be highly visible from park viewpoints and roads and would not achieve the desired Visual Resource Management Objectives for these lands. [Cmt 2.029. 2.030]

Response: Standard Lease Terms and conditions place some limitations on activities to protect scenic integrity. The Forest Service will work with NPS in the event activities are proposed adjacent to Bryce Canyon National Park, to achieve Scenic Integrity Objectives as much as is feasible. Areas adjacent to Bryce Canyon National Park will be protected under a NSO stipulation under Alternative C. All surface use plans of operations will be available for review and comment by the appropriate NPS administration.

Public Concern ID 11.02
The Visual Resource Management Objective for Dixie National Forest lands in the vicinity of Bryce Canyon National Park should be no less than the Dixie National Forest's High SIO. [Cmt 2.030]

Response: Lands adjacent to Bryce Canyon National Park are currently Low, Moderate, and High SIO based on Dixie NF visual objectives. This leasing analysis does not make SIO assignments. However, based on public comment on the DEIS, a NSO stipulation was established for parcels of land adjacent to and near Bryce Canyon National Park to protect park resources, including visual and scenic integrity objectives. See **Public Concern 11.01** response.

Public Concern ID 11.03
It would not be possible to meet scenic integrity objectives under SLT, particularly in areas adjacent to Bryce Canyon National Park. [Cmt 2.031]

Response: See **Section 4.2.4** of the **DEIS**. Some alternatives would not meet objectives for High and Very High SIO. Standard Lease Terms state that the lease holder must take reasonable measures that may include modification to siting or design of facilities to minimize adverse impacts to visual resources (BLM Form 3100-11).

Public Concern ID 11.04
Many slopes within the viewshed of Bryce Canyon National Park are steep and comprised of fragile soil types. Surface disturbances on these slopes could result in inordinately large visual scars that can expand over time. [Cmt 2.032]

Response: Steep (>35 percent) slopes and soils derived from the Claron Limestone Formation do occur on the Dixie National Forest near the boundary of Bryce Canyon National Park; see **Section 3.8.8** of the **DEIS**. Leasing options on slopes >35 percent under Alternative B and C (NSO) would not allow drilling on these surfaces. Alternatives D and E could result in impacts as stated in the comment because stipulations would be less restrictive. See **Public Concern ID 1.09** response.

Public Concern ID 11.05
A NSO stipulation would protect lands adjacent to Bryce Canyon National Park from visual scars and viewshed impacts and should be applied to lands along the western boundary of the Park under all alternatives, particularly Alternative C where a TL stipulation is currently applied. [Cmt 2.025, Cmt 2.033]

Response: An NSO stipulation was established for parcels of land adjacent to and near Bryce Canyon National Park under Alternative C after public comment on the DEIS. The Forest Service will work with NPS in the event activities are proposed adjacent to Bryce Canyon National Park, to achieve Visual Resource Objectives for NPS lands. See **Public Concern ID 11.02 and 11.06** response.

Public Concern ID 11.06
The visibility of oil and gas related facilities should be reduced through topographic screening, coloration to blend with the landscapes, and minimizing the area of surface disturbance. [Cmt 2.034]

Response: **Appendix C** contains these and other measures that would be implemented to reduce scenic impacts. Standard Lease Terms also state that the lease holder must take reasonable measures that may include modification to siting or design of facilities to minimize the adverse impacts to visual resources (BLM Form 3100-11).

Public Concern ID 11.07
To protect the clear view of the night sky in Bryce Canyon National Park, Cedar Breaks National Monument, Boulder Mountain, and other nearby areas, protective stipulations should be applied. These may include NL or NSO stipulations or other stipulations requiring that facilities have no night lighting or that lighting be shield from view off-site that could be incorporated into the lease terms and conditions within these areas. [Cmt 2.035, 2.055, 2.056, 12.048]

Response: An NSO stipulation was established for areas surrounding Bryce Canyon National Park under Alternative C. See **Public Concern ID 11.02**. Measures in Appendix C, which are applicable under all alternatives, require facilities to limit night lighting to only essential lighting amounts, use low pressure sodium lights to reduce output, and shield lighting to the extent practicable from above.

Public Concern ID 11.08
Due to the steep slopes and unstable geology present within the viewshed of Cedar Breaks National Monument, surface disturbance in these areas would create unavoidable scars visible from great distances. The combination of NL and NSO in Alternatives B and C would provide effective protection to visual resources in these areas; however, the TL and SLT options under Alternatives D and E would not. [Cmt 2.053, 2.054]

Response: See **Public Concern ID 5.02** response. Leasing options on slopes >35 percent under Alternative B and C (NSO) would not allow drilling on these surfaces. Alternatives D and E could result in impacts as stated in the comment because stipulations would be less restrictive. See **Public Concern ID 1.09** response.

Public Concern ID 11.09
Light pollution impacts are discussed in the DEIS using vague terms and the amount of light pollution that will result from oil and gas activity should be clearly disclosed. [Cmt 5.006, 5.007]

Response: See **Public Concern ID 4.04** response. Light emissions are addressed in general terms in the DEIS because lighting amounts cannot be quantified with precision at the leasing stage. Light pollution is a concern for night sky resources and lighting on all developments will be limited to only essential lighting amounts, will use low pressure sodium lights to reduce output, and will shield lighting to the extent practicable from above. These measures were added to the **FEIS** (**Appendix C**). Light pollution impacts that incorporate these mitigations will be more quantifiable at the site-specific analysis stage.

Public Concern ID 11.10
The DEIS asserts that light pollution can be mitigated by shining light downwards is based on the word of non-experts in the field of light pollution, which ignores the physics of light waves and is inconsistent with the hard look required by NEPA. [Cmt 5.008, 5.009]

Response: Fully shielding and shining light downward to decrease light pollution is a mitigation in the DEIS is recommended by the International Dark-Sky Association, referenced by the National Park Service. Recent studies in the field of light pollution also recommend shielding as an effective mitigation (Luginbuhl et al. 2009a and 2009b).

Public Concern ID 11.11
Oil and gas activity would negatively impact the scenic integrity of the Boulder Mountain area. [Cmt 12.047, 43.005]

Response: If a production field occurred in the vicinity of the Boulder Mountain area (the Aquarius Plateau between Highway 24 and Highway 12), the scenic integrity of this area could be impacted, depending on the exact location. Standard Lease Terms state that the lease must take reasonable measures that may include modification to siting or design of facilities to minimize adverse impacts to visual resources (BLM Form 3100-11). Most portions of the Boulder Mountain area contain more protective stipulations of CSU or NSO. See **Public Concern ID 1.06** and **15.11** responses. If activities were proposed in the Boulder Mountain area, site-specific NEPA analysis would address SIO and other resource issues in more detail.

Public Concern ID 11.12
Oil and gas leasing should not be allowed to impact the beautiful landscapes of the Dixie National Forest, particularly in view of Utah's National Parks. [Cmt 15.001, 250.003]

Response: See **Public Concern ID 1.08 and 11.02** response

Public Concern ID 11.13
Oil and gas leasing should only be allowed if it does not jeopardize the scenic integrity of the region. [Cmt 40.009]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 11.14
In DEIS Section 4.2.5.3, Alternative C, did the second paragraph, mean to say there are few High Scenic Integrity Objective (SIO) lands that are '*Available*' for leasing. [Cmt 282.015]

Response: Wording in the FEIS has been changed from "unavailable" to "available" as noted.

7.4.12 IRAs

Public Concern ID 12.01
Alternative C would open up to much area to leasing and allow unnecessary development in IRAs. [Cmt 42.003, 46.004, 47.004, 48.005, 50.005, 51.004, 52.003, 54.004, 56.002, 57.003, 59.003, 60.003, 61.003, 62.008, 64.003, 65.003, 66.003, 67.004, 68.007, 69.004, 70.003, 71.004, 72.006, 73.003, 74.004, 77.004, 78.004, 79.004, 80.003, 81.003, 85.003, 86.004, 87.006, 88.004, 89.004, 90.003, 91.003, 92.005, 94.004, 95.003, 97.004, 98.005, 100.004, 101.003, 102.003, 106.003, 107.003, 108.003, 109.003, 110.002, 110.006, 111.004, 113.004, 114.004, 115.003, 117.003, 119.006, 120.004, 121.004, 122.004, 123.003, 124.004, 125.004, 126.003, 127.003, 128.003, 129.003, 130.003, 131.003, 132.003, 133.006, 134.004, 135.005, 136.004, 138.003, 139.004, 140.004, 141.004, 142.003, 144.003, 145.003, 146.005, 147.006, 148.003, 149.004, 150.004, 151.003, 152.003, 153.003, 154.006, 155.003, 156.009, 157.003, 158.003, 159.003, 160.004, 161.007, 162.003, 164.003, 165.004, 166.003, 167.003, 168.004, 169.003, 170.003, 171.009, 172.008, 173.003, 175.006, 177.003, 178.005, 179.005, 180.006, 181.005, 182.005, 183.003, 184.004, 185.003, 186.003, 187.003, 188.004, 191.004, 192.003, 193.003, 194.003, 195.003, 196.003, 197.005, 198.004, 199.004, 200.004, 201.006, 202.005, 203.003, 204.004, 205.004, 206.004, 207.003, 208.004, 209.003, 210.006, 211.006, 212.004, 213.005, 214.003, 215.003, 216.004, 217.004, 219.003, 220.003, 222.003, 223.003, 224.004,

225.004, 226.004, 227.003, 228.003, 229.004, 230.003, 232.003, 233.005, 234.003, 235.003, 237.004, 238.003, 239.003, 240.004, 241.004, 242.003, 245.004, 247.003, 248.003, 249.003, 250.008, 251.003, 252.003, 253.003, 254.006, 255.004, 256.003, 258.003, 259.005, 260.005, 261.003, 262.005, 263.003, 264.004, 265.003, 266.005, 268.003, 269.003, 270.003, 272.003, 274.003, 275.003, 276.004, 277.003, 278.003, 279.004]

Response: See **Public Concern ID 5.02** response. Under Alternative C the areas mapped as IRA's would be protected under a NSO stipulation. Alternative B analyzes the areas mapped as IRAs under No Lease.

Public Concern ID 12.02
The Forest Service should err on the side of caution and assume applicability of the 2001 RACR. Accordingly, Alternatives C2, D2, and E2 are inconsistent with RACR and would, at this time, be illegal and should be labeled as such. Further, alternatives inconsistent with RACR are not reasonable alternatives and are a waste of agency and public resources. [Cmt 1.003]

Response: Because there are currently differing court decisions in different federal courts each with the potential to have national ramifications, the DEIS presented the analysis of impacts with and without the RACR rule in effect. Any alternative selected by the Decision Maker would be consistent with all laws and regulations.

Public Concern ID 12.03
Alternatives C2, D2, and E2 are inappropriate and should be dropped from consideration because the Forest Service must preserve the roadless characteristics in IRAS to protect itself from legal challenges and preserve the opportunity for courts, federal rule-makings, or congress to decide ultimate management of IRAs. [Cmt 1.004]

Response: The Final EIS analyzes the preferred alternative (Alternative C), with a stipulation of NSO to protect those areas identified as IRA's for roadless characteristics. Alternatives D and E provides a dual analysis of these mapped areas due to the current legal situation, as explained in the **Public Concern ID 12.02** response.

Public Concern ID 12.04
The DEIS has not communicated the significance of alternatives to the public, in that the quality, magnitude, and duration of impacts to IRAs are unclear. [Cmt 1.014, 3.029]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 12.05
The DEIS is contradictory in analyzing IRAs as having NSO stipulations and should analyze the impacts of the actual CSU stipulation applied, which has the potential to be altered resulting in less restrictive stipulations allowing road construction and timber removal. [Cmt 3.018, 3.052, 3.053, 3.055]

Response: The Final EIS has analyzed Alternative C under an NSO stipulation regardless of the 2001 Roadless Rule being enjoined or not. Alternative D and E will continue to be analyzed both under a restrictive NSO in the event new rulings come into effect to protect these areas for their roadless characteristics or not. Regarding the potential for the CSU stipulation to be altered, see **Public Concern ID 12.06** response.

Public Concern ID 12.06

IRAs could lose their CSU leasing stipulations if agency-wide regulations are discarded or the 2001 RACR is eliminated. [Cmt 3.054]

Response: Between the Draft and Final EIS the CSU stipulation for Alternative C was reconsidered and an unmodified NSO was assigned to protect Inventoried Roadless Areas. Under Alternative D IRAs would be protected by a NSO stipulation if the 2001 RACR decision is upheld. The CSU (CSU-04) for IRAs in Alternative D2 would be used if no other rules were in place for governing the IRAs. All other Stipulations attached to leases for resource protection not related to the 2001 RACR would apply to the lease even if RACR is eliminated or if agency-wide regulations are discarded. The Record of Decision signed by the responsible official of the Forest Service at the end of the NEPA process would identify which lands would be available for oil and gas leasing along with the associated lease stipulations applied in the alternative chosen. Alternatives D1 and E1 could not be chosen in the event 2001 RACR is eliminated.

Public Concern ID 12.07
To ensure a fair and comprehensive DEIS, the legal process surrounding the 2001 RACR should be allowed to be resolved prior to a decision on the DEIS. [Cmt 6.008, 9.006]

Response: Due to the long and protracted legal history of the 2001 RACR, it is difficult to determine when the legal issues will be resolved. As a result, the Forest Service believes the most prudent course of action is to continue with the NEPA process for oil and gas leasing on lands administered by the Dixie National Forest. The Forest Service's preferred alternative (Alternative C), as modified in the Final EIS, would protect the roadless characteristics and wilderness attributes of those areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000 (IRAs) with a NSO stipulation, which will preserve the ability for these areas to be managed as roadless areas. See **Public Concern ID 12.02** and **12.03** responses.

Public Concern ID 12.08
NSO should be applied to all IRAs in order to conserve the roadless characteristics of IRAs and meet the intent of the 2001 RACR. [Cmt 7.023, 8.062]

Response: The EIS looks at a range of alternatives and Alternative C would apply an NSO on all IRAs to protect the roadless character of the area regardless of the legal status of the 2001 Roadless Rule. Alternatives D1 and E1 also consider placing an NSO on all IRAs which would allow no new temporary or permanent roads or road reconstruction and no timber harvest to meet the intent of the 2001 RACR. Less restrictive stipulations of CSU and SLT are analyzed in alternatives D2 and E2 respectively.

Public Concern ID 12.09
The CSU stipulation applied under Alternatives D2 and E2 is not appropriate as two-track road construction would harm roadless characteristics and violate the intent of RACR. [Cmt 7.024]

Response: As described in **Section 2.3.2** of the **DEIS**, Alternatives D2 and E2 were developed to analyze the impacts of less restrictive leasing options than what would be required by the 2001 RACR (due to uncertainty in the future status of the rule). As a result, the CSU stipulation applied under alternative D2 (CSU-04; there are no CSU stipulations under E2) is, by design, not in compliance with the 2001 RACR and would allow some degree of impacts to roadless characteristics to occur. Alternative D2 or E2 could not be chosen unless the 2001 RACR is not in effect and they would, at that time, not violate the RACR. If the 2001 RACR is upheld in

federal court, the non-appropriate alternatives (Alternatives D2 and E2) would be dropped from consideration (See **Public Concern ID 12.02**).

Public Concern ID 12.10
The NL stipulation for IRAs under Alternative B is overly restrictive. The Forest Service can balance drilling and protect the integrity of IRAs by applying NSO to IRAs and including upfront planning to preserve wildlife habitat. [Cmt 7.025, 7.031, 8.069]

Response: See **Public Concern ID 5.02** response. Alternative C, D1, D2, E1, and E2 contain less restrictive stipulations for IRAs.

Public Concern ID 12.11
If the CSU stipulation considered under Alternative C is the same as NSO, an actual NSO stipulation should be applied to IRAs. [Cmt 7.026]

Response: See **Public Concern ID 12.05** response. The actual stipulation analyzed under Alternative C is an NSO, See Appendix D.

Public Concern ID 12.12
The fish, wildlife, and recreation opportunities provided by IRAs merit NSO stipulations regardless of the legal status of the 2001 RACR and NSO should apply to all alternatives rather than apply a dual analysis to Alternatives D2 and E2. [Cmt 8.063, 8.064, 8.067, 8.079]

Response: See **Public Concern ID 5.02 and 12.09** response.

Public Concern ID 12.13
The CSU applied under Alternative D2 is vague and does not distinguish between roads open for public travel and roads closed to the public or between full size vehicle roads and 50-inch trails. Oil and gas development should not be allowed on roads currently closed to the public or on 50-inch trails. [Cmt 8.072, 8.073]

Response: As further clarified in **Public Concern ID 12.14** and **Public Concern ID 12.15**, the CSU (CSU-04) was clarified to state that "travel may occur only along designated roads." According to the definition in 36 CFR 212.1, a designated road is a National Forest System road that is designated for motor vehicle use by the public on a motor vehicle use map. The Dixie National Forest Motorized Travel Plan was completed and a Record of Decision was signed on 16 April 2009.

Public Concern ID 12.14
Under the CSU applied to Alternative D2, construction zones or two-track roads should be prohibited. [Cmt 8.074]

Response: As described in **Section 2.5.4.2**, **Section 4.3.4.5**, and **Appendix D** of the **DEIS** mechanical construction of roads (new and temporary) would be prohibited. In addition, language has been added to **Appendix D** of the **FEIS** clarifying that no mechanical construction applies to all linear disturbance regardless of classification as "roads" or "construction zones."

Public Concern ID 12.15
If development is allowed under the CSU applied to Alternative D2, only Forest Service "system roads" should be used and development should be restricted to areas that have been significantly altered prior to January 12, 2001. Use of existing roads for energy development

should not be allowed until the Dixie National Forest motorized travel plan is complete. [Cmt 8.075, 8.076, 8.077, 8.078]

Response: The Dixie National Forest Motorized Travel Plan was completed and a Record of Decision was signed on 16 April 2009. The Motorized Travel Plan prohibits cross-country travel, adds some previously unauthorized routes to the official transportation system, and closes some routes affecting resource values. The Motorized Travel Plan does not add unauthorized roads in IRAs to the transportation system and closes several previously authorized system roads in IRAs. If Alternative D2 was selected (see **Public Concern ID 12.09** response), only system roads that are open to the public under the Motorized Travel Plan could be used under CSU-04.

Public Concern ID 12.16
The amount of area removed from oil and gas consideration because of IRA designation is excessive. The commenter encourages the Forest Service to reassess the leasing options on IRA's and make them consistent with the direction provided in the September, 2008 injunction. [Cmt 9.004, 9.005]

Response: See response to **Public Concern ID 12.02**.

Public Concern ID 12.17
New and improved roads to well sites would increase accessibility of IRAs to ATV recreationists. [Cmt 12.006]

Response:
Dixie National Forest Oil and Gas Operating Standard #14 requires that new oil and gas roads be closed to the public, with gates installed to prevent public access (**DEIS, Appendix C**). This would limit accessibility of IRAs to ATV recreationists. Refer to **Section 5.1.2.1** ("Recreation") of the **DEIS** for a discussion of cumulative impacts resulting from ATVs.

Public Concern ID 12.18
The leasing of IRAs under the CSU specified in Alternative C would invite future legal battles by companies wanting more access. [Cmt 12.020]

Response: Alternative C in the Final EIS is analyzed as an NSO to protect the roadless characteristics and potential wilderness values regardless of the 2001 Roadless Rule. Alternatives D and E continue to have a dual analysis in the event the 2001 Roadless Rule or similar ruling were to be valid at the time of decision.

Public Concern ID 12.19
Contrary to the analysis in the DEIS, road widening of existing two-track roads in IRAs under Alternative D2 in order to provide access for a drill rig would constitute a "reconstructed road" and would damage the roadless characteristics of IRAs. [Cmt 12.021]

Response: As discussed in **Section 2.5.4.2**, **Section 4.3.4.5**, and **Appendix D** of the **DEIS** the CSU leasing option applied to IRAs under Alternative D2 (CSU-04) would not allow any mechanical construction or reconstruction of roads, only the use of designated roads (see **Public Concern 12.15**). Further, Alternative D2 could not be selected unless the 2001 RACR is no longer in effect. If the 2001 RACR is upheld in federal court, the non-appropriate alternatives (Alternatives D2 and E2) would be dropped from consideration (see **Public Concern ID 12.09** response).

Public Concern ID 12.20
If oil was discovered in IRAs under Alternative D2, roads and site development would be required to the detriment of the roadless characteristics. [Cmt 12.022]

Response: A CSU stipulation applied to IRAs under Alternative D2 (CSU-04) does not allow road construction (See **Section 2.5.4.2**, **Section 4.3.4.5**, and **Appendix D** of the **DEIS**). As a result, it is unlikely that a production field would occur, as a production field would require permanent roads to service the wells and transport the oil to market. As explained in **Section 4.3.4.5** of the **DEIS**, CSU-04 was designed to allow for exploration within IRAs, which would likely occur near the IRA boundaries. Further, Alternative D2 could not be selected unless the 2001 RACR is no longer in effect. If the 2001 RACR is upheld in federal court, Alternatives D2 and E2 would be dropped from consideration (see **Public Concern ID 12.09** response).

Public Concern ID 12.21
IRAs have a higher intrinsic value than oil and gas and that the values for which IRAs were designated should be preserved. [Cmt 12.024, 40.008, 135.002, 189.001, 245.001]

Response: See **Public Concern ID 1.05** response.

7.4.13 Special Use Areas

Public Concern ID 13.01
The DEIS fails to address impacts to potential wilderness areas, which are a separate resource than IRAs that would have different impacts than those described for IRAs. Impact to potential wilderness areas should be discussed in the context of their potential for wilderness designation. [Cmt 1.012, 1.015, 6.009]

Response: **Section 3.3.3** of the FEIS contains a discussion of areas currently classified as "Unroaded or Undeveloped" and identified on the 2005 Draft Inventory of Unroaded and Undeveloped Areas. The inventory and evaluation of Unroaded/Undeveloped areas was conducted jointly with the Fishlake National Forest for their Forest Plan Revisions that are currently underway, and was based on direction in the Intermountain Region Planning Desk Guide: A Protocol for Identifying and Evaluating Areas for Potential Wilderness". Impacts to these areas in the context of their potential for wilderness designation are discussed in Section 4.3.

Public Concern ID 13.02
The DEIS fails to consider the non-use wilderness values that would be irreversibly and/or irretrievable lost if leasing is allowed in potential wilderness areas. [Cmt 1.013]

Response: Impacts to non-use wilderness values within Unroaded/Undeveloped areas are analyzed in **Section 4.3** as part of *Measurement Indicator #1* (specifically "Narrative Discussion of Impacts to Wilderness Attributes"). Irreversible and irretrievable resources are discussed in Section 4.15.

Public Concern ID 13.03
The cumulative impacts discussion should include a discussion of all potential wilderness areas under other agencies jurisdiction that lies adjacent to the Dixie National Forest. [Cmt 1.016]

Response: The Cumulative Effects Area for IRAs and Unroaded/Undeveloped areas includes the Dixie National Forest boundary plus the outermost boundary of the Boulder Mountain/Boulder Top/Deer Lake and the Long Neck Mesa/Steep Creek/Oak Creek-Steep Creek/Oak Creek IRAs on the Dixie National Forest portion of the Fremont River Ranger District administered by the Fishlake National Forest (see **Section 5.3.1**). Areas with wilderness characteristics adjacent to the Dixie National Forest are described in detail within the Utah Wilderness Inventory of 1999 (available online). Any proposed oil and gas development on the Dixie National Forest would take these individual areas into account in site-specific NEPA analysis.

Public Concern ID 13.04
The CSU stipulation under Alternative C does not provide adequate protection to eligible Wild and Scenic Rivers and the Forest Service should apply a NL stipulation to these areas in order to provide proper protection to these areas and uphold the mandate of the Wild and Scenic Rivers Act. [Cmt 1.017, 1.023, 12.026, 12.033]

Response: See **Public Concern ID 13.05** response.

Public Concern ID 13.05
The CSU stipulation for eligible Wild and Scenic Rivers would allow too much development and construction activities within the eligible stream corridors and have the potential to degrade the outstandingly remarkable values of these streams and impact local communities. Degradation of outstandingly remarkable values would be a violation of the Wild and Scenic Rivers Act and Forest Service guidelines. Of particular concern are activities allowed under CSU that would involve construction requiring soil compaction and the clearing of vegetation, which can increase erosion and sediment delivery to these streams; the potential for toxic chemical spills; and increased man-made alterations and noise. [Cmt 1.018, 1.019, 1.020, 1.021, 1.022, 12.027, 12.028]

Response: As explained in **Section 3.3.3** of the **DEIS**, the Wild and Scenic Rivers Act of 1968 does not provide management guidelines to river segments determined to be eligible or suitable by the Forest Service under Section 5(d) of the Act. As a result, management guidelines for eligible streams on the Dixie National Forest are outlined in Chapter 80 of Forest Service Handbook (FSH) 1909.12 (USFS 2006a). The guidelines state that the free-flowing character of the identified river must be maintained, the outstandingly remarkable values protected, and the classification maintained as inventoried. Accordingly, the CSU stipulation developed for Alternatives C and D (CSU-05) does not allow development that would impact the free-flowing nature of these streams, their outstandingly remarkable values, or their classification. It also prohibits roads and several other specific developments (e.g., power transmission lines and pipelines) as outlined in FSH 1909.12. The CSU, however, does not preclude all oil and gas activity and **Section 4.3.4.5** of the **DEIS** mentions several types of facilities (e.g., well pads and central tank batteries) not explicitly prohibited in FSH 1909.12. **Section 4.3.4.5** of the **DEIS** states that these facilities could be located within ¼-mile of an eligible stream if these facilities would not degrade the outstandingly remarkable values or make the stream ineligible for inclusion in the National Wild and Scenic River System. If locating these types of facilities (or any oil and gas activity) within ¼-mile of an eligible stream would degrade the outstandingly remarkable values (which may be likely in many cases) they would not be allowed. In addition to CSU-05, the appropriate stipulation (corresponding to each alternative) applicable to water and watershed resources would apply to eligible streams in order to protect water quality.

Public Concern ID 13.06

The DEIS should present a more in-depth analysis of the impacts to Wild and Scenic Rivers because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.030]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 13.07
The 3,380 acres of leased land that predate the formation of the Box-Death Hollow Wilderness Area are currently protected as statutory wilderness; however, the Forest Service should adequately account for the statutory status of these areas and annul the leasing rights. In addition the FEIS is the appropriate document to discuss whether the original intent of the bill establishing the wilderness area was for the leased lands to be considered for inclusion in the wilderness area once the leases expired. [Cmt 3.020, 3.060, 3.061]

Response: USFS does not have the authority to annul leases. The leased lands that pre-date the formation of the Box Death Hollow Wilderness area remain in suspension until such time as they are released by the BLM. Public law 98-423 dated September 28, 1984 provides guidance for these areas. If the existing leases are annulled or expire they would no longer be available for leasing.

Public Concern ID 13.08
Seismic line trails created by off-road buggies during seismic exploration creates the potential for ATV recreationists to create new unauthorized trails in previously roadless areas. [Cmt 12.007]

Response: See **Public Concern ID 14.07** response.

Public Concern ID 13.09
The Wild and Scenic Rivers act specifies that the ¼-mile buffer around eligible Wild and Scenic Rivers is to protect streams from any development; however, the DEIS sets a bad precedent by allowing development in these areas under vague terms that could allow more development that anticipated and could be open to being challenged in court. [Cmt 12.029, 12.031]

Response: See **Public Concern ID 13.05** response.

Public Concern ID 13.10
Oil and gas activity under Alternative E would allow development within IRAs and eligible Wild and Scenic Rivers without any reasonable limits. [Cmt 12.032]

Response: Alternative E2 (see response to **Public Concern ID 12.02**) would allow leasing in IRAs under SLT and Alternatives E1 and E2 would allow leasing adjacent to eligible Wild and Scenic Rivers under SLT. SLT includes requirements to minimize impacts to resource values and leases available under SLT would be subject to the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements* contained in **Appendix C** and the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book* (BLM and USFS 2007). However, leases under SLT would not include any limits particular to IRAs and eligible Wild and Scenic River and impacts to these areas could occur. Also, see the response to **Public Concern 5.02**.

Public Concern ID 13.11
Directional drilling technology could easily eliminate the need for unnecessary development within the ¼-mile buffer around eligible Wild and Scenic Rivers. [Cmt 12.034]

Response: Directional drilling technology could eliminate the need for unnecessary development and would be used where possible. As roads would not be allowed within the ¼-mile buffer, it is unlikely that a full drill pad or other facilities would be located within the buffer and directional drilling technology would likely need to be used if oil and gas were discovered adjacent to eligible Wild and Scenic Rivers.

Public Concern ID 13.12
Oil and gas development should not be allowed within the ¼-mile buffer around eligible Wild and Scenic Rivers or within roadless areas. [Cmt 189.002, 209.004, 250.004]

Response: See **Public Concern ID 5.02** response.

7.4.14 Recreation

Public Concern ID 14.01
Increased traffic near backcountry recreation areas and scenic byways could degrade the scenic values of Bryce Canyon National Park and affect visitor experience, recreation, and tourism. [Cmt, 2.022, 2.040, 2.041]

Response: Traffic increases are discussed in **Section 4.10.3**. Average daily traffic volume would increase by 3 percent along State Highway 12 through Red Canyon (Powell Ranger District) under a full development scenario. Impacts to visual resources are discussed in **Section 4.2.3**. Visual impacts due to traffic for seismic exploration or well installation would be temporary (9-12 months per well site) and could be major in High SIO areas that surround Bryce Canyon National Park and along Scenic Byways. Impacts to recreational experiences are discussed in **Section 4.4.3**.

Public Concern ID 14.02
The DEIS should present a more in-depth analysis of the impacts to recreation because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.031]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 14.03
Properly protecting wildlife habitat from the degradation associated with oil and gas activity is necessary in order to preserve the exceptional hunting and fishing opportunities found on the eastern end of the Dixie National Forest. [Cmt 6.005]

Response: Impacts to hunting and fishing opportunities are discussed as “dispersed recreation activities” in **Section 4.4.3** of the **DEIS**. Impacts to big game are discussed in **Section 4.6.4**. See **Public Concern ID 1.01**, **1.06,** and **14.05** responses.

Public Concern ID 14.04
The Forest Service should address the impacts of oil and gas activity on Blue Ribbon Fisheries and their associated recreational values. [Cmt 7.020, 8.055]

Designated Blue Ribbon Fisheries within the Dixie National Forest boundary include Panguitch Lake, MaGath Lake, Paragonah (or Red Creek) Reservoir, and Panguitch Creek (UDWR 2006b). See **Public Concern ID 15.25** response. All lakes, reservoirs, and creeks are included in “Streams, Lakes, Springs, Wetlands, Floodplains, and Riparian Areas” and thus would be

protected by NL or NSO leasing options within at least a 300-foot buffer under Alternatives A, B, and C (**Table 4.7-4**). Impacts from oil and gas activity on water resources are described in **Sections 4.7.3** to **4.7.5** of the **DEIS**. In Recreation Resources (**Section 4.4**), general impacts to fishing are addressed indirectly through the ROS class inventory.

Public Concern ID 14.05
Oil and gas leasing will have adverse impacts on hunting. [Cmt 8.003]

Response: As discussed in the Special Status Species section (**Section 4.6** of the **DEIS**), some big game could be displaced by some connected actions. Impacts to hunting and fishing opportunities are discussed as "dispersed recreation activities" in **Section 4.4.3**. Impacts to big game are discussed in **Section 4.6.4**.

Public Concern ID 14.06
The potential for ATV recreationists to create new unauthorized trails following disturbance by seismic exploration poses the greatest single problem associated with oil and gas activity on the Dixie National Forest. [Cmt 12.011]

Response: Impacts from ATVs creating unauthorized routes following oil and gas disturbances are discussed in **Section 5.1.2.1** ("Recreation"), and briefly in **Sections 4.8.3** and **4.9.3**. Implementation of the Motorized Travel Plan is expected to reduce the use of "unauthorized routes" as cross-country travel is no longer allowed on the Dixie National Forest.

Public Concern ID 14.07
Recreational opportunities are one of the greatest values of the Dixie National Forest and oil and gas activity should only be allowed by means that do not jeopardize those values. [Cmt 40.007]

Response: See **Public Concern ID 1.01** and **5.02** response.

7.4.15 Wildlife and Fisheries

Public Concern ID 15.01
Alternative C would cause more severe harm to big game than Alternative B. [Cmt 42.007, 46.008, 47.008, 48.009, 50.009, 46.008, 47.008, 48.009, 50.009, 51.008, 52.007, 53.006, 54.008, 55.011, 56.006, 57.007, 59.007, 60.007, 61.007, 62.012, 64.007, 65.007, 66.007, 67.008, 68.011, 69.008, 70.007, 71.008, 72.010, 73.007, 74.008, 77.008, 78.008, 79.008, 80.007, 84.004, 85.007, 86.008, 87.010, 88.008, 89.008, 90.007, 91.007, 92.009, 94.008, 95.007, 97.008, 98.009, 99.008, 100.008, 101.007, 102.007, 106.007, 107.007, 108.007, 109.007, 110.010, 111.008, 113.008, 114.008, 115.007, 116.005, 119.010, 120.008, 121.008, 122.008, 123.007, 124.008, 125.008, 126.007, 127.007, 128.007, 129.007, 130.007, 131.007, 132.007, 133.010, 134.008, 135.009, 136.008, 138.007, 139.008, 140.008, 141.008, 142.007, 144.007, 145.007, 146.009, 147.010, 148.007, 149.008, 150.008, 151.007, 152.007, 153.007, 154.010, 155.007, 156.013, 157.007, 159.007, 160.008, 161.011, 162.007, 164.007, 165.008, 167.007, 168.008, 169.007, 170.007, 171.013, 172.012, 175.010, 177.007, 178.009, 179.009, 180.011, 181.009, 182.009, 184.008, 185.007, 186.007, 187.007, 188.008, 191.008, 192.007, 193.007, 194.007, 195.007, 196.007, 197.009, 198.008, 200.008, 201.010, 202.009, 203.007, 204.008, 205.008, 206.008, 207.007, 208.008, 209.008, 210.010, 211.010, 212.008, 213.009, 214.007, 215.007, 216.008, 217.008, 219.007, 220.007, 222.007, 223.007, 224.008, 225.008, 226.008, 227.007, 229.008, 230.007, 232.007, 233.009, 234.007, 235.007, 237.008, 238.007, 239.007, 240.008, 241.008, 245.008, 247.007, 248.007, 249.007, 250.012, 251.007, 252.007,

253.007, 254.010, 255.008, 256.007, 258.007, 259.009, 260.009, 261.007, 262.009, 263.007, 264.008, 265.007, 266.009, 268.007, 269.007, 270.007, 272.007, 274.007, 275.007, 276.008, 277.007, 278.007, 279.008, 279.008]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 15.02
Alternative C would cause more severe harm to aquatic species than Alternative B. [Cmt 41.008, 42.005, 46.006, 47.006, 48.007, 50.007, 51.006, 52.005, 53.004, 54.006, 55.009, 56.004, 57.005, 59.005, 60.005, 61.005, 62.010, 63.003, 64.005, 65.005, 66.005, 67.006, 68.009, 69.006, 70.005, 71.006, 72.008, 73.005, 74.006, 77.006, 78.006, 79.006, 80.005, 84.002, 85.005, 86.006, 87.008, 88.006, 89.006, 90.005, 91.005, 92.007, 94.006, 95.005, 97.006, 98.007, 99.006, 100.006, 101.005, 102.005, 106.005, 107.005, 108.005, 109.005, 110.008, 111.006, 113.006, 114.006, 115.005, 116.003, 119.008, 120.006, 121.006, 122.006, 123.005, 124.006, 125.006, 126.005, 127.005, 128.005, 129.005, 130.005, 131.005, 132.005, 133.008, 134.006, 135.007, 136.006, 138.005, 139.006, 140.006, 141.006, 142.005, 144.005, 145.005, 146.007, 147.008, 148.005, 149.006, 150.006, 151.005, 152.005, 153.005, 154.008, 155.005, 156.011, 157.005, 159.005, 160.006, 161.009, 162.005, 164.005, 165.006, 167.005, 168.006, 169.005, 170.005, 171.011, 172.010, 175.008, 177.005, 178.007, 179.007, 180.009, 181.007, 182.007, 184.006, 185.005, 186.005, 187.005, 188.006, 191.006, 192.005, 193.005, 194.005, 195.005, 196.005, 197.007, 198.006, 199.006, 200.006, 201.008, 202.007, 203.005, 204.006, 205.006, 206.006, 207.005, 208.006, 210.008, 211.008, 212.006, 213.007, 214.005, 215.005, 216.006, 217.006, 219.005, 220.005, 222.005, 223.005, 224.006, 225.006, 226.006, 227.005, 229.006, 230.005, 232.005, 233.007, 234.005, 235.005, 237.006, 238.005, 239.005, 240.006, 241.006, 245.006, 247.005, 248.005, 249.005, 250.010, 251.005, 252.005, 253.005, 254.008, 255.006, 256.005, 258.005, 259.007, 260.007, 261.005, 262.007, 263.005, 264.006, 265.005, 266.007, 268.005, 269.005, 270.005, 272.005, 274.005, 275.005, 276.006, 277.005, 278.005, 279.006]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 15.03
Alternative C would cause more severe harm to wildlife and their habitats than Alternative B. [Cmt 166.006, 181.002, 253.009]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 15.04
Alternative C would cause more severe harm to Colorado River tributaries than Alternative B. [Cmt 209.006]

Response: See **Public Concern ID 5.02** response. All Ranger Districts of the Dixie National Forest contain streams or groundwater flows that drain to the Colorado River Basin. Impacts are discussed in **Section 4.7.4** (see "Watershed Resources and Surface Water" and "Groundwater").

Public Concern ID 15.05
The DEIS fails to take a hard look at potential impacts to wildlife and fisheries, including known direct and cumulative impacts to wildlife and fisheries in the region that have occurred and are now occurring. [Cmt 1.024, 1.025, 1.030, 1.031, 8.001, 8.002, 151.010, 172.002]

Response: The impact analyses in the EIS provide the necessary hard look at the potential environmental effects of connected actions, by comprehensively considering the direct, indirect, and cumulative effects of the proposed leasing and connected actions. Direct and indirect impacts to wildlife and fisheries were disclosed in the **DEIS** in **Sections 4.5** and **4.6**. Cumulative impacts to wildlife and fisheries were disclosed in **Sections 5.5** and **5.6**. Differing viewpoints bought up by outside parties during the DEIS comment process were also considered and incorporated into the FEIS.

Public Concern ID 15.06
The DEIS has not communicated the significance of alternatives to the public, in that the quality, magnitude, and duration of impacts to wildlife and fisheries are unclear. [Cmt 1.033, 1.034,]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 15.07
Under Alternative C, there could be impacts to wildlife habitat and movements, and fisheries habitat contamination within lands covered by Timing Limitations adjacent to BCNP. [Cmt 2.039, 2.043]

Response: The TL stipulations were put in place to protect various wildlife and habitat concerns. More and less restrictive stipulations were analyzed in other alternatives.

Public Concern ID 15.08
Under Alternative C, NSO would adequately protect wildlife and fisheries, including wildlife habitat within IRAs. [Cmt 2.057, 2.058, 2.059]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 15.09
The State Engineer should reject water right appropriations in the Green and Colorado Rivers in association with oil and gas development because the natural flows are critical to wildlife and fisheries. [Cmt 4.009, 4.010]

Response: This is outside the scope of this document. The Forest Service does not have the authority to assign water rights temporary or otherwise.

Public Concern ID 15.10
The DEIS should acknowledge that the use of wooden planking would not eliminate the serious threat of an accidental spill into the aquatic habitat. [Cmt 7.010, 8.046, 8.048]

Response: This is acknowledged in **Section 4.5.4.5** of the **DEIS** (Aquatic species; *Measurement Indicator #5*).

Public Concern ID 15.11
The large and undisturbed areas of wildlife habitat on the eastern edge of the Dixie (Boulder Mountain and Aquarius Plateau) will be fragmented and degraded by oil and gas activities. [Cmt 6.004]

Response: If a production field occurs on or near Boulder Mountain or the Aquarius Plateau then the commenter is correct that this area will be fragmented and degraded by oil and gas

activities. The adverse impacts from a production field occurring anywhere on the Forest are discussed in **Section 4.5.4.7** of the **DEIS**.

Public Concern ID 15.12
Commenter does not support NSO allowing road crossings under Alternative C because it would reduce the ability of the Forest to mitigate or deny a road crossing on Blue Ribbon Fishery streams. [Cmt 7.013]

Response: No road crossings are allowed within sensitive fisheries habitat under Alternative C. Designated Blue Ribbon Fisheries within the Dixie National Forest boundary include Panguitch Lake, MaGath Lake, Paragonah (or Red Creek) Reservoir, and Panguitch Creek (UDWR 2006b; see **Public Concern ID 15.25** response). Mitigation measures in fish and wildlife habitats will be implemented regardless of alternative (listed in Appendix C) and in accordance with Forest Service Policy on the reclamation of lands disturbed by mineral and associated activities (FSM 2840).

Public Concern ID 15.13
The three Blue Ribbon Fishery streams that occur on the Dixie National Forest should be discussed in the DEIS. Specifically, impacts to the two Blue Ribbon Fisheries criteria that pertain to oil and gas should be discussed, which include natural reproduction capacity and water quality and quantity. [Cmt 7.016, 7.017, 7.021, 7.030, 8.051, 8.052, 8.056]

Response: Blue Ribbon Fisheries within and downstream of the Dixie National Forest will be discussed in the FEIS. Regarding natural reproduction capacity, oil and gas activities would not interfere with UDWR management strategies to produce fish of significant size and/or numbers to provide a quality angling experience on any Blue Ribbon Fishery lake or stream. Impacts to water quality from oil and gas activities are described in **Sections 4.7.3** to **4.7.5** of the **DEIS**. Impacts to water quantity from oil and gas activities are described in **Section 4.7.4.6**.

Public Concern ID 15.14
The EIS should balance the needs of wildlife and fisheries with energy development. For example, leasing in crucial habitats not protected by NSO (such as areas covered by TL) should be accompanied by comprehensive and responsible planning to reduce impacts. [Cmt 8.004, 8.006, 8.007, 8.011, 8.012, 8.013, 8.014, 8.015, 8.016, 8.017, 8.018, 19.002]

Response: See **Public Concern ID 1.01** and **Public Concern ID 1.09** responses.

Public Concern ID 15.15
The Dixie National Forest should consider geographically-phased energy development in order to preserve key wildlife and fisheries habitat components and minimize wildlife displacement. Geographic phasing should consider species-specific life-stage habitat requirements, baseline conditions (species present and condition of habitat), and UDWR population objectives. [Cmt 8.019, 8.020, 8.021, 8.022, 8.024, 8.025, 8.080, 8.081, 8.082, 8.083]

Response: The amount of oil and gas exploration and development in the RFDS is not large enough to warrant geographically phased energy developments at this time. If a field development is proposed that would warrant phased development it would be considered in the site specific development plan. In this EIS, a variety of Wildlife and Fisheries resource protection measures have been considered for the action alternatives, including Timing Limitations (see **Section 4.6.3** of the **DEIS**) and compliance with UDWR population objectives (see **Section 4.6.2** of the **DEIS**) for big game.

Public Concern ID 15.16
All wildlife migration routes should remain intact. [Cmt 8.023, 62.003]

Response: Linear disturbances from oil and gas activities, such as from seismic exploration and roads, may hinder migration and dispersal for big game species and greater sage-grouse. However, corridors of undisturbed habitat on the Dixie National Forest would provide routes for most individuals to avoid disturbances. Impacts with regard to fragmentation of habitat are discussed in **Section 4.6.3** of the **DEIS**.

Public Concern ID 15.17
The EIS must include a commitment to adequately plan for and fund mitigation, monitoring, and restoration of fisheries and wildlife habitats on all oil and gas developments, including migratory bird habitats and hunting and fishing areas. For this to occur, the duration of energy developments must be known, as well as the amount of revenue that will come from the development relative to what is needed for restoration. The monitoring process for hunting and fishing areas should allow for alterations in development if unintended adverse impacts occur [Cmt 2.064, 2.065, 8.026, 8.027, 8.028, 8.029, 8.030, 8.031, 8.032, 8.033, 8.035, 8.036]

Response: This level of planning is more appropriate at the field development stage or if site specific issues arise at time of site visits.

Public Concern ID 15.18
There should be a plan in the FEIS for compensating hunters for the loss of big game and hunting values as a result of energy development, particularly in limited entry hunt units. Alternative hunting locations should be provided. [Cmt 8.058, 8.059, 8.060, 8.061]

Response: Refer to **Public Concern ID 14.05** response. Impacts to Limited Entry Hunt Units are not anticipated. Any impacts or necessary mitigation to a particular hunting area would be determined at the site-specific development stage.

Public Concern ID 15.19
Big game habitat security and clean waters for wild trout provided by IRAs should be protected by NSO, regardless of 2001 RACR legal status. Leasing on NSO should be accompanied by a plan to retain migration corridors and the viability of crucial habitats for big game. [Cmt 8.065, 8.066, 8.070]

Response: Refer to **Public Concern ID 5.02** response. Seismic activities would have some impacts on big game; however, fragmentation would be more likely as a result of road density increases (see *Measurement Indicator #4*), which would not occur under NSO. Road density impacts are described in **Section 4.6.4.6** of the **DEIS** (SLT). Winter and summer ranges for big game are protected by leasing options (TL-02, TL-03, and CSU-10) to retain the viability of crucial habitats during periods of use (see **Table 2.5-1**; **Appendix D**).

Public Concern ID 15.20
Seismic exploration would fragment wildlife habitat by encouraging ATVs and displacing animals. [Cmt 12.010, 43.002, 187.009]

Response: Impacts to wildlife with regard to displacement and seismic activities are discussed in **Section 4.5.3** of the **DEIS**. Refer to **Public Concern ID 14.07** response.

Public Concern ID 15.21
Commenters expressed the opinion that native wildlife species and habitats are more valuable than commercial development. [Cmt 14.003, 16.002, 72.002, 147.001, 188.001, 233.002, 250.002, 275.011]

Response: See **Public Concern ID 1.01** response regarding multiple use.

Public Concern ID 15.22
Commenters expressed concern that native species may become endangered or extinct under the preferred alternative. [Cmt 29.001, 110.003, 181.002]

Response: Consultation with USFWS on threatened and endangered species occurred during preparation of the DEIS. A Biological Evaluation and Biological Assessment are part of this proposal and evaluate the potential impacts to Endangered and Threatened, and Sensitive species, respectively. A Biological Assessment was prepared and submitted to the USFWS for concurrence and a Biological Opinion was issued on January 21, 2011. Consultation with the USFWS would also occur as part of standard lease terms (via Lease Notices) for any site specific proposal. At the time of site-specific analysis, an additional Biological Evaluation and Biological Assessment to evaluate impacts to Endangered and Threatened, and Sensitive species will be completed. Consultations with the USFWS will ensure compliance with Section 7 of the Endangered Species Act, which directs all federal agencies to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. In addition, special leasing options were developed for the action alternatives to provide protections for Endangered, Threatened, and Sensitive species (see **Section 2.5** of the **DEIS**) that go beyond requirements of the Endangered Species Act (Endangered and Threatened species) and Forest Service directives (Sensitive species).

Public Concern ID 15.23
Key habitat areas for wildlife, including birds and big game, should be preserved. [Cmt 30.003, 119.002, 129.012, 171.001, 189.004, 218.003]

Response: Key habitat areas for wildlife, including migratory bird nests (**Section 4.5.4** of the **DEIS**) and crucial big game ranges (**Section 4.6.4** of the **DEIS**) are protected by leasing options designed to minimize impacts to these resources (see **Table 2.5-1** of the **DEIS**).

Public Concern ID 15.24
A commenter expressed belief that there would be no impacts to displaced animals as a result of oil and gas drilling. [Cmt 39.003]

Response: Impacts to wildlife from displacement are discussed in **Sections 4.6** and **4.7** of the **DEIS** under *Measurement Indicator #3* (Noise Levels). Displaced animals may be forced to use less suitable habitat and adverse reproductive effects to populations may occur as a result.

Public Concern ID 15.25
No leasing should be allowed in the watershed supporting existing or potential Blue Ribbon Fisheries, including Panguitch Lake, East Fork Sevier River, Lower Panguitch Creek, Mammoth Creek, and Upper Sevier River. [Cmt 282.032]

Response: Designated Blue Ribbon Fisheries within the Dixie National Forest boundary include Panguitch Lake, MaGath Lake, Paragonah (or Red Creek) Reservoir, and Panguitch Creek (UDWR 2006b). These waters and all others within the boundaries of the Dixie National Forest

would be protected by ≥300-foot NSO buffers under Alternatives A, B, and C. No Leasing (NL) would be allowed within 300 feet of these streams under Alternative B., In addition, sensitive trout habitat (although none is within Blue Ribbon Fisheries) is protected by a 500-foot NSO buffer under Alternative C. These are options the decision maker can choose. The potential for water quality impacts to streams and lakes under NL and NSO is discussed in **Sections 4.7.4.2** and **4.7.4.3**. The potential for impacts to waterbodies downstream from or outside the boundaries of the Dixie, including designated Blue Ribbon Fisheries, is discussed in **Section 4.7.4.6** of the **FEIS.** Any areas of "considered" or "potential" Blue Ribbon-status Fisheries that occur within the boundaries of the Dixie would also be protected by ≥300-foot buffers under Alternatives A, B, and C.

Public Concern ID 15.26
The DEIS should present a more in-depth analysis of the impacts to fish and wildlife because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.032, 3.033]

Response: See **Public Concern ID 4.04** response.

7.4.16 Special Status Species

Public Concern ID 16.01
Alternative C would cause more severe harm to Mexican spotted owls, sage grouse, pygmy rabbits, and sensitive plants than Alternative B. [Cmt 42.006, 46.007, 47.007, 48.008, 50.008, 51.007, 52.006, 53.005, 54.007, 55.010, 56.005, 57.006, 59.006, 60.006, 61.006, 62.011, 64.006, 65.006, 66.006, 67.007, 68.010, 69.007, 70.006, 71.007, 72.009, 73.006, 74.007, 77.007, 78.007, 79.007, 80.006, 84.003, 85.006, 86.007, 87.009, 88.007, 89.007, 90.006, 91.006, 92.008, 94.007, 95.006, 97.007 98.008, 99.007, 100.007, 101.006, 102.006, 106.006, 107.006 108.006, 109.006, 110.009, 111.007, 113.007, 114.007, 115.006, 116.004, 119.009, 120.007, 121.007, 122.007, 123.006, 124.007, 125.007, 126.006, 127.006, 128.006, 129.006, 130.006, 131.006, 132.006, 133.009, 134.007, 135.008, 136.007, 138.006, 139.007, 140.007, 141.007, 142.006, 144.006, 145.006, 146.008, 147.009, 148.006, 149.007, 150.007, 151.006, 152.006, 153.006, 154.009, 155.006, 156.012, 157.006, 159.006, 160.007, 161.010, 162.006, 164.006, 165.007, 167.006, 168.007, 169.006, 170.006, 171.012, 172.011, 175.009, 177.006, 178.008, 179.008, 180.010, 181.008, 182.008, 184.007, 185.006, 186.006, 187.006, 188.007, 191.007, 192.006, 193.006, 194.006, 195.006, 196.006, 197.008, 198.007, 200.007, 201.009, 202.008, 203.006, 204.007, 205.007, 206.007, 207.006, 208.007, 209.007, 210.009, 211.009, 212.007, 213.008, 214.006, 215.006, 216.007, 217.007, 219.006, 220.006, 222.006, 223.006, 224.007, 225.007, 226.007, 227.006, 229.007, 230.006, 232.006, 233.008, 234.006, 235.006, 237.007, 238.006, 239.006, 240.007, 241.007, 242.004, 245.007, 247.006, 248.006, 249.006, 250.011, 251.006, 252.006, 253.006, 254.009, 255.007, 256.006, 258.006, 259.008, 260.008, 261.006, 262.008, 263.006, 264.007, 265.006, 266.008, 268.006, 269.006, 270.006, 272.006, 274.006, 275.006, 276.007, 277.006, 278.006, 279.007, 279.007]

Response: See **Public Concern ID 5.02** and **Public Concern ID 15.22** responses.

Public Concern ID 16.02
Alternative C would harm endangered and threatened species. [Cmt 133.002, 209.005]

Response: See **Public Concern ID 5.02** and **Public Concern ID 15.22** responses.

Public Concern ID 16.03

The DEIS fails to take a hard look at potential impacts to sensitive species, including known direct and cumulative impacts to sensitive species in the region that have occurred and are now occurring, monitoring data on declining Dixie National Forest species, historical population demographics, and condition of habitat for sensitive species on the Dixie National Forest. [Cmt 1.026, 1.027, 1.028, 1.029, 1.032]

Response: The Dixie National Forest has monitoring and survey data for relevant sensitive species from both site-specific projects on the Forest and Forest-wide monitoring. Summary and analysis of the information will be disclosed in the BE/BA and is contained in the current Life History Report (Rodriguez 2008), and therefore is not included in this EIS. The analysis contained in the FEIS meets the requirements of the CEQ (Part 1502) regarding "hard look." The impact analyses in the DEIS comprehensively consider the direct, indirect, and cumulative effects of the proposed leasing and connected actions. Direct and indirect impacts to sensitive species were disclosed in the **DEIS** in **Section 4.6**. Cumulative impacts to special status species were disclosed in **Section 5.6**. Differing viewpoints bought up by outside parties during the DEIS comment process were also considered and incorporated into the FEIS.

Public Concern ID 16.04
If the DEIS were to take a hard look at impacts to greater sage grouse (see PCS 16.02), the DEIS would conclude that cumulative impacts to sage grouse from oil and gas activities would be major. [Cmt 1.037]

Response: If a production field occurred within a vast expanse of sage-grouse habitat, such as John's Valley, Boulder Top, or the Aquarius Plateau, then cumulative impacts to sage-grouse would be major. These impacts would only be possible under Alternatives D1, D2, E1, and E2. The cumulative impact determinations for greater sage-grouse in the FEIS have been modified to reflect this, and that elsewhere on the Dixie, cumulative impacts would be moderate due to the naturally fragmented habitat.

Public Concern ID 16.05
The DEIS has not communicated the significance of alternatives to the public, in that the quality, magnitude, and duration of impacts to sensitive species are unclear. [Cmt 1.035, 282.013]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 16.06
The DEIS is arbitrary, vague, and self-contradictory with regard to greater sage grouse impacts. Specifically, impacts to greater sage grouse from invasive species are "major" under NSO and "moderate" under CSU. Impacts to greater sage grouse brood-rearing habitat under both NSO and CSU should be major. [Cmt 1.038, 1.039, 1.041, 1.042]

Response: The commenter is correct that the DEIS was not consistent in determinations to greater sage-grouse following the various measurement indicators across alternatives. Determinations in the FEIS have been corrected.

Public Concern ID 16.07
The DEIS does not mention impacts or place any restrictions within sage grouse winter habitat. [Cmt 1.040]

Response: Additional information regarding sage-grouse wintering habitats and requirements was added to the FEIS – see **Section 3.6.3.3** of the **FEIS**.

Public Concern ID 16.08
References should be given in the DEIS to back up impact determinations to greater sage grouse under Alternative C. [Cmt 1.043]

Response: Additional studies were considered in the analysis of impacts to greater sage-grouse and added to the **FEIS** in **Sections 4.6.4** and **4.6.5**. Impact determinations were based mainly on Parrish et al (2002) and using additional information from Connelly et al. (2004) in the FEIS revisions.

Public Concern ID 16.09
A reference should be given in the DEIS to back up claims regarding the historic and possible future eradication of cheatgrass. [Cmt 1.044]

Response: The statement referenced (**Section 4.6.4.4** – greater sage-grouse; **Section 4.6.4.5** – sensitive fishes, and **Section 4.6.4.7** – greater sage-grouse) has been re-worded in the FEIS. Commenter is correct in that the Dixie has never "eradicated" cheatgrass from any area. The Forest does not actively eradicate cheatgrass, although some methods, such as foraging livestock, have been used to reduce cheatgrass levels. The Forest may have the tools necessary to "eradicate" cheatgrass in the future. However, the Forest Service currently does not have authorization to use methods such as aerial spray chemicals to control cheatgrass.

Public Concern ID 16.10
The impacts language in the DEIS for greater sage grouse reads like potboiler and is not specific enough to Dixie National Forest populations and therefore does not give proper context to the reader. [Cmt 1.045]

Response: Additional information was added to the **FEIS** in **Section 3.6.3.3**. Also see **Public Concern ID 16.11** response.

Public Concern ID 16.11
Regarding impacts to greater sage grouse, important data taken from coalbed methane developments in Wyoming, contained in Holloran (2005), Walker et al. (2007), and Doherty et al. (2008), are not cited in the DEIS. The impacts to greater sage grouse of oil and gas roads, drilling, and development on the Dixie National Forest would not be expected to differ from those documented on coalbed methane developments in Wyoming. [Cmt 1.046, 1.047, 1.048, 1.049, 1.050, 1.051, 1.052, 1.053, 1.054, 1.055]

Response: These studies were considered in the revised analysis of impacts to greater sage-grouse and they were added to the **FEIS** in **Sections 4.6.4** and **4.6.5**. Impacts found in Wyoming, however, are at a drastically larger scale than those that may occur on the Dixie National Forest. Sage-grouse habitat in Wyoming is generally open and flat, and extensive (Connelly et al. 2004). Sage-grouse habitat on the Dixie National Forest contains varied topography and vegetation communities are heterogeneous on a smaller scale. Sage-grouse populations on the Dixie have not contracted in size at the same scale as populations in Wyoming. According to Connelly et al. (2004), forested and alpine habitats in mountainous areas were likely unoccupied historically by sage-grouse, including the Markagunt, Paunsaugunt, and Aquarius Plateaus. However, current populations in Utah appear to be more isolated than they likely were in pre-settlement times (Schroeder et al. 2004). Wyoming studies were considered but when taken in the context of known habitat conditions on the Dixie that are

different from habitat conditions in Wyoming, the impacts analysis for greater sage-grouse was not changed.

Public Concern ID 16.12
Impacts to greater sage grouse in the DEIS should be at a larger geographic scale, and should specifically combine data from Connelly et al. (2004) with the number of leks within a critical distance of permitted, leased, and potential oil and gas developments, not just established ones. [Cmt 1.056, 1.057, 1.058]

Response: A large-scale analysis is inappropriate for sage-grouse on the Dixie National Forest because sage-grouse populations are naturally fragmented and isolated (see description of "South Central" population; WAFWA 2008; Connelly et al. 2004). In addition, a site-specific approach that incorporates all permitted, leased, and potential oil and gas developments would be more appropriate for the site-specific analysis stage and is not appropriate in the scale of this EIS.

Public Concern ID 16.13
The DEIS fails to present an accurate picture of cumulative impacts to greater sage grouse with regard to current impacts on and poor conditions of sage grouse habitats, specifically those caused by livestock grazing under Alternative C in Chapter 5 and in the Executive Summary. [Cmt 1.059, 1.060, 1.061, 1.065, 1.066, 1.067, 1.068, 1.069]

Response: The following language was added to **Section 5.6.2** of the **FEIS** under Livestock Grazing.

Livestock grazing is the most widespread land use across the sagebrush biome, and most sagebrush habitats have been grazed in the past century (Connelly et al. 2004). Adverse impacts to sagebrush habitat from grazing can occur through 1) improper grazing that depletes the grass and forb understory, tramples soils, and disrupts macrobiotic crust cover, 2) invasions of exotic plants (due to loss of understory, altered soils, loss of macrobiotic crusts, etc), particularly cheatgrass, 3) increased fire intensity and frequency, 4) reduced water infiltration, 5) increased soil erosion (Connelly et al. 2004).

Dynamics of sagebrush communities are complex, and plant species' response to grazing may not be predictable. Grazing can alter water and nutrient availability, soils, and vegetation past thresholds to which the system can return, such that some vegetation community states may be irreversible. Regarding management, assumptions about current vegetation communities vs. community 'ideal' states may not be accurate, and conversely, releasing vegetation communities from grazing may have no or unpredictable results, such as exacerbating the influence of exotic plants such as cheatgrass. For these reasons, the impacts of grazing on sage-grouse habitat are unclear.

Public Concern ID 16.14
The DEIS fails to present an accurate picture of the poor condition of Utah prairie dog habitat and Utah prairie dog populations on the Dixie National Forest. [Cmt 1.070, 1.074]

Response: Sagebrush steppe habitats are not trending downward in areas where prairie dogs occur on the Dixie National Forest. Further, recent monitoring of Utah prairie dog colonies on the Dixie shows that populations are stable (Rodriguez 2008).

Public Concern ID 16.15

The DEIS needs to supplement its assessment of "poor" transplant success of Utah prairie dogs with quantitative data. [Cmt 1.071]

Response: The following information was added to the FEIS. From 1972 through 2002, over 19,561 Utah prairie dogs were removed from private lands and relocated to lands managed by the BLM, USFS, NPS, and State of Utah (Bonzo and Day 2003). In 2002, a total of 382 prairie dogs were translocated from 21 different colonies in the West Desert Recovery Area, to three different locations (two in the West Desert; one on the Paunsaugunt). Post-release counts at two West Desert sites accounted for 1) between 11 and 16 Utah prairie dogs (on different days; out of 186 released) at one site, and 2) between 9 and 34 Utah prairie dogs (on different days; out of 196 total) at the other. From these results it appears that survivorship of the translocated Utah prairie dogs for this particular effort was low. Since 2002, a more successful translocation effort has been observed at a relocation site on the Dixie National Forest (Berry Springs, within the Paunsaugunt Recovery Unit), where many provisions of a Recommended Translocation Procedures document (2006 – see USFWS 2009) have been implemented. Spring counts at this location increased from 8 adult Utah prairie dogs in 2007 to approximately 100 adult Utah prairie dogs in 2010 (UDWR 2011; USFWS 2009).

Public Concern ID 16.16
The claim that Utah prairie dogs are "locally abundant" on the Powell Ranger District needs to be supplemented with quantitative data, or removed because it is inaccurate. [Cmt 1.072]

Response: "Locally abundant" was an imprecise choice of words to reflect that the Powell Ranger District is home to the majority of Utah prairie dogs on the Dixie National Forest, and that these colonies may also contain the majority of prairie dogs within the Paunsaugunt Recovery Unit described in the Utah Prairie Dog Recovery Plan (USFWS 1991), considering that only colonies on public lands count toward recovery of the species. Language in the FEIS has been modified. See **Section 3.6.2.2**.

Public Concern ID 16.17
The descriptions of Utah prairie dog populations on each Ranger District are vague. [Cmt 1.073]

Response: Utah prairie dog counts from 1972-2002 in each Recovery Unit (Bonzo and Day 2003) are the most recent data available; a summary of this data was added to the FEIS.

Public Concern ID 16.18
Potentially "major" impacts to Utah prairie dog warrant a more adverse determination in the Biological Assessment than "May Affect – Not Likely to Adversely Affect." [Cmt 1.075, 1.078]

Response: Consultation with the USFWS resulted in a "May Affect – Likely to Adversely Affect" determination for Utah prairie dog.

Public Concern ID 16.19
"Negligible to major" impact determinations for Utah prairie dog under Alternatives B and C seem arbitrary and should be clarified. [Cmt 1.076, 1.077]

Response: Impacts from the potential spread of invasive species were determined to be minor in the FEIS, following the Biological Assessment and concurrence by USFWS. Again, the determination for Utah prairie dog for this EIS is "May Affect – Likely to Adversely Affect" due to the unknown extent, timing, and location of connected actions. These unknowns were the original reason the DEIS presented a range of impact determinations for Utah prairie dog.

Public Concern ID 16.20
The DEIS fails to acknowledge current grazing impacts on Utah prairie dog habitat in cumulative effects. [Cmt 1.079]

Response: Utah prairie dog will be included in the "Past, Present, and Reasonably Foreseeable Future Actions" Section of the **FEIS** under Livestock Grazing. See **Section 5.6.2**.

Public Concern ID 16.21
Similar inadequacies pertain to other sensitive species as were described specifically for Utah prairie dog and greater sage grouse (see PCS 16.5-16.19). [Cmt 1.080]

Response: The analysis of impacts to Sensitive species meets CEQ requirements – Part 1502. See **Public Concern ID 16.03** response.

Public Concern ID 16.22
Similar inadequacies pertain to other cumulative impacts, such as for roads and OHV routes, as were described specifically for livestock grazing (see PCS 16.12). [Cmt 1.081]

Response: The analysis of cumulative impacts meets CEQ requirements – Part 1502.

Public Concern ID 16.23
Under Alternative C, there could be impacts to sensitive species within lands covered by Timing Limitations adjacent to BCNP. [Cmt 2.044]

Response: The impacts of leasing within these Timing Limitation lands on sensitive species in BCNP will be addressed in cumulative effects.

Public Concern ID 16.24
The Dixie National Forest should consider additional protections for sensitive species with potentially "moderate" or "major" impacts under Alternative C, such as larger protective buffers, additional No Lease areas, and road/well pad density limitations. [Cmt 2.060]

Response: Impact determinations made for sensitive species under all action alternatives were conservative. Lease options developed for Sensitive species and Construction and Operating Procedures developed by the Dixie National Forest (**Appendix C**) will minimize the possibility of these impacts (i.e., moderate or major).

Public Concern ID 16.25
The Dixie National Forest should incorporate additional protections for T&E species with "moderate" or "major" impacts under Alternative C to avoid take, or else consider "May Affect – Likely to Adversely Affect" determinations for these species. [Cmt 2.061]

Response: See **Public Concern ID 16.24** response. Take would be avoided or mitigated regardless of leasing options for T&E species. Endangered Species Act consultation is a separate process under NEPA and mitigation measures will be recommended if deemed necessary by the FWS, through the BA and BO at the site-specific analysis stage. For this EIS, "May Affect – Likely to Adversely Affect" determinations were made by the USFWS for all T&E species that may occur on the Dixie National Forest (California condor, Mexican spotted owl, and Utah prairie dog). Separate USFWS Lease Notices are also in place for these species as conservation measures.

Public Concern ID 16.26
The Dixie National Forest should examine the potential for water depletions in the Upper Colorado River basin and determine effects to endangered fish in the Colorado River. [Cmt 2.062]

Response: There are no depletions anticipated for connected actions at this (leasing) stage; see **Public Concern ID 15.09** response. If an oil and gas development were to remove water from the lower Colorado River watershed impacts would be assessed at the site-specific analysis stage, and consultation with USFWS would occur if depletions were anticipated.

Public Concern ID 16.27
The DEIS should incorporate USFWS-developed lease notifications and the measures contained within them for bald eagle, Virgin River chub and woundfin, Mexican spotted owl, southwestern willow flycatcher, and Utah prairie dog. [Cmt 2.063]

Response: USFWS lease notifications were adopted for California condor, Mexican spotted owl, and Utah prairie dog through the BA consultation process for this EIS. Virgin River chub and woundfin were not analyzed in the BA due to a lack of suitable habitat on the Forest.

Public Concern ID 16.28
The DEIS should change the buffer around sage grouse leks. The DEIS should follow studies by Walker (2007), Moynahan (2004), and Holloran and Anderson (2005) by incorporating a 4-mile buffer for sage grouse leks; for all surface disturbing activities, permanent structures, noise levels, and number of wells per square mile. Or the DEIS should incorporate a 0.5-mile buffer for greater sage grouse as contained in Utah's Plan for Sage Grouse and Development (2006). [Cmt 2.066, 2.067, 2.068, 2.069, 2.070, 9.009, 11.006]

Response: Extending the greater sage-grouse buffer to 2 miles would capture some additional sagebrush (4,784 total acres across all Ranger Districts), and would also capture 2,694 acres of unsuitable habitats for greater sage-grouse, including aspen/conifer, mountain brush, pinyon-juniper, or ponderosa pine woodland (JBR 2009). For this reason, the 2-mile NSO buffer will be adopted for suitable habitat (e.g., sagebrush, grassland) for under Alternative C. Unsuitable habitats that fall within the buffer (e.g., ponderosa pine, aspen, mixed conifer, etc.) will be excluded from the NSO stipulation.

A 4-mile buffer for greater sage-grouse leks would capture too much unsuitable habitat, due to the naturally fragmented and isolated nature of sage-grouse habitat on the Dixie (see **Public Concern ID 16.11** and **16.12** responses.

Public Concern ID 16.29
The protections for greater sage grouse under Alternative C are not sufficient to protect this species from a declining trend and this violates the Forest Service mandate to protect sensitive species. [Cmt 5.016]

Response: A 2-mile sagebrush NSO buffer around greater sage-grouse leks and CSU stipulations in nesting and brood-rearing habitat (CSU-09) were developed by the Dixie National Forest to protect greater sage-grouse from a declining trend under Alternative C. Impact determinations were made conservatively and thus moderate or major impacts pertain to an unexpected set of circumstances. See **Public Concern ID 16.24** response.

Public Concern ID 16.30
The Forest Service needs to consider sensitive CRCT and BCT in management decisions and provide protections for these native trout following the respective conservation agreements. [Cmt 7.001]

Response: The Forest Service is signatory to the Conservation Agreement for Colorado River cutthroat trout in the states of Colorado, Utah, and Wyoming, as well as the Range-Wide Conservation Agreement and Strategy for Bonneville cutthroat trout. The Forest is actively participating in the Conservation Teams for each species, which develop assessments of conservation actions.

Public Concern ID 16.31
The DEIS makes little note of how important existing populations of CRCT and BCT are and the restoration opportunities and potential for reintroduction of these species on the forest. The DEIS should include a survey of streams on the Forest with the potential for restoration and reintroduction of CRCT and BCT. [Cmt 7.002, 7.003, 8.037, 8.038, 8.039]

Response: See **Public Concern ID 16.30** response. As part of the overall conservation process, the Forest coordinates with UDWR in continually surveying existing populations of CRCT and BCT, and evaluating restoration and reintroduction opportunities. Active management of trout fisheries in Utah is primarily under UDWR jurisdiction.

Public Concern ID 16.32
The DEIS lacks adequate protection for occupied native trout habitat under Alternative C. Specifically, NSO does not provide a large enough buffer, which should be 500 ft, and it contains allowances for road crossings, which are unacceptable. These protections would help the Forest better meet its multiple use mandate. [Cmt 7.005, 7.006, 7.007, 7.008, 7.009, 7.029, 8.041, 8.042, 8.043, 8.044, 8.045]

Response: Alternative B contains a 500-foot NSO buffer for streams. A 300-foot NSO buffer under Alternative C still provides a reasonable level of protection for this resource, and no road crossings would be allowed under Alternative C (NSO) in Fisheries Habitat (defined as occupied and suitable). Streams containing sensitive trout ("Fisheries Habitat") under Alternative C would be protected by a 500-foot NSO buffer in the FEIS.

Public Concern ID 16.33
Commenters expressed a lack of support for NSO allowing road crossings because it would reduce the ability of the Forest to mitigate or deny a road crossing on streams harboring native trout or that are suitable for restoration of native trout. [Cmt 7.012, 8.047]

Response: Alternative C would not allow road crossings under NSO in Fisheries Habitat (see **Public Concern ID 16.32**).

Public Concern ID 16.34
The DEIS should replace NSO in bald eagle wintering areas with CSU. [Cmt 9.010]

Response: NSO stipulations in bald eagle wintering areas were developed in order to protect bald eagles from a declining trend and fulfill the Forest Service mandate to protect Sensitive species.

Public Concern ID 16.35

The Forest Service should protect sensitive habitats and wildlife, as well as threatened and endangered species. [Cmt 32.002, 44.001, 44.005, 56.008, 137.002, 189.003, 218.002, 249.009, 254.002]

Response: See **Public Concern ID 15.22** response. The Forest maintains a list of Sensitive species that receive special management emphasis to ensure their viability; see **Section 3.6.3** of the **DEIS**.

Public Concern ID 16.36
In Table 4.6-5 (CSU), an estimate of the total suitable MSO habitat should be shown to make the comparison to the 706 estimated acres lost. [Cmt 282.016]

Response: This information was omitted for brevity in **Table 4.6-5** because impacts are identical to SLT, and the reader is referred to the discussion under SLT for complete information. Less than 10 percent of the "potential, unverified" habitat area would be disturbed if all activities occurred (i.e., 706 acres) in this habitat.

Public Concern ID 16.37
In Table 4.6-5 (CSU), the cell discussing habitat fragmentation for California condor should be filled in (removed reference to TL). [Cmt 282.017]

Response: This information was omitted for brevity in **Table 4.6-5** and the reader is referred to **Table 4.6-4** (TL) because impacts are the same.

Public Concern ID 16.38
The DEIS should present a more in-depth analysis of the impacts to special status species because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.034]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 16.39
The SIR fails to summarize existing credible scientific information regarding on-ground impacts to sensitive Dixie National Forest species at oil and gas leasing sites in the West in the cumulative impacts section. This violates NEPA regulation 1502.22 (incomplete or unavailable information). [Cmt 284.065]

Response: See **Public Concern ID 10.03** response.

Public Concern ID 16.40
The SIR fails to consider cumulative impacts on Dixie National Forest sensitive species in light of climate impacts with oil and gas impacts that were both predicted under Alternative C and ignored in the DEIS (see **Public Concern ID 16.03**, **16.07**, **16.11**, **16.13**, **16.14**, **16.20**, and **16.21**). This violates the "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions" (issued by the Council on Environmental Quality) because climate change is a 'reasonably foreseeable change' to the affected environment that Agencies must consider. (Cmt 284.066, 284.067, 284.068, 284.069]

Response: Climate change impacts are only discussed in the air resources section of the FEIS. This is because, as stated in Section 2.0 of the SIR, the climate change analysis in the SIR was prepared in response to comments from the Environmental Protection Agency as pertained to Air Resources. Other resources such as water, vegetation, and soils were covered in the

cumulative impacts section of air resources with regard to climate change impacts. Special status species were, indeed, neglected in the SIR discussion. However, the cumulative effects section of Air Resources in the FEIS will include a discussion of special status species that would most be affected by climate change.

7.4.17 Water

Public Concern ID 17.01
Alternative C would cause severe harm to water resources. [Cmt 42.004, 46.005, 47.005, 48.006, 50.006, 51.005, 52.004, 53.003, 54.005, 55.008, 56.003, 57.004, 59.004, 60.004, 61.004, 62.009, 63.002, 64.004, 65.004, 66.004, 67.005, 68.008, 69.005, 70.004, 71.005, 72.007, 73.004, 74.005, 77.005, 78.005, 79.005, 80.004, 85.004, 86.005, 87.007, 88.005, 89.005, 90.004, 91.004, 92.006, 94.005, 95.004, 97.005, 98.006, 99.005, 100.005, 101.004, 102.004, 106.004, 107.004, 108.004, 109.004, 110.007, 111.005, 113.005, 114.005, 115.004, 116.002, 119.007, 120.005, 121.005, 122.005, 123.004, 124.005, 125.005, 126.004, 127.004, 128.004, 129.004, 130.004, 131.004, 132.004, 133.007, 134.005, 135.006, 136.005, 138.004, 139.005, 140.005, 141.005, 142.004, 144.004, 145.004, 146.006, 147.007, 148.004, 149.005, 150.005, 151.004, 152.004, 153.004, 154.007, 155.004, 156.01, 157.004, 159.004, 160.005, 161.008, 162.004, 164.004, 165.005, 166.004, 167.004, 168.005, 169.004, 170.004, 171.01, 172.009, 175.007, 177.004, 178.006, 179.006, 180.008, 181.006, 182.006, 184.005, 185.004, 186.004, 187.004, 188.005, 191.005, 192.004, 193.004, 194.004, 195.004, 196.004, 197.006, 198.005, 199.005, 200.005, 201.007, 202.006, 203.004, 204.005, 205.005, 206.005, 207.004, 208.005, 210.007, 211.007, 212.005, 213.006, 214.004, 215.004, 216.005, 217.005, 219.004, 220.004, 222.004, 223.004, 224.005, 225.005, 226.005, 227.004, 229.005, 230.004, 232.004, 233.006, 234.004, 235.004, 237.005, 238.004, 239.004, 240.005, 241.005, 245.005, 247.004, 248.004, 249.004, 250.009, 251.004, 252.004, 253.004, 254.007, 255.005, 256.004, 258.004, 259.006, 260.006, 261.004, 262.006, 263.004, 264.005, 265.004, 266.006, 268.004, 269.004, 270.004, 272.004, 274.004, 275.004, 276.005, 277.004, 278.004, 279.005]

Response: BMPs designed to mitigate impacts to water quality include the Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements (Appendix C), the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – the Gold Book, and BLM Onshore Order No. 7. These BMPs are standard for surface disturbing activities and are proven to minimize the effects to surface waters. They are common to all alternatives and are in addition to the protective stipulations supplied under each alternative. Also, see **Public Concern ID 5.02** response.

Public Concern ID 17.02
Given the arid nature of land surrounding the Dixie National Forest, if impacts to water or watershed resources occur under Alternative C, the effects would be felt on surrounding and downstream lands. [Cmt 1.082]

Response: The potential for impacts to be felt on surrounding and downstream lands is acknowledged in **Section 4.7.3** of the **DEIS** and discussed in further detail in **Section 4.7.4.6** of the **DEIS** (see the "**Water Uses**" and "**Impacts to Water Quantity**" sections of **Section 4.7.4.6**). Although the discussion of impacts for Alternative C (**Section 4.7.5.3**) states that impacts under Alternative C are likely to be less severe than described in **Section 4.7.4.6**. Additional protections for water resources were included under Alternative C in the Final EIS, including NL for sensitive aquifers under lava fields, a lease notice for Drinking Water Protection Zones, and a 500-foot buffer in sensitive fisheries habitat (see **Section 7.3**).

Public Concern ID 17.03
The Forest Service's mapping of local and regional aquifers is incomplete and there may be greater permeability in the lava fields over sensitive aquifers, higher underground flows, and greater trans-basin movement of water than is currently realized. This may lead to an underestimation of impacts [Cmt 1.083, 1.092]

Response: Given the incomplete information regarding local and regional aquifers, as well as regarding the exact location of oil and gas activity, the Forest Service took a conservative approach to analyzing impacts. This was done by analyzing not only those impacts to water and watershed resources that are likely to occur, but all impacts that could occur (see **Section 4.7.3** of the **DEIS**). This was done to avoid the underestimation of impacts. Further, the Forest Service recognizes that the flow and trans-basin movement of groundwater may be greater than realized and has provide appropriate protection for these resources (including at the least the *Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements*, Appendix C). In the FEIS, Alternative C was changed to include a NL leasing option for lava fields over sensitive aquifers. Also, in the preferred alternative, NL or NSO stipulations apply to all water and watershed resource components (also see **Public Concern ID 17.29** response)

Public Concern ID 17.04
Due to their highly porous nature, lava fields over sensitive aquifers are extremely susceptible to contamination. A NSO stipulation under Alternative C would allow seismic exploration and directional drilling, both of which present unacceptably high risks of contamination through increased erosion, the potential for the release of a toxic contaminant, and through the production of waste water. [1.084, 1.085, 1.086, 1.087, 1.088, 1.089, 1.090, 1.091]

Response: In the FEIS, Alternative C was changed to include a NL leasing option for lava fields over sensitive aquifers. As a result, no leasing would be allowed in these areas and any potential impacts from seismic exploration and directional drilling would be eliminated.

Public Concern ID 17.05
Alternative E provides no special protection to lava fields over sensitive aquifers and should it be adopted these areas could be severely contaminated in the long term as a result of direct surface disturbance and construction of roads, as well as the increased potential for the spill of toxic contaminants. [Cmt 1.093, 1.094, 1.095, 1.096]

Response: Alternative E does not provide special protection to lava fields over sensitive aquifers and the impacts to these aquifers could be long term and major as described in **Section 4.7.4.6** of the **DEIS**. The response to **Public Concern ID 5.02** explains the rationale for including Alternative E in the analysis, despite the possibly for greater environmental impacts. The preferred alternative (Alternative C), as modified in the Record of Decision, applies the NL leasing option to lava field over sensitive aquifers.

Public Concern ID 17.06
The Forest Service should revise its alternatives, particularly its chosen alternative, to include NL for lava fields over sensitive aquifers, as this is the only leasing option that provides enough protection for these unique and ecologically critical areas. [Cmt 1.097]

Response: In the FEIS, Alternative C was changed to include a NL leasing option for lava fields over sensitive aquifers.

Public Concern ID 17.07
Water and watershed resources are susceptible to contamination from toxic substances and from increases in sediment. Increases in sediment may change flow conditions, lead to channel aggradation, and harm aquatic habitat. [Cmt 1.098, 1.099]

Response: Water and watershed resource are susceptible to contamination and a change in ecological and geomorphologic changes. These impacts are described in **Sections 4.7.3**, **4.7.4**, and **4.7.5** of the **DEIS**.

Public Concern ID 17.08
The Forest Service's mapping of watershed resources is incomplete and the Forest Service lacks adequate data concerning the location, extent, and ecological characteristics of these areas to gauge whether the leasing options applied under the various alternatives provide sufficient protection. [Cmt 1.100, 1.102, 1.103]

Response: As the location of impacts is unknown, the DEIS analyzes the general impacts that could occur to watershed resources under the various leasing options applied. However as explained in **Section 2.3.1** of the **DEIS**, "leasing options are applied to the resource component and not simply to specific geographic areas." As a result, although the mapping of watershed resources is incomplete, the appropriate leasing option will be applied to any resources present within a lease area at the time it is offered for lease (see response to **Public Concern ID 4.06**)

Public Concern ID 17.09
The NSO option under Alternative C allows road and pipeline crossings and does not adequately protect water and watershed resources from the impacts of roads, including increased sediment delivery and the increased potential for a spill or leak of toxic contaminants. [Cmt 1.101, 1.104, 1.105, 1.106, 1.107]

Response: The potential for impacts to occur from road and pipeline crossings is acknowledged in **Sections 4.7.4.3** and **4.7.4.6** of the **DEIS**. However, as discussed in **Section 4.7.4.3**, this type of NSO was developed in recognition of the need for road crossings within a landscape that is dissected by streams. See also the response to **Public Concern ID 5.02**.

Public Concern ID 17.10
The NSO option under Alternative C allows seismic exploration and directional drilling to occur within the 300-foot buffer around water and watershed resources, which does not provide adequate protection from erosion and spills of toxic contaminants. [Cmt 1.108, 1.109]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 17.11
Instead of the NSO option under Alternative C, the Forest Service should apply a NL option to an area at least as great as that covered by the 300-foot buffer, similar to what is done in Alternative B. The protections afforded to water and watershed resources under NL and Alternative B are much stronger than under NSO. [Cmt 1.110]

Response: See response to **Public Concern ID 5.02**.

Public Concern ID 17.12
The NSO option applied to municipal watersheds under Alternative C does not provide adequate protections from the impacts associated with seismic exploration and directional

drilling. The Forest Service should instead apply the NL option provided for in Alterative B. [Cmt 1.111, 1.112, 1.113, 12.035]

Response: See response to **Public Concern ID 5.02**.

Public Concern ID 17.13
Despite the potential for substantial effects to water and watershed resources, the DEIS fails to examine the adverse impacts of stormwater runoff. [Cmt 1.114]

Response: The analysis of impacts in the DEIS does not specifically mention stormwater runoff. However, the discussion of sediment related impacts to watershed resources and water quality (**Sections 4.7.4.3** and **4.7.4.6** of the **DEIS**) addresses the potential impacts related to stormwater runoff from roads, well pads, etc. Further, site specific mitigation related to stormwater runoff is included in Appendix C (Section IV, #20 and Section V, subsection E).

Public Concern ID 17.14
The DEIS must acknowledge that all surface waters on the Dixie National Forest are Category I waters. Also, the DEIS must provide the water monitoring data necessary to establish baseline conditions and identify the practices or measures that would be put in place to guarantee the no degradation of water quality would result from any actions approved by the Forest Service. [Cmt 1.115, 1.116, 1.117, 1.118]

Response: The Utah Division of Water Quality designates beneficial use classifications for surface waters within Utah, and protects those waters so as to maintain their designated uses (State of Utah 2007). Classes relevant to streams on the Dixie National Forest include: IC - protected for domestic purposes with prior treatment; 2B - protected for secondary contact recreation such as boating, wading, or similar uses; 3A - protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; 3C - protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain; 3D - protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain; and 4 - protected for agricultural uses including irrigation of crops and stock watering. Numeric surface water quality criteria are applied to each of these beneficial use classes by regulation at Utah Annotated Code R317-2-14.

BMPs designed to mitigate impacts to water quality include the Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements (Appendix C), the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – the Gold Book, and BLM Onshore Order No. 7. These BMPs are standard for surface disturbing activities and are accepted by the State of Utah as a viable way to meet water quality standards to minimize the effects to surface waters. They are common to all alternatives and are in addition to the protective stipulations supplied under each alternative. Water monitoring data, where available, would be used to establish baseline conditions for any site-specific environmental studies in the future.

Public Concern ID 17.15
Under Alternative C, leasing would be allowed along the western boundary of Bryce Canyon National Park under TL, which due to the steep slopes and unstable geology in that area could increase sediment delivery to streams. Also, watershed contamination due to spills of toxic contaminants is a concern. [Cmt 2.037, 2.038]

Response: Under Alternative C, steep slopes and areas of high erosion potential on the western boundary of Bryce Canyon National Park would be protected by an NSO stipulation.

Public Concern ID 17.16
The DEIS should present a more in-depth analysis of the impacts to water and watershed resources because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.035]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 17.17
The DEIS should provide more specific information regarding the impacts to water resources that could occur as a result of improperly cased of sealed wells. [Cmt 3.062, 3.019]

Response: Casing and cementing requirements are outlined in BLM Onshore Oil and Gas Order No. 2 (43 CFR 3160). Information on casing and cementing requirements, as well as more specific information regarding potential impacts from improperly cased wells has been added to **Section 4.7** of the **FEIS**.

Public Concern ID 17.18
The DEIS does not discuss the potential for oil and gas leasing to increase demand for surface water in the Great Basin or Colorado River Basin . This is significant because flows in the Colorado River are declining, and demands for water in the region, including California, are increasing such that leasing of federal lands will contribute to a future water crisis in Utah. [Cmt 4.002, 4.003, 4.004, 4.005, 4.006]

Response: See **Public Concern ID 16.26** and **15.09** responses. In general, surface water demands within the Great Basin and Colorado River Basin are disproportionate to the scale of the Cumulative Effects Area for watershed resources, which was determined to be the area affected by connected actions to leasing over the next 15 years. Thus these concerns are outside the scope of this document. As discussed in **Section 5.7.2** of the **DEIS**, the Dixie National Forest does capture, store, and release water that supports not only proximate ecosystems, but 15 municipal water systems that serve as the only (or predominant) source of culinary water for the 28 municipalities within the CEA. However, the potential for impacts to water resources as a result of connected actions associated with oil and gas leasing is related more to degrading water quality than to reducing water quantity. There would be no depletions at the leasing stage; potential depletions would be more appropriately addressed at the site-specific analysis stage.

Public Concern ID 17.19
The DEIS does not assess the potential for the appropriation of water for oil and gas use to be rejected based on the over allocation of water rights, as well as the potential to impair existing water rights, interfere with more beneficial uses of water, affect public recreation, affect the natural spring flows, threaten native fish, or prove detrimental to public welfare. [Cmt 4.007, 4.008, 4.016]

Response: Consumptive use of water is the jurisdiction of the Utah State Engineers Office and they would administer the permitting of water wells for oil and gas production or exploration. Effects to water quality and quantity are addressed in **Sections 4.7.3**, **4.7.4** and **4.7.5** of the **DEIS**.

Public Concern ID 17.20
The DEIS does not analyze the potential for oil and gas leasing to permanently contaminate the water used and affect future beneficial uses of the water, senior water rights, and the public welfare. [Cmt 4.011, 4.013, 4.014, 4.015]

Response: See **Public Concern ID 17.19** response.

Public Concern ID 17.21
As Utah State Code requires all water appropriations to be for a continuous beneficial use, the DEIS must demonstrate the beneficial use of water used in oil and gas leasing. [Cmt 4.017, 4.018, 4.019, 4.020, 4.021, 4.022, 4.024]

Response: The DEIS discusses the impacts to the human environment, including water resources, that are expected to occur as a result of actions connected to oil and gas leasing (See **Sections 4.7.3**, **4.7.4**, and **4.7.5** of the **DEIS**). However, as described in the response to **Public Concern ID 17.19**, the Utah State Engineers Office administers the permitting of water appropriations for oil and gas use. Lessees would be required to demonstrate the beneficial use of water in order to obtain a permit for water use. See response to **Public Concern ID 17.19**.

Public Concern ID 17.22
Federal statues such as NEPA require the Forest Service to analyze the impact of water use on water resources. [Cmt 4.023]

Response: Impacts to water resources from water use are discussed in **Sections 4.7.3**, **4.7.4** and **4.7.5** of the **DEIS**.

Public Concern ID 17.23
The DEIS does not address the impacts of leasing on potential tribal water claims and the availability of water in relation to the other demands on Utah's water supply. [Cmt 4.025]

Response: The EIS does look at the need for short-term water use and it is stated that drilling activities would require the user to negotiate with existing holders of water rights for the use of water. The user would also be responsible for obtaining the necessary permits from the Utah State Engineers Office. See **Public Concern ID 16.26** and **15.09** responses.

Public Concern ID 17.24
One response expressed general concern regarding impacts to water resources within the Escalante River watershed, including the sedimentation of streams due to the highly erosive nature of the sedimentary geology and the potential for contamination of the extremely permeable Navajo Sandstone aquifer. The Escalante River watershed, including Boulder Mountain and the Aquarius Plateau provide water to the communities of Boulder and Escalante. [Cmt 6.006, 6.007, 6.012, 6.013, 12.025, 12.037, 12.040]

Response: Refer to **Public Concern ID 1.06** response. General impacts with regard to sedimentation of streams and contamination of culinary water sources are discussed in **Section 4.7.4.6** of the **DEIS**. This general discussion applies to the Escalante River watershed. Separate NEPA analysis would take place to analyze any site-specific development plan in this area.

Public Concern ID 17.25

Seismic line trials created by off-road buggies during seismic exploration creates the potential for ATV recreationists to create new unauthorized trails, which could lead to erosion and sediment delivery to streams. [Cmt 12.009]

Response: Refer to **Public Concern ID 14.07** response.

Public Concern ID 17.26
The area beneath the rim of Boulder Mountain is landslide prone, if a landslide were to occur it could rupture pipelines and pollute water resources. [Cmt 12.039]

Response: See **Public Concern ID 1.06** and **1.09** responses. Areas of active rockfall, landslides and unstable slopes have been analyzed under No Surface Occupancy for Alternatives B, C, and D. If activities were proposed in the Boulder Mountain area, site-specific NEPA analysis would address unstable soils in more detail. These particular impacts, while considered unlikely, are discussed in **Section 4.7.4.6** of the **DEIS** under "Other Water Quality Impacts."

Public Concern ID 17.27
Several responses stressed the importance of clean water and the concern that oil and gas leasing would lead to pollution of water resources. [Cmt 29.002, 33.003, 40.006, 43.003, 109.011, 172.003]

Response: **Section 4.7.4.6** of the **DEIS** contains a conservative discussion of potential impacts to water resources (under SLT). Construction and Operating Standards would reduce the possibility of impacts to water resources (**Appendix C**; see **Public Concern ID 1.09** response).

Public Concern ID 17.28
The Forest Service should complete the groundwater resources and aquifer inventory as proposed in Chapter 3 (3-77). [Cmt 282.020]

Response: This groundwater resource and aquifer inventory is a priority for the Dixie National Forest.

Public Concern ID 17.29
Drinking Water Source Water Protection Zones should be mapped and considered for more restrictive stipulations. Specifically, under Alternative C there should be No Leasing within these Zones and NSO within a one-mile buffer around these zones. [Cmt 282.021, 282.022]

Response: The FEIS currently provides NSO within municipal watersheds under Alternative C (**Section 4.7.4.3** – Groundwater). The protection of the Drinking Water Source Protection Zones will be addressed with a lease notice requiring adherence to R309-600 Utah Admin. Code Source Protection: Drinking Water Source Protection for Groundwater Sources. This Lease Notice incorporates the most recent direction from the BLM concerning protection of all usable ground water zones (≤ 10,000 mg/L as defined in Onshore Oil and Gas Order No. 2) associated with oil and gas exploration and development (BLM IM No. UT 2010-055). Note that the BLM retains sole responsibility for making decisions with regard to the analysis of subsurface impacts, following the provisions of the National BLM / U.S. Forest Service MOU *Concerning Oil and Gas Leasing and Operations,* FS Agreement No.: 06-SU-11132428-052 (2006). The USFS retains sole responsibility for making decisions with regard to the analysis of surface impacts and is ultimately responsible for the accuracy of the information. Additional measures specific to groundwater were added to **Appendix C**. Potential impacts to groundwater are discussed in

Sections 4.7.4.3 (NSO) and **4.7.4.6** (SLT). The Lease Notice for Drinking Water Protection Zones is contained in **Appendix D** of the FEIS.

Public Concern ID 17.30

The EIS needs to anticipate the potential for groundwater contamination, specifically in Drinking Water Source Water Protection Zones, to occur during drilling using occurrences in the Pinedale Anticline area as a guide. [Cmt 282.023, 282.025]

Response: See **Public Concern 17.29** response. The Forest Service considered the latest information available concerning the potential for groundwater contamination in Drinking Water Source Protection Zones, including direction from BLM IM UT 2010-055 (Lease Notice for Ground Water Source Protection Zones, Appendix D) and FS Agreement No.: 06-SU-11132428-052 (2006; see Page 2 of Appendix C). At the time an APD is filed which proposes locating a well within the Drinking Water Source Protection Zone a monitoring plan will be required from the operator prior to drilling.

Public Concern ID 17.31

Aquifers should be protected from fluid migration by requiring a cement casing to be constructed that seals off the entire aquifer, down to the deepest portion of the aquifer that is being used or has the potential to be used, and not just at a portion near the surface or to the depth of existing nearby water wells. [Cmt 282.024]

Response: BLM Onshore Oil and Gas Order No. 2 (43 CFR 3160) requires cementing or casing to fully protect and/or isolate all usable water zones. Casing and cementing will be required for any water bearing formation which contains total dissolved solids equal to or less than 10,000 mg/L (as per Onshore Oil & Gas Order No. 2). This information has been added to **Section 4.7** of the **FEIS**.

Public Concern ID 17.32

By potentially allowing leasing in watersheds that are on the 303(d) list, impaired waters would be subject to additional loading of sediments and possibly other pollutants. Some TMDLs (e.g., Sevier River) did not take potential oil and gas impacts into account. No Lease would be the appropriate stipulation for already-impacted watersheds. [Cmt 282.026, 282.027]

Response: All streams, lakes and waterbodies were analyzed in the various Alternatives with stipulations ranging from NL to SLT. The preferred alternative applies a NSO stipulation of 300 ft around all waterbodies which is anticipated to mitigate any introduction of any pollutant including sediment. Any future exploration or full field development that might impact a 303d listed segment or any waterbody with a TMDL such as the Sevier River would require additional practices outlined in the Well Site Design Requirements and Best Management Practices (SWCP's) found in Appendix C. The combination of the 300 ft. buffer and the additional practices outlined in Appendix C will adequately mitigate any circumstances that might lead to inputs to any waterbody on the Dixie National Forest.

Public Concern ID 17.33

The area surrounding Navajo Lake would not be suitable for any type of drilling due to the potential interaction between groundwater and surface water. [Cmt 282.029]

Response: The area surrounding Navajo Lake would be NSO under Alternative C (NL under Alternatives A and B). Directional drilling into the areas could still occur; however, impacts would be mitigated by the use of cement casing (see **Public Concern ID 17.31** response) and other measures described in the response to Public Concern ID 17.30. Under Alternatives D1

and D2 much of the area immediately surrounding the lake would be NSO due to the underlying sensitive aquifer. Under Alternative E the area would be available under SLT.

7.4.18 Soils

Public Concern ID 18.01
Surface disturbance associated with access roads, drill pads, or utility corridors on steep and unstable slopes will create unavoidable scars in the viewshed from Cedar Breaks. [Cmt 2.052]

Response: See **Public Concern ID 11.04** response.

Public Concern ID 18.02
The DEIS should present a more in-depth analysis of the impacts to soils and geologic hazards because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.036]

Response: See **Public Concern ID 4.04** response. Impacts are discussed in **Section 4.8** of the **FEIS**.

Public Concern ID 18.03
The DEIS needs to fully consider the impacts of pollution from oil and gas activities on soils. [Cmt 6.010]

Response: The potential impacts on soils from pollution associated with exploratory well development are disclosed in **Section 4.8.3** of the **DEIS**. Also see **Public Concern ID 1.09**.

Public Concern ID 18.04
Seismic exploration would cause deep scars in the land by encouraging ATVs. [Cmt 12.008]

Response: See **Public Concern ID 14.06** response.

Public Concern ID 18.05
The area beneath the rim of Boulder Mountain is extremely landslide-prone and could be destabilized by roads and pipelines. [Cmt 12.038]

Response: See **Public Concern ID 1.06**, **1.09**, and **11.04** responses. The FEIS analyzes the impacts on steep slopes and Alternatives B, C, and D provide for NSO or CSU on active rockfall areas, landslide areas, slopes >35 percent, and areas of high erosion potential. See **Section 4.8** of the **DEIS** for analysis. If activities were proposed in the Boulder Mountain area, site-specific NEPA analysis and project design would address unstable soils in more detail.

Public Concern ID 18.06
Steep slopes should be excluded from leasing due to their potential for sediment loading into downslope waterbodies. [Cmt 282.030]

Response: Alternative B and C protect steep slopes over 35 percent and unstable soil with a NSO stipulation. Directional drilling would be permitted and seismic activities conducted by helicopter may be permitted if it can be shown that impacts associated with steep slopes and unstable soils could be avoided. See **Section 4.7.3** of the **DEIS**. All activities would be allowed on marginally unstable slopes. However, Construction and Operating Standards developed by the Dixie National Forest would minimize sediment delivery. See **Public Concern ID 1.06**

response. Site-specific NEPA analysis would address potential watershed impacts; it is not possible to assess watershed impacts at the leasing stage quantitatively.

7.4.19 Vegetation

Public Concern ID 19.01
Under Alternative C, there could be exotic weed invasions as a result of oil and gas developments within lands covered by Timing Limitations adjacent to BCNP. These areas should include a rehabilitation stipulation as well as mandatory standards and guidelines for revegetation and exotic weed control. [Cmt 2.023, 2.026, 2.027]

Response: Lands adjacent to BCNP will be covered with an NSO stipulation to protect park resources. **Appendix C** of the **DEIS** contains construction and operating standards and well site design requirements for the Dixie National Forest, which include requirements for reclamation and exotic weed control. See **Public Concern ID 1.09** response.

Public Concern ID 19.02
The DEIS should present a more in-depth analysis of the impacts to fish and wildlife because the impacts analysis is vague and does not provide sufficient detail. [Cmt 3.037]

Response: See **Public Concern ID 4.04** response. Impacts to vegetation resources are addressed in **Section 4.9** of the **FEIS.**

Public Concern ID 19.03
Seismic exploration would damage plant life. [Cmt 43.004]

Response: Impacts to vegetation from seismic exploration are discussed in **Section 4.9.3** of the **DEIS**.

Public Concern ID 19.04
Alternative C would impact plants more adversely than Alternative B. [Cmt 166.005, 172.004]

Response: See **Public Concern ID 5.02** response.

7.4.20 Transportation

Public Concern ID 20.01
Regarding lands along the western boundary of Bryce Canyon National Park, the potential exists for leases to create avenues of inappropriate and unauthorized use of the Park by the public. If leases in these areas cannot be avoided, a stipulation that controls access and mandates reclamation at the conclusion of operations should be included. [Cmt 2.024, 2.028]

Response: See **Appendix C** of the **FEIS** for operating standards that include those for reclamation. Regarding access, Appendix C states that “unless otherwise specified by the responsible Forest Service officer, new oil and gas access roads shall be closed to the public. Operators must construct and maintain gates to Forest Service design standards at intersections of project access roads with National Forest System roads or other highways to prevent unauthorized traffic from entering. A locking system will be required to allow a Forest Service lock in addition to the operator’s lock.”Road access would be controlled by a CSU stipulation that would, at a minimum, be implemented around the Bryce Canyon National Park boundary. In addition a NSO stipulation for Alternative C prevents any surface disturbances on lands adjacent to Bryce Canyon NP.

Public Concern ID 20.02
The DEIS has not communicated the significance of alternatives to the public, in that the quality, magnitude, and duration of impacts to transportation resources are unclear. [Cmt 3.038]

Response: See **Public Concern ID 4.04** response. Refer to the **Section 4.10** of the **FEIS**.

7.4.21 Socioeconomics

Public Concern ID 21.01
Oil and gas activity is dangerous to workers, poses a legitimate pollution risk to air and water, and may also increase social and psychological problems. As a result, oil and gas activity presents a risk to human health and the Forest Service is required under NEPA to consider the impacts on human health, including the physiological, social, and psychological impacts. [Cmt 1.119, 1.120, 1.121, 1.122, 1.123, 1.124, 1.125, 4.012]

Response: CEQ 1508.14 requires the "human environment," which includes the natural and physical environment and the relationship of people to that environment, be considered in all project analyses. Socioeconomic impact analysis was completed for this project (**Section 4.11** of the **DEIS**). Public health and safety issues were also addressed throughout the document in relation to air, water, visual and other natural resource impacts.

Every operation authorized under a federal oil and gas lease will conform to the USDI BLM and USDA Forest Service standards and meet all relevant standards for safe operations standards. Construction and Operating Standards (**Appendix C**) provides additional measures for efficient and safe operations (see **Public Concern ID 1.09** response). Actions such as required lighting of exploratory rigs are required for employee safety, and operators are authorized to take immediate action to safeguard human life (BLM and USFS 2007). In addition, the petroleum and petrochemical industry along with many safety organizations have addressed specific hazards in oil and gas well drilling, and servicing operations by developing a number of publications, recommended practices and guidelines that specifically address safe work practices.

Public Concern ID 21.02
The DEIS has not communicated the significance of alternatives to the public, in that the quality, magnitude, and duration of impacts to socioeconomic resources are unclear. [Cmt 3.041]

Response: See **Public Concern ID 4.04** response.

Public Concern ID 21.03
Increased traffic near backcountry recreation areas and scenic byways could degrade the scenic values of Bryce Canyon National Park and affect visitor experience, recreation, and tourism. [Cmt 2.021]

Response: Impacts to visual, recreation, and socioeconomic resources have been addressed for each alternative in **Sections 4.2, 4.4,** and **4.11**, respectively, of the **FEIS**.

Public Concern ID 21.04
The adverse environmental impacts associated with oil and gas leasing have the potential to decrease recreation on the Dixie National Forest and in nearby national parks, which would have negative impact the economies of local communities. [Cmt 3.066, 6.001, 6.003, 12.001, 12.041, 12.049, 12.053, 43.006, 43.008, 62.005, 253.010]

Response: The potential offset/relocation of recreation in leasing areas (*Measurement Indicator #6*) is discussed in Socioeconomic Resources (**Section 4.11.3** of the **DEIS**). Impacts to recreation use are disclosed in **Section 4.4.3**.

Public Concern ID 21.05
The Forest Service should address the impacts of oil and gas activity on Blue Ribbon Fisheries and their importance to recreation and local communities. [Cmt 7.018, 7.019, 8.053, 8.054]

Response: Refer to **Public Concern ID 14.04** and **15.25** responses.

Public Concern ID 21.06
The DEIS may understate the importance of oil and gas activity on state and local economies and the Forest Service should consider additional relevant information available from the State of Utah before finalizing the DEIS. [Cmt 11.007, 11.008]

Response: The State of Utah was a cooperating agency in this FEIS and provided the Dixie National Forest with important information on the socioeconomic impacts of oil and gas activities. Impacts to socioeconomic resources are discussed in **Section 4.11** of the **FEIS**. The State of Utah also reviewed the contents of the EIS prior to its public release.

Public Concern ID 21.07
Pollution associated with oil and gas activity could decrease the value of sustainable agricultural projects, as well as other tourism based on principles of sustainability. [Cmt 12.036, 12.053]

Response: **Section 4.11** of the **FEIS** contains a discussion of the indirect negative effects on leisure/hospitality (tourism) spending and employment caused by a decrease in the use of developed and undeveloped recreation sites near leasing areas; see *Measurement Indicator #6*. Regarding impacts to sustainable agriculture, refer to **Public Concern ID 18.03** response for soil pollution. Water pollution is discussed in **Public Concern ID 17.27** response.

Public Concern ID 21.08
Communities in southern Utah have serious housing shortages and cannot accommodate the existing workforce. If an oil boom builds up communities, they would later experience a serious decline when the exploration boom is over. [Cmt 12.051, 12.052]

Response: These potential impacts are discussed in **Section 4.11.3** of the **DEIS**. Impacts on counties in the six-county area are likely to be temporary, short-term, and minor, due to the relatively minor amount of exploration and development activity predicted by the RFDS.

Public Concern ID 21.09
Due to the prevalence of seasonal jobs, the community of Boulder, Utah maybe be impoverished relative to the State of Utah and the impacts of oil and gas activity on tourism (see Public Concern ID 21.4) could be a potential environmental justice issue. [Cmt 12.055, 12.056]

Response: The US EPA Office of Environmental Justice defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. As discussed in **Sections 4.11.3** and **4.4.5.3** of the **DEIS**, the impacts to recreation and tourism under the Forest Service preferred alternative (Alternative C) are expected to be short term and negligible to minor.

7.4.22 Air

Public Concern ID 22.01
The Forest Service's analysis of potential impacts to air quality is insufficient under NEPA and the Clean Air Act, and as a result, the alternatives cannot be evaluated and the Forest Service is prevented from making a well-informed decision. [Cmt 1.126]

Response: See **Public Concern ID 22.07 through 22.12** responses. The air quality analysis was revised as a supplement to the DEIS. Refer to the Supplemental Information Report (SIR) for the DEIS, issued in February 2010, and **Appendix SIR-1**.

Public Concern ID 22.02
The Proposed Action could have a significant adverse effect on air quality and Air Quality Related Values (AQRVs), particularly visibility, in Class I areas near the Dixie National Forest. [Cmt 1.127, 1.131, 1.132]

Response: The air quality modeling performed to support the DEIS documented the air quality and AQRV impacts per unit of emissions at a variety of distances, which could be used to assess the potential impact of any size development in any relationship to any receptor, including those located in nearby Class I areas. In the FEIS, the air quality modeling has been changed to include more conservative emissions inputs. See **Public Concern ID 22.03** response.

Public Concern ID 22.03
AQRVs in Class I areas near the Dixie National Forest could be significantly adversely affected by the Proposed Action and these AQRVs need to be specifically addressed in the DEIS. [2.001, 2.002]

Response: AQRVs following the latest FLAG document have been specifically addressed in the FEIS (**Section 4.12.2.5**). Visibility impacts for Class I areas could potentially reach the FLAG limit of 1 deciview out to 55 km for the 20-well development scenario. The analyses also indicate that Federal Land Managers could request a future cumulative visibility impact analysis for receptors out to 100 km.

Public Concern ID 22.04
The Forest Service must complete a cumulative effects analysis that includes both near-field and far-field analyses, with comprehensive emissions and meteorological data inputs, and include compliance with NAAQS, Class II increments, AQRVs, and Class I increments in potentially affected Class I areas. [Cmt 1.137]

Response: In question during this leasing analysis is the decision as to whether to authorize leasing on the Dixie National Forrest not whether to authorize a proposed drilling and production operation. Given this distinction, it is not practical to analyze every possible proposed action that may be developed in the future. As a result, this EIS requires that future proposed development projects include an additional air quality analysis to address cumulative impacts. This ensures that air quality resource impacts are analyzed and protected and are analyzed at period during project development when specific project related information is available.

Public Concern ID 22.05
The Forest Service's air quality modeling utilized air dispersion models that are outdated and no longer accepted by the EPA or the NPS and, as a result, the analysis is legally insufficient under

NEPA and the Clean Air Act and does not provide an adequate basis to evaluate the alternatives. The Forest Service must develop an appropriate modeling protocol with the EPA [Cmt 1.126, 1.128]

Response: The modeling protocol was updated as a supplement to the DEIS (see **Appendix SIR-1**). Regarding coordination with NPS, refer to **Public Concern IDs 22.22 through 22.25**.

Public Concern ID 22.06
The Forest Service's air quality modeling is inadequate because it relies on outdated models, and the near-field EPA-approved model (i.e., AERMOD) should be used to evaluate effects to the NAAQS and increments. [Cmt 2.011, 2.012, 2.018]

Response: The air quality modeling analysis used air quality models recommended by the UDAQ. Alternative models including AERMOD and refined full-scale CALPUFF were considered to be questionably applicable because of the lack of available meteorological data to drive the dispersion analyses and the undefined locations of the proposed sources. The revised, more conservative air quality modeling analysis that is in the FEIS was determined to be appropriate following meetings with EPA. See **Public Concern ID 22.05** response.

Public Concern ID 22.07
The Forest Service's air quality analysis is legally insufficient under NEPA and the Clean Air Act because it fails to analyze the impacts of the proposed leasing scenarios on ozone concentrations, particularly in adjacent Class I areas that are near NAAQS limits for ozone. [Cmt 1.126, 1.129, 5.013]

Response: See **Public Concern ID 22.08** response.

Public Concern ID 22.08
The Final EIS should include an analysis of the potential effects to ozone, specifically ozone NAAQS analysis, considering the proximity to the Zion NP ozone monitor that found the area was near nonattainment and the finding that there could be potential compliance problems with the Class II NAAQS out to 5-10km for NO_2, which is a precursor pollutant to ozone. [Cmt 2.004, 2.005, 2.006]

Response: Ozone is addressed specifically in the FEIS in the cumulative effects section of Air Resources. Refer to **Section 5.12.3.1**. A small volume of ozone precursors could be emitted as a result of the proposed action. The potential for those emissions to lead to ozone impacts after combining with other regional air emissions in Class I areas is being studied in other regional air quality studies.

Public Concern ID 22.09
The Forest Service air quality analysis is legally insufficient under NEPA and the Clean Air Act because it fails to consider impacts of the proposed action on $PM_{2.5}$ concentrations. [Cmt 1.126, 1.130]

Response: The modeling protocol, which used PM_{10} as a surrogate for $PM_{2.5}$ because the scarcity of $PM_{2.5}$ emissions data and the lack of a regulatory structure for implementing enforceable $PM_{2.5}$ ambient air quality impact limits, was determined to be appropriate following meetings with UDAQ and EPA.

Public Concern ID 22.10

The Forest Service's air quality modeling is legally insufficient under NEPA and the Clean Air Act because the adverse impact of nitrogen and sulfur deposition exceedances in nearby Class I and surrounding areas was not addressed in the DEIS. [Cmt 1.126, 1.133]

Response: The effects of deposition of nitrogen and sulfur were directly addressed in the air quality impact analyses. Deposition rates were predicted (per unit of emissions) at any receptor location at a variety of different distances and elevations relative to potential source in the Forest. Class I deposition thresholds are met from 5km out for SO_2 and from approximately 13 km out for NO_2 (see **Public Concern ID 22.11** response).

Public Concern ID 22.11
The evaluation of potential increases in sulfur and nitrogen deposition should be included in the Chapter 4 effects analysis because nitrogen deposition could exceed NPS analysis thresholds out to between 50 and 70 km and sulfur deposition could exceed NPS analysis thresholds out to between 20 and 30 km from the source. [Cmt 2.003]

Response: The effects of deposition of nitrogen and sulfur were directly addressed in the air quality impact analyses. Deposition impacts following the FLAG document are discussed in **Section 4.12.2.5** of the **FEIS**. Class I deposition thresholds are met from 5km out for SO_2 and from approximately 13 km out for NO_2. FLAG-recommended deposition impact thresholds for Class I areas could be reached out to 45 km for the 20-well development scenario.

Public Concern ID 22.12
The Forest Service's air quality modeling is legally insufficient under NEPA and the Clean Air Act because the analysis neglected to consider existing background levels of air pollutants as required for a valid analysis of impacts to NAAQS, Class I and Class II increments, and potential violations of the Clean Air Act. [Cmt 1.126, 1.134, 1.135, 1.136, 1.137]

Response: The analysis details were clear in the use of the screening table to predict impacts at any location, and documenting that total concentration (those impacts plus background concentration) would have to be compared against applicable ambient air quality standards. While the screening tables will provide an initial estimate of the impact of larger developments, site specific approval, including air quality impact analyses and permitting would be required for any development beyond exploratory drilling. Compliance with NAAQS and increments would need to be demonstrated through this future permitting activity.

Public Concern ID 22.13
The NAAQS and increments analysis needs to be adjusted to account for the existing background concentrations; otherwise the analysis does not address the potential for a standard violation or the amount of increment consumed. The DEIS does not properly clarify the differences between Class I and Class II increments or nation-wide NAAQS for criteria pollutants, which is confusing for the reader. [Cmt 2.007, 2.008, 2.009]

Response: PSD and NAAQS increments and thresholds were documented in the DEIS. In addition, the air quality analysis has since been enhanced by the release of the SIR which provides context to those impact thresholds and the methods by which compliance should be assessed. See **Public Concern ID 22.12** response.

Additionally, given the purpose of this EIS document and its associated actions (i.e. the authorization of initial oil and gas land leasing) it is too early to have specific information about the regions in which the eventual development is likely to occur and in what form that

development will occur. As a result, it is not reasonable to include a background concentration for an unknown region. Source-only impacts were presented in the EIS so that reasonable conclusions could be drawn without the inclusion of site specific information.

Public Concern ID 22.14
The DEIS analysis appears to determine that NAAQS violations would occur in contrary to the Forest Service's legal obligation under the Clean Air Act and its own regulations (36 CFR 219.27(a)(12)) to maintain or exceed Federal and State air quality standards. [Cmt 1.140, 1.141, 5.014]

Response: Exploratory drilling as described in the EIS is shown to meet all Clean Air Act, State, and Federal air quality impact limits. The analysis in the DEIS documents that subsequent development after exploratory drilling could have the potential to adversely impact ambient air quality. A revised air quality impact analyses was conducted in response to comments received on the DEIS. This revised analysis has included mitigated emission rates and the predicted air quality impact results indicate better compliance with NAAQS compared to the DEIS. As described in the EIS, site-specific air quality permitting would be required for future development activities on the Forest and this permitting activity would need to show compliance with applicable State and Federal air quality regulations.

Public Concern ID 22.15
The Forest Service must inventory and include all potential emissions from activities on the Dixie National Forest, including all emissions relating to oil and gas development in its analysis. All air pollutions sources outside the Dixie National Forest that would impact the areas potentially affected by oil and gas leasing should also be inventoried and included. [Cmt 1.138, 1.139]

Response: Background air quality concentrations described in the analysis already include impacts of the limited number of other sources in the Dixie National Forest and surrounding areas. As described in the DEIS, air quality impacts from exploration activities would be within applicable air quality standards. Future development activities would go through site-specific air quality permitting which would incorporate data from future emissions inventories and/or background air quality.

Public Concern ID 22.16
The DEIS does not properly clarify AQRV effects and the purpose of AQRV assessments, which is confusing for the reader. [2.010]

Response: AQRV effects and the purpose of AQRV assessments were addressed in more detail in the FEIS (Section 4.12.2.5). The air quality analysis in the FEIS enhances that discussion to provide context to those impact limits and methods to document compliance with applicable limits.

Public Concern ID 22.17
Forest Service needs to use the most current EPA approved air models for near field and far field analysis, visibility, and Class I and Class II increments, including the proper meteorological data. This includes using the CALPUFF v5.8 model, WRAP data, National Weather Service data, receptor data from NPS, EPA VISCREEN, and EPA CALPUFF/CALPOST or EPA-approved AERMOD for visibility impacts. [Cmt 2.013, 2.014, 2.015, 2.016, 6.011]

Response: The challenge in the air quality modeling analysis is that the location of potential activity and its site-specific emissions magnitude is not yet available. The air quality modeling performed to support the DEIS documented the air quality and AQRV impacts per unit of emissions at a variety of distances, which could be used to assess the potential impact of any size development in any relationship to any receptor. The modeling analysis was prepared consistent with UDAQ guidance and that agency's specific recommendations. The models used were reviewed for this application by the UDAQ and the EPA and determined to be appropriate for this application.

Public Concern ID 22.18
The Forest Service should develop a new modeling protocol for use in the analysis and submit it to the NPS and EPA Region 8 for review and concurrence. [Cmt 2.017]

Response: A new, more conservative modeling protocol was prepared in response to comments on the DEIS and was provided for review by the EPA, UDAQ, and NPS.

Public Concern ID 22.19
Given the presence of nearby Class I areas, the best available mitigation measures should be incorporated into the final decision document or, alternatively, the Forest Service should consider excluding areas that could impact Class I areas from leasing. [Cmt 2.019, 2.020]

Response: In response to comments on the DEIS, additional air quality impact modeling was conducted which included mitigated emission rates reviewed by the EPA. The revised air quality impact analysis is included in the FEIS.

Public Concern ID 22.20
The DEIS does not analyze impacts to the Class I airsheds associated with the three wilderness areas on the Dixie National Forest. [Cmt 5.012]

Response: The challenge in the air quality modeling analysis is that the location of potential site-specific activity and its emissions magnitude is not yet available. The air quality modeling performed to support the EIS documents the air quality and AQRV impacts per unit of emissions at a variety of distances, which can be used to assess the potential impact of any size development in any relationship to any receptor. See **Public Concern ID 22.02** and **22.03** responses. AQRVs following the latest FLAG document have been specifically addressed in the FEIS (**Section 4.12.2.5**).

Public Concern ID 22.21
The DEIS is not in compliance with the Clean Air Act as it does not consider the cumulative impacts to air quality from the proposed oil and gas activity on adjacent BLM lands. [Cmt 5.015]

Response: See Public **Concern ID 22.14** and **22.15** responses.

Public Concern ID 22.22
Given the limited anticipated development under the RFDS, we recognize that the air quality modeling analysis results are intended to be used as an impact screen to determine when more refined analyses are necessary for NAAQS, increment, and AQRV protection. [Cmt 283.001]

Response: Comment noted, and previously agreed upon in discussions with Dixie National Forest staff and the National Park Service Air Quality Division.

Public Concern ID 22.23

The National Park Service provides the following recommendations regarding the use of information from the air quality modeling report:

- If a site-specific project is proposed within the scope of the "exploratory drilling scenario," including total proposed emissions, and will be located more than five km from any Class I area, we feel that the screening analysis adequately evaluates any AQRV concerns, and no additional AQRV modeling would be required. This determination, however, should account for any potential cumulative effects if multiple exploratory wells are proposed within the same area within a similar timeframe.
- If an exploratory well is proposed in an area immediately adjacent to a Class I area (i.e., less than five km), we recommend that the Dixie NF conduct an initial VISCREEN analysis and consult with the NPS regarding whether any additional analyses are necessary.
- If a site-specific project is proposed within the scope of the "Dixie 20-well development scenario," including total proposed emissions, and will be located more than 55 km from any Class I area, we feel that this analysis is adequate to "screen" the project from further AQRV assessment.
- If a site-specific project is proposed within the scope of the "Dixie 20-well development scenario," including total proposed emissions, and will be located less than 55 km from any Class I area, we feel that refined modeling analyses should be conducted following the recommendations in the FLAG Guidance.
- If a site-specific project is proposed, the scope of which is less than the "Dixie 20-well development scenario" but greater than the "exploratory drilling scenario", we recommend that the Dixie NF consult with the NPS to determine the appropriate level of required air quality analyses for Class I areas, including any intended use of the "normalized" impact screening tables found in Appendix A of the 2010 modeling report or additional screening models such as the VISCREEN model for visibility impacts.

[Cmt 283.002]

Response: These recommendations will be incorporated into Operating Standard 41(a) to define "as appropriate."

Public Concern ID 22.24

Recommendations made by the National Park Service [listed in **Public Concern ID 22.23**] should account for any cumulative impacts that may be occurring from existing development on the Dixie National Forest, as they are used to "screen" individual projects to determine when more refined analyses are necessary. [Cmt 283.003]

Response: Comment noted, and previously agreed upon in discussions with Dixie National Forest staff and the National Park Service Air Quality Division.

Public Concern ID 22.25

It is understood that the Dixie National Forest will develop lease notice language to ensure that potential lessees are aware of the potential need to conduct refined air quality analyses and/or employ any necessary air quality effect analyses in order to address the concerns of the National Park Service. [Cmt 283.006]

Response: The Dixie National Forest has agreed to develop lease notice language as stated above.

Public Concern ID 22.26

The Dixie National Forest must demonstrate that the level of oil and gas development authorized through the leasing EIS will protect NAAQS and PSD increments established under the Clean Air Act. However, the SIR indicates that oil and gas development on the Dixie National Forest will cause or contribute to exceedances and/or violations of the ozone NAAQS and PSD increments for both Class I and Class II areas, and presents no mitigation measures or alternatives to address these impacts. [Cmt 284.001, 284.010, 284.012, 284.014, 284.019]

Response: The USFS has attempted at all stages of the development of this Oil and Gas Leasing Environmental Impact Statement (EIS) and associated Supplemental Information Report to fully analyze air impacts as well as to demonstrate that the associated actions related with this EIS would not result in violations of any applicable air quality regulation. The results of the SIR have been utilized to develop conservative limitations as to what development would be allowed to occur under the approval of this EIS without the completion of additional analysis. These limitations will be incorporated into the final EIS as well as into binding lease stipulations should leasing be found to be the preferred alternative. Specifically, limitations will be included in **Appendix C** of the FEIS which will stipulate minimum distances for development from existing regional Class I areas as well as requirements for additional air quality analyses should proposed developments exceed the bounds assumed within this EIS. Refer to **Public Concern ID 22.35** response for ozone.

Public Concern ID 22.27
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because NEPA requires the USFS to undertake a careful examination of direct, indirect, and cumulative impacts of its proposed actions. The SIR does not adequately analyze direct, indirect, or cumulative impacts to air quality because the state regulations it deferred to are inadequate. [Cmt 284.002, 284.010, 284.011, 284.013]

Response: In accordance with the requirements under NEPA, the USFS has developed an analysis to fully disclose the potential impacts of the associated actions to all interested parties. The analysis was designed to ensure that a conservative assessment was developed and that the results of such an assessment would help characterize total potential impacts. Additionally, the USFS has incorporated the finding of the analysis into the final EIS to ensure that potential impacts related to the proposed actions are either directly mitigated or analyzed further to ensure that impacts do not exceed the appropriate regulatory limits. Given the theoretical nature of the proposed actions at this point in time, the analysis was designed to be flexible and to ensure that a conservative assessment would result. The analysis included the best available information for direct, indirect and cumulative impacts associated with the proposed actions.

The USFS has attempted to fully disclose all potential impacts associated with proposed alternatives including comparisons of maximum potential impacts versus regulatory thresholds (NAAQS and PSD increments). Furthermore, the USFS has developed requirements for inclusion in the FEIS based on the analysis to ensure that associated impacts are either immediately protective of the appropriate regulatory threshold or receive additional analytical scrutiny before development may occur.

Public Concern ID 22.28
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because Utah does not have a network of air quality monitors in the areas relevant to this action sufficient to determine compliance with NAAQS. [Cmt 284.003]

Response: The structure of the air resource analysis allows for multiple monitored "background" values to be utilized when comparisons with the NAAQS are performed. This allows a conservative assessment and NAAQS comparison to be developed. Additionally, the State of Utah has an ongoing NSR and PSD permitting program in place for the entire State and provides "background" values for that program that cover this region. These values can be considered to be appropriate for a NEPA or other regulatory analysis.

Public Concern ID 22.29
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because relevant Class I areas monitor ozone is summer, but ozone concentrations can exceed NAAQS in winter when most, if not all, Class I monitors are off-line. [Cmt 284.004]

Response: The recent air quality analyses that have demonstrated elevated winter time ozone events have occurred in regions with significantly more oil and gas industry development than those proposed in the alternatives associated with this EIS such as the Pinedale Anticline in western Wyoming. As a result, it is not reasonable to assume that such monitoring would be required in order to complete an oil and gas leasing EIS with the proposed level of development documented in the Dixie EIS document.

Public Concern ID 22.30
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because Utah has not submitted State Implementation Plan revisions to EPA pursuant to Section 110 of the Clean Air Act to ensure attainment and maintenance of the ozone and PM2.5 NAAQS, meaning no analysis or finding has been made showing that current state air quality rules are sufficient to ensure compliance with these NAAQS. [Cmt 284.005]

Response: It is beyond the scope of this EIS document to compel the State of Utah to develop or provide SIP revisions. Rather the EIS process requires that the USFS provide information regarding the proposed actions and their potential impacts in light of existing regulatory conditions, including those found in Utah's existing SIPs.

Public Concern ID 22.31
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because the State of Utah permitting requirements do not apply to stationary sources that emit 5 tons per year or fewer of any criteria pollutant, and only require an analysis of ambient air quality impacts if a source releases more than 40 tons of nitrogen oxides, 5 tons of fugitive PM10, and 15 tons of non-fugitive PM10. Furthermore, State of Utah permitting requirements do not require analysis of impacts to ozone or to PM2.5. [Cmt 284.006]

Response: It is beyond the scope of this EIS document to compel the State of Utah to revise their permitting requirements. Rather the EIS process requires that the USFS provide information regarding the proposed actions and their potential impacts in light of existing regulatory conditions, including those found in Utah's existing permitting regulations.

Public Concern ID 22.32
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because the State of Utah is failing to

permit stationary oil and gas production facilities in accordance with PSD requirements under the Clean Air Act and EPA guidance. Namely, the State of Utah is not appropriately identifying stationary sources consistent with the regulatory definition of a stationary source. [Cmt 284.007]

Response: It is beyond the scope of this EIS document to compel the State of Utah to revise their PSD permitting requirements. Rather the EIS process requires that the USFS provide information regarding the proposed actions and their potential impacts in light of existing regulatory conditions. Furthermore, the air quality analysis associated with this EIS analyzed the impacts of all theoretical sources of emissions associated with oil and gas lease development.

Public Concern ID 22.33
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because the State of Utah does not limit emissions related to vehicle tailpipes or fugitive dust or particulate matter to ensure compliance with the NAAQS. [Cmt 284.008]

Response: It is beyond the scope of this EIS document to compel the State of Utah to revise their permitting requirements. Furthermore, the State of Utah does routinely require that all sources of emissions including vehicle tailpipe and fugitive dust emissions be included in analyses for determining compliance with the NAAQS.

Public Concern ID 22.34
The USFS cannot defer to state or federal regulations to demonstrate that NAAQS and PSD increments under the Clean Air Act will be protected because the State of Utah does not address the cumulative impacts of oil and gas development to air quality. Although the State has a permitting program, this program only applies to single stationary sources that “consume increment” and does not address emissions from older stationary sources or from oil and gas development in the aggregate on a regional level. [Cmt 284.009]

Response: It is beyond the scope of this EIS document to compel the State of Utah to revise their permitting requirements. Furthermore, State of Utah according to their “Utah Division of Air Quality Modeling Guidelines” dated December 17, 2008, indicates “For NAAQS and PSD Class II analyses, all permitted sources which are located within 50 km of the subject source's area of significant impact should be included in the analysis. For PSD Class I analyses, all permitted sources located within 50 kilometers of the Class I area being analyzed should be included in the analysis, if the new major source or major modification has an impact in that Class I area that is over the Class I SIL.” This would provide a route for the inclusion of emissions from “older stationary sources or from oil and gas development in the aggregate on a regional level”.

Public Concern ID 22.35
The USFS does not fully analyze the direct, indirect, and cumulative impacts of oil and gas development to ambient concentrations of ozone air pollution, despite readily available modeling methods, which is troubling in light of increasing ozone trends throughout the West and Utah that link rising ozone concentrations and industrial development with increases in VOC and NOx emissions. [Cmt 284.014, 284.015, 284.016, 284.019, 284.020]

Response: The USFS places great importance and concern on ambient ozone concentrations that may reach or exceed the NAAQS. However, given the low level of oil and gas development proposed within the EIS and the uncertainties associated with the eventual set-up of the proposed developments, it would be premature during the leasing stage to complete a stand-

alone ozone analysis that would quantify impacts of ozone. The reason being; such an analysis would be predicated on information that has yet to be proposed by any potential lease bidders. Therefore, the results of such an analysis would not provide information upon which dependable mitigation strategies could reasonably be developed as the analysis would not necessarily represent developments that would be proposed. As a result, the USFS has proposed for the FEIS a system by which only small scale exploratory and very limited development actions may occur without additional ozone analyses that would include project specific information and would directly quantify direct, indirect, and cumulative impacts of oil and gas development on ozone concentrations.

Public Concern ID 22.36
The USFS has not disclosed or expressed concern over the 8-hour ozone NAAQS exceedances in Washington County, measured in Zion National Park. These exceedances are an indication that proposed oil and gas developments will significantly impact air quality and not protect the NAAQS and public health. In light of this the USFS has not business to conclude that the ozone NAAQS will be protected. [Cmt 284.017, 284.018, 284.021, 284.022]

Response: The USFS places great importance and concern on ambient ozone concentrations that may reach or exceed the NAAQS. As a result, the USFS has developed language for the FEIS that will strictly require additional air quality analyses for ozone prior to any proposed oil and gas production that is not expressly covered by this leasing phase EIS. These analyses would be required to analyze ozone utilizing all available regional ozone data and would fully assess the potential impact of further oil and gas production development.

Public Concern ID 22.37
It is unclear how the State of Utah's recommendation of a region-wide cooperative approach supports entirely foregoing an ozone impact analysis. If anything, the State of Utah's recommendations support the USFS preparing a region-wide ozone analysis, which is feasible using readily available modeling methods and emissions data. [Cmt 284.022. 284.023]

Response: The decision that will be made based on this EIS document will revolve around the ability to lease federal lands for oil and gas development as well as the potential for very limited exploration and production development. As a result, the impacts of the actions are so limited in scale that they are unlikely to even influence the outputs of a regional scale photochemical grid modeling simulation.

In addition, the time and resource expenditures associated with the development of a regional scale photochemical grid simulation are beyond the scope of this EIS development process. Under 40 CFR Section 1502.22 it states that:

"When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking...

> (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:
>
> 1. A statement that such information is incomplete or unavailable;

2. a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
3. a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
4. the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."

Based on the fact that the cost of performing a regional scale photochemical grid modeling analysis is beyond the resources of the Dixie National Forrest for this EIS. The USFS will amend the text of the FEIS to include the items listed in subpart 1 through 4 of 40 CFR Section 1502.22. Portions of this information has previously been included in the EIS and the SIR documents, however, the text of the FEIS will be amended to further bolster the discussion of Ozone based on existing scientific analyses.

Additionally, the USFS has included in the **FEIS Appendix C**, stipulations that will require additional ozone analyses to be completed for projects that are proposed which exceed the strict definition of the theoretical development utilized in the DEIS and SIR. As a result, ozone impacts associated with leased lands will be thoroughly vetted prior to leases being able to be used for oil and gas extraction. Performing the ozone analysis at that time will also enhance the overall accuracy of the analysis as specific project proposals will have been developed which will include accurate facility design information. Currently this level of detail is unavailable which would decrease the accuracy of any theoretical impact analyses.

Public Concern ID 22.38
We request that the USFS 1) prepare a quantitative analysis of ozone impacts, using either CAMx or CMAQ, to ensure that the NAAQS will be protected, and 2) conduct a source-apportionment analysis to determine the contribution of activities on the Dixie National Forest to regional ozone concentrations that exceed the NAAQS. [Cmt 284.024, 284.025, 284.027]

Response: As mentioned in **Public Concern ID 22.37** response, completing a regional scale photochemical grid modeling analysis is beyond the resources available for this project. As a result, the USFS was obligated to utilize available "scientific evidence" for this analysis. As it represented the most recently produced regional photochemical grid analysis which included geographical coverage of the Dixie NF, the UBAQS was selected for use on this project. The USFS acknowledges that a finer scale analysis would be desirable and will include this information in the FEIS. However, as no more recent or finer scale studies are available for comparison, the USFS has utilized the UBAQS study for this analysis.

Public Concern ID 22.39
No federal agency (particularly EPA) has endorsed the Uinta Basin Air Quality Study in a federal analysis, and because the study was funded by the Independent Petroleum Association of Mountain States (IPAMS), the scientific integrity and objectivity of the study is suspect. [Cmt 284.026]

Response: In preparing the SIR for this EIS, the USFS consulted with EPA Region 8 to determine what regional scale ozone analyses would be available that would have geographic coverage of the Dixie NF and could be used to aid in the assessment of potential ozone impacts. Following meetings with EPA Region 8 it was determined that the use of UBAQS would be acceptable for use in this analysis. The EPA did indicate that the UBAQS had potential shortcoming that should be noted. These shortcomings have been included in the FEIS to provide a firm understanding of the information that is being used to make the record of decision.

Additionally, although the UBAQS was funded by an industry trade organization, its findings were released for open scientific review and were determined to be appropriate for use in this analysis following meetings with EPA Region 8. Although the study does contain shortcomings, it remains the most recently produced photochemical grid simulation of the Dixie NF region.

Public Concern ID 22.40

Contrary to the USFS's assertion that "the connected actions to leasing described in this EIS will not result in a significant impact on regional cumulative ozone concentrations" (SIR at 31), the UBAQS study actually shows that not only will there be significant impacts, but that oil and gas development on the Dixie National Forest will contribute to violations of the ozone NAAQS. The USFS clearly did not assess the data in the UBAQS report appropriately and consequently has no basis to conclude that cumulative impacts have been adequately addressed. [Cmt 284.028, 284.029, 284.030]

Response: The UBAQS data for ozone design value, both current and future year, is processed based on two sets of meteorological data for "current" years 2005 and 2006. This data is also then used in the "future" year simulations with the inclusion of forecasted emissions growth. As a result, the UBAQS indicated two different predicted design values for ozone in the Dixie NF project region for "future" year 2012. For the 2005 data set, the design values are predicted to approach or potentially exceed the current NAAQS ozone threshold. However, for the 2006 data set, the future ozone design values are predicted to remain in compliance with the current ozone NAAQS for all regions of the Dixie NF project area. Due to this meteorological based variability, as well as the other potential sources of absolute error in the modeling simulation, it is suggested that the "current" and "future" year simulations be reviewed in relative terms. That is to say that one should compare the change in ozone concentrations from the "current" to the "future" year. When this is done, the UBAQS indicates that the ozone concentrations in the Dixie NF project region are likely to be unchanged or go down slightly. This information will be included in the discussion of ozone impacts in the FEIS.

Public Concern ID 22.41

The SIR does not analyze impacts to PM2.5 concentrations, nor the impacts associated with PM2.5, which is a violation of NEPA and USFS regulations. It is unclear how the Utah Governor's Office recommendation of a region-wide approach supports foregoing a PM2.5 impact analysis, because state and federal regulations do not ensure that mobile source emissions will protect the NAAQS and do not require PM2.5 impacts analysis prior to issuing permits to stationary sources. [Cmt 284.031, 284.032, 284.033, 284.036]

Response: Given that PM2.5 is a subset of PM10, it is conservative to assume that a PM2.5 analysis may be completed utilizing PM10 model output data. Such an analysis would provide a technically defensible and highly conservative assessment of primary PM2.5 impacts. As a result, the USFS has included in the FEIS an assessment of primary PM2.5 project impacts

utilizing PM10 model output data and regional PM2.5 background data from the National Park Service (NPS) IMPROVE network in nearby Bryce Canyon National Park. This assessment explicitly states potential primary PM2.5 impacts and fulfills the requisite "hard look" for PM2.5 impacts.

The Utah Division of Air Quality (UDAQ) requires that all new newly proposed sources of air pollution regulated through their NSR or PSD programs include an explicit demonstration of PM2.5 compliance prior to the issuance of an air quality approval order. In addition, UDAQ also requires that all onsite sources of air pollution (including mobile sources) be accounted for during the NAAQS compliance demonstration that occurs prior to an approval order being granted.

Public Concern ID 22.42
There is no data to support that the region is in compliance or will remain in compliance with the PM2.5 NAAQS. In fact, there are no PM2.5 monitors in the region. This and given that the DC Circuit Court of Appeals remanded the PM2.5 NAAQS, means that there is a critical need for the USFS to take a hard look at the impacts of oil and gas development to PM2.5 concentrations. [Cmt 284.034, 284.035, 284.038]

Response: The structure of the primary air resource analysis in this EIS allows for any number of monitored values to be utilized when comparisons with the NAAQS are performed. This allows a conservative assessment and NAAQS comparison to be developed when PM2.5 monitored data is available. Although FRM method PM2.5 data is not currently available from the State of Utah, regional PM2.5 data is available through the NPS IMPROVE network of monitors. This data can be used for ongoing analyses when combined with the conservative model output information included in this EIS analysis. See **Public Concern ID 22.43** response.

Public Concern ID 22.43
Ignoring PM2.5 in the SIR is a significant oversight by USFS in light of the BLM Richfield RMP air quality analysis showing exceedances in the nearest PM2.5 stations to that area, which is in close proximity to the Dixie National Forest. [Cmt 284.037]

Response: As expressed in **Public Concern ID 22.41** response, the FEIS has been adapted to include an explicit analysis of impacts associated with PM2.5 (as conservatively predicted by PM10 model outputs). The analysis made use of monitored PM2.5 data from the nearby Bryce Canyon National Park which provides a monitored assessment of regional PM2.5 conditions and shows no exceedance of the PM2.5 NAAQS.

Public Concern ID 22.44
The USFS must quantitatively analyze PM2.5 concentrations and also consider secondary PM2.5 formation, since that process can possibly result in the highest concentrations of PM2.5. Specifically, we request that the USFS ensure that 1) annual PM2.5 concentrations in the CEA do not exceed 14 micrograms per cubic meter, and 2) 24-hour PM2.5 concentrations do not exceed 35 micrograms per cubic meter. [Cmt 284.039, 284.040, 284.041, 284.042]

Response: See **Public Concern ID 22.41** response. Given that the Clean Air Act currently limits PM2.5 levels, the USFS will defer to the existing NAAQS for this PM2.5 analysis. As a result, an annual limit of 15 micrograms/cubic meter and a 24-hr limit of 35 micrograms/cubic meter will be used for this analysis.

The creation and movement of secondary PM2.5 is a process that includes both atmospheric chemistry and calculated atmospheric dispersion. As a result, the only means by which an assessment of secondary PM2.5 impacts can be made is through the execution of a regional scale photochemical grid model. As discussed in **Public Concern ID 22.37** response, completing a photochemical modeling analysis is beyond the scope of this EIS. As a result, the EIS has incorporated information from a previously completed regional modeling assessment. As with ozone, the results of the UBAQS have been incorporated into the FEIS to provided assessment of secondary PM2.5 impacts. This information has been caveated to express that the UBAQS does have some shortcomings but remains the most recent analysis that include the Dixie project area.

Public Concern ID 22.45
Based on the analysis in the SIR, the USFS must modify the Dixie RMP to prohibit oil and gas development within at least 20 km of all Class I airsheds. Otherwise, oil and gas development will violate at least one federal air quality standard. [Cmt 284.043, 284.045]

Response: The **FEIS Appendix C** has been updated to include language that compels any future development proponents to perform additional air quality analyses to prove that no adverse impacts will occur if they propose to site a production project with 55km of a Class I area or an exploration project with 5km of a Class I area.

Public Concern ID 22.46
Based on the analysis in the SIR, the USFS must modify the Dixie RMP to require certain pollution control devices to limit nitrogen dioxide pollution. Otherwise, development predicted in the RFDS will violate PSD increment limits in Class II areas, which is impermissible because the entire State of Utah outside of National Parks is Class II. [Cmt 284.044, 284.046, 284.047, 284.048]

Response: The **FEIS Appendix C** has been updated to include language that limits NO2 emissions. Specifically, the following language has been added:

" The operator will comply with a Condition of Approval for Applications for Permit to Drill that requires: (1) All new and replacement internal combustion diesel fired drilling engines must meet or exceed Tier II emissions limits as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (2) All new and replacement internal combustion diesel fired well pump engines must meet or exceed Tier II emissions limits for Particulate Matter and Tier III emissions limits for Oxides of Nitrogen and Carbon Monoxide as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (3) All new and replacement spark ignited natural gas fired internal combustion well-pump engines must meet or exceed emissions limits for Oxides of Nitrogen, Carbon Monoxide and Volatile Organic Compounds from New Source Performance Standard Subpart JJJJ for Stationary Spark Ignition Internal Combustion Engines manufactured since 2008. (4) All new and replacement internal combustion gas field engines of less than or equal to 300 design-rated horsepower must not emit more than 2 grams of NOx per horsepower-hour. This requirement does not apply to gas field engines of less than or equal to 40 design-rated horsepower. (5) All new and replacement internal combustion gas field engines of greater than 300 design rated horsepower must not emit more than 1.0 grams of NOx per horsepower-hour."

Within the State of Utah, only sources classified as PSD major sources are required to determine compliance with the PSD Class II increment. Given the magnitude of the reasonably foreseeable emission for this analysis, the analyzed project would not be subject to a Class II increment analysis. Additionally, the Class II analysis is performed at a source's fenceline, which provides setback from project emission sources. Such a setback was not considered in the analysis associated with this EIS. As a result, although the PSD increment limits are included in the EIS for reference, they do not have regulatory enforceability within the NEPA framework.

Public Concern ID 22.47
The SIR's recommendation that any exploration taking place within 5 km of a Class I area must include a cumulative air quality analysis is under-inclusive, allowing a development 6-7 km away to exceed PSD increment limits and not require a cumulative impacts analysis. The SIR should recommend a cumulative impacts analysis for any project within 10 km of a Class I area. [Cmt 284.049]

Response: The **FEIS Appendix C** has been updated to include language that compels any future development proponents to perform additional air quality analyses to prove that no adverse impacts will occur if they propose to site a production project with 55km of a Class I area or an exploration project with 5km of a Class I area. In addition, all projects that will not strictly conform to the reasonably foreseeable modeled analysis must complete an additional air quality analysis.

Public Concern ID 22.48
The SIR fails to calculate emissions from recreational activities such as ATVs and snowmobiles and include them in its modeling efforts for cumulative effects. This is a significant oversight because any motor vehicle use can generate significant amounts of fugitive dust, i.e., PM2.5 and PM10, and tailpipe emissions. [Cmt 284.050, 284.053]

Response: Given that the size and location of future oil and gas developments are only theoretical at this leasing stage, it is not possible to include accurate assessments of potential vehicle travel in the modeled development regions. As a result, the inclusion of such assessments would not result in increased accuracy of modeled impacts. To the contrary, the inclusion on theoretical vehicle traffic could erroneously bias the analysis to a significant degree. That said, an assessment of onsite, project induced vehicle travel was included in the analysis to ensure that all known sources were accounted for.

Public Concern ID 22.49
The emissions inventory prepared by SUWA (Williams 2008) indicates why the USFS must inventory fugitive dust, i.e., PM2.5 and PM10, from ATVs in the SIR, and demonstrates how severely inadequate the SIR's cumulative impacts emissions inventory is, both in the analysis of particulate matter from vehicle travel and from the routes themselves. [Cmt 284.051, 284.052, 284.053]

Response: See **Public Concern ID 22.48** response.

Public Concern ID 22.50
Although we support the approach of determining the screening level of air quality analyses in the SIR as a technical support document for the FEIS, the language in the SIR should be strengthened in terms of when to do an additional refined cumulative impact modeling. Specifically, adverse impacts shown in the analysis in Section 4.12.2.5 of the SIR should be

addressed in site-specific NEPA analysis (via cumulative impact modeling) prior to any development. [Cmt 285.001, 285.002]

Response: The Forest Service agrees with this recommendation and language was revised in **Section 4.12.2.5** of the **FEIS**.

Public Concern ID 22.51
Using 5 tons/year as the criterion for controlling impacts (Section 5.12.3 of the SIR) appears unjustified as we are unaware of any requirement for pollution controls or for modeling sources > 5 tons/year (except fugitive PM10) in Utah at this time. [Cmt 285.003]

Response: Utah's New Source Review Program as implemented by Utah Administrative Code R307-401 indicates that the program applies to "any person intending to: …construct a new installation which will or might reasonably be expected to become a source or an indirect source of air pollution...". This definition is later adapted in section R307-401-9 to exempt small sources of air pollution. Specifically, the rule reads:

> A small stationary source is exempted from the requirement to obtain an approval order in R307- 401-5 through 8 if the following conditions are met:
>
> > (a) its actual emissions are less than 5 tons per year per air contaminant of any of the following air contaminants: sulfur dioxide, carbon monoxide, nitrogen oxides, PM10, ozone, or volatile organic compounds;
> >
> > (b) its actual emissions are less than 500 pounds per year of any hazardous air pollutant and less than 2000 pounds per year of any combination of hazardous air pollutants;
> >
> > (c) its actual emissions are less than 500 pounds per year of any air contaminant not listed in (a) or (b) above and less than 2000 pounds per year of any combination of air contaminants not listed in (a) or (b) above.

Based on a conservative reading of the Administrative Rules quoted above, it can be said that the State of Utah's permitting program does regulate all sources of criteria pollutant air emissions that exceed 5 tons per year. In addition, since Utah's New Source Review Program as implemented by Utah Administrative Code R307-401 includes a requirement for all sources subject to R307-401 to include "An analysis of best available control technology for the proposed source or modification" it is reasonable to assume that all sources in Utah emitting more than 5 tons per year of any criteria pollutant would be subject to both permitting and pollution control requirements.

As for the air quality modeling requirement, the State of Utah currently requires all sources with maximum "potential to emit" emissions that are greater than those found in the table below to conduct air quality modeling. However, the New Source Review Program also indicates in R307-401-8 that before an approval order may be granted the State must ensure that "The proposed installation will meet the applicable requirements of... National Primary and Secondary Ambient Air Quality Standards." As a result, the State may require additional information be presented to ensure that air quality modeling would demonstrate compliance with the NAAQS. Therefore it is reasonable to conclude that the 5 ton per year threshold for emissions sources can also ensure that dispersion modeling is completed if needed.

Pollutant	Emissions (tons per year)
Sulfur dioxide (SO_2)	40.0
Oxides of Nitrogen (NO_x)	40.0
PM_{10} – fugitive emissions and fugitive dust	5.0
PM_{10} – non-fugitive emissions or non-fugitive dust	15.0
Carbon monoxide (CO)	100.0
Lead (Pb)	0.6

Public Concern ID 22.52
The FEIS should qualify the SIR statement that connected actions will not result in a significant impact on regional cumulative ozone concentrations. The SIR may be relying too much upon the modeling results in UBAQS when we now have ozone monitoring results that greatly exceed the NAAQS. At a minimum, the Final EIS should acknowledge these monitoring results and the proposed approach by BLM Utah to manage air resources with both more regional ozone modeling and more air monitoring locations in Utah. [Cmt 285.004, 285.009]

Response: The Forest Service agrees with these statements and appropriate language was added to Section 5.12.3.1 of the FEIS.

Public Concern ID 22.53
Table 3.12-1 in the SIR should be revised to show the anticipated range of a reduced standard proposed for ozone (0.060-0.070) and the recently promulgated one-hour standard for NO2. [Cmt 285.005, 285.006]

Response: **Table 3.12-1** of the SIR was revised in the FEIS.

Public Concern ID 22.54
The BLM Utah State Office has proposed to conduct regional photochemical modeling since cumulative regional development activity has produced sufficient emissions to cause NAAQS exceedances at Uintah Basin monitors. Although this modeling may not occur in the near-term, oil and gas leases awarded during implementation of the proposed action should contain a notice requiring a detailed VOC inventory for any future proposed plan of operation. [Cmt 285.007]

Response: The Forest Service agrees with these statements and appropriate language was added to the FEIS. The requirement of a detailed VOC inventory was added to the end of Appendix C (Item 41) and to the Lease Notice for Air Resources.

Public Concern ID 22.55
The following changes should be made in the FEIS:

1. Page 20: Consider right-justification for the data in table 4-12.1 to improved readability.

2. Page 24, 4.12.2.5 Visibility and Deposition Analysis - FLAG**:** Suggest changing "could request" to 'shall'.

3. Page 25: The numbers in the table 4-12.5 would be presented more understandably if right-justified so that those activities with the greatest emissions stood out.

4. Page 26: The Draft EIS included discussions of unavoidable adverse impacts, the relationship between short-term uses and long-term sustainability, irreversible and

irretrievable commitments of resources, and included Table 4.15-1. Is there a reason these valuable discussions have been omitted from the SIR? If not, we recommend that they be kept in the Final EIS.

5. Page 26: EPA assumes that original Draft EIS sections 4.16 "Compliance with Other Law and Regulations" and 4.17 “Forest Plan Consistency Determination” have been omitted in the SIR but will be reinstated or kept for the Final EIS.

6. Page 30: The word is acid 'rain' and probably not 'range'. Also many 'provincial' coal-powered electricity generating units (EGU) … may not be a good word choice; consider replacing with 'regional'.

[Cmt 285.008]

Response: All changes listed above were made in the FEIS. All exclusions in the SIR noted above were done for the sake of clarity and will be retained in the FEIS.

7.4.23 Grazing

Public Concern ID 23.01
The problems caused by grazing on BLM lands are not candidly described in the DEIS cumulative impacts section. For example, some of the allotments on GSENM were recently retired due to failed management in the protection of aquatic habitat and watersheds. [Cmt 1.062]

Response: The definition of cumulative impacts per CEQ Regulations Sec. 1508.7 is as follows: "Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Grazing impacts on the Dixie National Forest are disclosed in **Section 5.1.2.1** of the **DEIS**. These impacts are incorporated into the cumulative effects of the proposed oil and gas leasing, as are effects of the variety of actions occurring on National Forest System lands. Overall grazing trends on the Dixie National Forest are stable and are currently in line with Forest Plan standards and guidelines for these practices. Impacts occurring on private lands as well as non-National Forest public lands in the area have not been site-specifically analyzed for this EIS. These activities are outside the scope of the EIS.

Public Concern ID 23.02
Dixie National Forest plan grazing standards are routinely violated on many (Forest) locations and this should be disclosed in the cumulative impacts section. Evidence presented in GC Trust photos. [Cmt 1.063]

Response: Range conditions at specific Forest locations will be considered in site specific development proposals. Grazing practices on the Dixie National Forest are disclosed in the **Section 5.1.2.1** of the **DEIS**.

Public Concern ID 23.03

The language describing “historic” grazing impacts to Utah prairie dog in the cumulative effects section should be changed to include ongoing impacts, because ongoing impacts are occurring. [Cmt 1.064]

Response: In its finding on a petition to up-list the Utah prairie dog from Threatened to Endangered (Federal Register Volume 72(34); 21 February 2007) the USFWS found no evidence to show that grazing is [currently] having a negative effect on prairie dogs, or that [grazing impacts] are becoming more severe, to the extent that up-listing may be warranted.

Public Concern ID 23.04
The DEIS fails to consider grazing impacts, and in so doing avoids analyzing an important issue to Boulder cattle ranchers. These ranchers will be affected by oil and gas leasing more than any other permittees on the Dixie National Forest and grazing issues should be considered in the DEIS so that conflicts can be anticipated. [Cmt 12.054]

Response: Range conditions and current impacts due to grazing at specific Forest locations will be considered in site specific development proposals.

7.4.24 Noise

Public Concern ID 24.01
Noise from oil and gas activity could have a significant impact on the natural soundscape of Bryce Canyon National Park. [Cmt 2.036]

Response: An NSO stipulation was applied under Alternative C to all areas surrounding Bryce Canyon National Park (BCNP; that were not already NSO) to protect BCNP resources from impacts associated with oil and gas development.

7.4.25 Other

Public Concern ID 25.01
The DEIS does not discuss climate change. As the decision to open lands to oil and gas leasing would contribute to climate change in a variety of ways and these impacts cannot be adequately analyzed at the drilling permit application stage, the Forest Service should prepare a supplement to the DEIS that includes the most recent information available related to global climate and the impacts of oil and gas leasing. As the additional analysis would include new information and analyses, the Forest Service should provide opportunity for public comment. [Cmt 1.011, 1.151, 1.152, 1.153, 1.154, 1.155, 1.156, 1.157, 1.158, 1.159, 3.021, 3.040, 3.056, 3.057, 3.058]

Response: Climate Change is discussed in the cumulative effects section of Air Resources (**Section 5.12.3.2** of the **FEIS**). Additional climate change analysis was incorporated into the DEIS as a Supplemental Information Report (SIR) that was available for public comment between 19 February and 22 March 2010.

Public Concern ID 25.02
The DEIS should more adequately address the potential cumulative impacts to recreation from oil and gas activity coupled other extraction activities in the area along the western boundary of Bryce Canyon National Park. [Cmt 2.045, 2.046]

Response: Cumulative impacts to recreation resources have been addressed in **Section 5.4** of the **FEIS**. The CSU stipulation for ROS Roaded Natural and Semi-Primitive Motorized for

Alternatives B, C, and D (CSU-08) include stipulations that require the location of roads to minimize the intrusion of sight and sounds. An NSO stipulation was established for parcels of land adjacent to and near Bryce Canyon National Park under Alternative C.

Public Concern ID 25.03
The area along the western boundary of Bryce Canyon National Park was designated as unsuitable for surface coal mining. Many of the factors that make this area unsuitable for surface coal mining also make this area unsuitable for oil and gas leasing. [Cmt 2.047]

Response: The suitability of an area for coal surface mining is not comparable to the suitability of an area for oil and gas leasing. The impacts connected with oil and gas leasing, as well as exploration and development (connected actions), have been considered in the **DEIS**.

Public Concern ID 25.04
The lack of analysis of potential impacts to cultural resources requires the Forest Service to do additional analysis along with the State Historic Preservation Office and Native American consultation. [Cmt 2.073]

Response: See **Public Concern ID 10.04** response. Consultation with the State Historic Preservation Office and Native American tribes will be required at the time site-specific activities are proposed.

Public Concern ID 25.05
The estimated oil and gas reserves on the Dixie National Forest contain relatively little oil and gas compared to the current rate of fossil fuel consumption in the US. As a result, exploiting the finite resources of the Dixie National Forest will have little or no impact on US energy prices or on the move for energy independence. [Cmt 3.008, 3.012, 3.013, 3.015, 3.072, 3.077, 73.011, 161.001, 211.001]

Response: The Forest Service recognizes that the estimated oil and gas reserves on the Dixie National Forest are finite and small in comparison to the current US rate of fossil fuel consumption. However, as stated in **Sections 1.3** and **1.4** of the **DEIS**, the purpose and need is to complete a Forest-wide leasing analysis to comply with the Federal Onshore Oil and Gas Leasing Reform Act of 1987. Concerns regarding the Forest Service's national policy regarding oil and gas development on National Forest System lands are beyond the scope of this EIS.

Public Concern ID 25.06
Rather than drilling for oil and gas, the US should pursue an energy based on principles of sustainable development, such as developing new technologies, renewable resources, increasing energy efficiency, and promoting conservation. [Cmt 3.014, 21.003, 26.001, 31.002, 54.001, 55.002, 55.003, 58.005, 65.011, 72.003, 73.012, 76.003, 78.001, 87.004, 96.001, 99.010, 133.003, 136.001, 146.001, 147.002, 155.011, 161.001, 161.002 171.002, 173.005, 175.002, 178.002, 180.002, 182.001, 189.006, 190.002, 194.011, 201.001, 204.001, 237.002, 250.005, 262.002, 268.010, 269.011, 276.002, 281.002]

Response: These concerns go beyond the scope of this EIS.

Public Concern ID 25.07
The Forest Service did not conduct adequate consultation with all Native American tribes that have the potential to be impacted by the proposed action, as required by the NHPA. [Cmt 3.049, 3.051]

Response: See **Public Concern ID 10.04** response. Tribal coordination was completed for the project.

Public Concern ID 25.08
The minimal short-term benefit expected from the small quantities of oil and gas on the Dixie National Forest (see Public Concern 25.5) is not worth compromising the long-term unique values, public benefits, and resources of the Dixie National Forest. [Cmt 3.068, 3.076, 21.002, 23.002, 41.001, 87.002, 87.003, 111.001, 151.011, 167.009, 201.003, 205.001, 210.002, 229.002, 233.001, 241.002, 244.002, 251.010]

Response: See **Public Concern ID 1.02** response.

Public Concern ID 25.09
The DEIS does not recognize that Utah is experiencing a drought which may continue due to climate change. [Cmt 4.001]

Response: Cumulative impacts related to climate change, including the effects of climate change on Utah resources, are discussed in **Section 5.12.3.2** of the **FEIS**.

Public Concern ID 25.10
Despite not knowing the precise location of ground disturbing activity, there are many instances in the DEIS where environmental impacts can be quantified and qualified with a fair amount of precision. [Cmt 5.005]

Response: **Section 2.2.2** of the **DEIS** discusses the disturbance expected from post leasing oil and gas activity and quantifies disturbance amounts for all types of disturbance expected. Chapter 4 provides specific examples of type of impacts expected depending on resource type, and uses GIS to quantify acres of impacts to resources.

Public Concern ID 25.11
The DEIS fails to adequately address the cumulative impacts of oil development on the Dixie National Forest combined with oil development on BLM land in the immediate vicinity. The Forest Service should offer a rationale as to why some adjacent BLM oil development would have cumulative impacts and why other adjacent BLM development would not. [Cmt 5.010, 5.011]

Response: The Cumulative Effects Areas (CEAs) vary by resource and some CEAs may include some adjacent BLM land and not other (for example Visual Resources, see **Section 5.2.1** of the **DEIS**). The rationale behind each CEA is explained in each resource section. For the CEAs that include all adjacent BLM land (e.g., Recreation Resources, Fish and Wildlife, Special Status Species) the DEIS included the most complete information available. This included existing oil and gas leases for all BLM land in the CEAs (obtained from the BLM), as well as projections of reasonably foreseeable development for the Richfield and Kanab BLM field offices, which recently completed their respective Resource Management Plans (RMP) and associated Reasonably Foreseeable Development Scenarios for oil and gas exploration. A projection of reasonably foreseeable development for the Cedar City Field Office was not included, as the Cedar City Field Office has not completed an updated RMP. However, additional data has been added to **Section 5.5** (Wildlife) of the **FEIS** from Cedar City Field Office's 1986 Reasonably Foreseeable Development Scenario, which predicts exploration.

Public Concern ID 25.12
The Forest Service should consider the cumulative effects of climate change on native trout and recognize that protecting and improving habitat from the impacts of oil and gas activity can lessen the impacts of climate change on native trout. [Cmt 7.027]

Response: Effects of climate change on native trout is discussed in **Section 2.3.3** of **Appendix SIR-2**. **Appendix SIR-2** also discusses the contribution of undisturbed forest (Baseline Condition – Forest Carbon Stock Estimates; Section 3.2.2) to carbon sequestration, which is shown to 'lessen' carbon emissions in the context of U.S. emissions (**Section 3.2.4** of **Appendix SIR-2**).

Public Concern ID 25.13
The DEIS is too stringent and excludes areas from consideration by applying an NSO. The DEIS should serve as a framework for site-specific analysis during subsequent EAs. [Cmt 9.001]

Response: Most areas of the Dixie NF that have a NSO applied for protection of resources can be granted a Modification or Waiver if the operator can demonstrate in a Surface Use Plan of Operations that resource values will be protected or adverse effects can be fully mitigated. Only those areas with NA (Not Available) or NL (No Leasing) stipulations would be excluded from consideration for leasing. Making decisions regarding lands legally available for leasing and the associated conditions under which leasing would occur is required by federal law and Forest Service regulations (see **Public Concern 1.07** response).

Public Concern ID 25.14
In its analysis of impacts, the DEIS does not take into account routinely applied mitigation measures. As a result, the environmental consequences are equivalent to a worst case scenario. The analysis in Chapter 4 should be modified to reflect the efficacy of lease stipulations, conditions of approval, and other mitigation measures. [Cmt 10.007, 10.008]

Response: The DEIS does take into account routinely applied mitigation measures such as those measured required by SLT (Standard lease terms and conditions in Alternative E). Additional mitigation measures (to those required by SLT) identified in **Appendix C** were considered in the impact analysis for the action alternatives, and leasing options (**Table 2.5-1**) were applied to protect the resources if additional protection measures were needed. Operating and design standards (SLT and **Appendix C**) were considered prior to looking at more restrictive stipulations for resources. In general, impact determinations under all action alternatives were conservative, even considering that SLT and additional measures would be implemented.

Public Concern ID 25.15
Due to the potential for impacts from oil and gas activity, the Forest Service should seek additional input from the Grand Staircase-Escalante National Monument. [Cmt 12.050]

Response: The BLM is a cooperating agency with the Forest Service in this EIS, and input from the BLM has been incorporated throughout the process. The DEIS was reviewed by Grand Staircase Escalante National Monument, BLM.

Public Concern ID 25.16
All plans considering oil and gas leasing should await a new Presidential administration. [Cmt 13.001, 59.011, 162.012, 193.011]

Response: As explained in **Section 1.3** of the **DEIS**, an environmental analysis and decisions regarding administrative lease availability is required by the Federal Onshore Oil and Gas Leasing Reform Act of 1987 and federal regulations 36 CFR 228, Subpart E, and 43 CFR 3100. These requirements are unrelated to the presidential administration, which changed 20 January 2009.

Public Concern ID 25.17
Alternative energies should be judged according to their effectiveness before development. [Cmt 17.003]

Response: These concerns are beyond the scope of this EIS.

Public Concern ID 25.18
Any decisions on the DEIS should based on common sense rather than on the opinions of environmental organizations. [Cmt 17.004]

Response: See **Public Concern ID 5.02** response.

Public Concern ID 25.19
Because continued reliance on fossil fuels contributes to climate change and because intact forests can reduce the impact of CO_2 emissions, oil and gas leasing is not an appropriate use of the Dixie National Forest and should not be authorized. [Cmt 29.004, 29.006, 34.003, 99.002, 121.002, 160.001, 241.002, 254.001, 281.002]

Response: See **Public Concern ID 1.01** response for multiple use. A climate change analysis was added to the DEIS as a Supplemental Information Report and is **Appendix SIR-2**.

Public Concern ID 25.20
Fracture drilling is a toxic process that destroys aquifers and when its impacts are exposed this process will be banned from use. [Cmt 33.001]

Response: See **Public Concern ID 1.13** and **1.09** responses.

Public Concern ID 25.21
Climate change is not occurring and oil and gas leasing is an appropriate use of the Dixie National Forest. [Cmt 39.002]

Response: See **Public Concern ID 25.01** response.

Public Concern ID 25.22
Recent changes in environmental law do not require deep consideration of habitat for endangered species or other environmental concerns. As a result, the duty to protect Utah's environmental resources falls on individual citizens, employees of the Dixie National Forest, and other governmental organizations. [Cmt 41.002, 41.003]

Response: See **Public Concern ID 1.07** and **15.22** responses.

Public Concern ID 25.23
Oil and gas leasing has negative environmental impacts, some of which may be irreparable or irreplaceable. [Cmt 44.003, 58.003, 101.010, 171.003]

Response: See **Public Concern ID 1.10** response.

Public Concern ID 25.24
The National Forest System is founded on the principle of citizen ownership and some citizens do not approve the use of the Dixie National Forest for oil and gas leasing. [Cmt 52.012, 92.001, 260.002]

Response: See **Public Concern ID 1.04** response.

Public Concern ID 25.25
Although natural gas may always have a place in US energy policy, now is not the time to pursue additional reserves. [Cmt 55.004]

Response: See **Public Concern ID 1.07** for purpose and need. The Reasonably Foreseeable Development Scenario (**Appendix A**) did not specifically predict any natural gas developments.

Public Concern ID 25.26
Oil and gas leasing should not occur on the Dixie National Forest because it serves as a vital link between other protected areas in Utah and Arizona, including Bryce Canyon, Zion, and Grand Canyon National Parks. [Cmt 62.002]

Response: The Dixie National Forest does lie somewhat between Bryce Canyon and Zion National Park. Fragmentation impacts from oil and gas activities are relevant to many (special status) wildlife and plant species. Fragmentation impacts (*Measurement Indicator #2*) are discussed in **Sections 4.6.4** and **4.6.5**.

Public Concern ID 25.27
Impact from oil and gas leasing would be comparable to the impacts of strip mining. [Cmt 63.004]

Response: Oil and gas exploration and development (connected actions) do not involve the removal of soil and rock over extensive areas to expose a mineral resource for extraction, otherwise known as “strip mining.” The potential effects from oil and gas activities cannot be directly related to those from strip mining operations because of the significant differences in resource extraction methods. Oil and gas developments would follow Best Management Practices including all Construction and Operating Standards set by the Dixie National Forest and in the Gold Book (BLM and USFS 2007). See **Public Concern ID 1.09** response.

Public Concern ID 25.28
To prevent environmental damage, oil and gas companies that commit too many environmental impacts should be retroactively billed for these impacts. [Cmt 70.012]

Response: Actions available to the Forest Service and BLM regarding bonding and non-compliance situations are outlined in the respective agency regulations.

Public Concern ID 25.29
The US should be more conservative in its use of oil and gas resources. [Cmt 86.001]

Response: This concern is beyond the scope of this EIS.

Public Concern ID 25.30
The Forest Service, in an effort with the Bush administration, is attempting to push oil and gas leasing without adequate environmental or public review. [Cmt 171.005]

Response: The DEIS was developed to be fully compliant with NEPA and all other applicable environmental laws and regulations. As required by NEPA, the DEIS included a formal 30-day public scoping period prior to developing the DEIS (a summary of the public scoping process can be found in **Section 1.9.1** of the **DEIS**) and a 60-day public comment period once the DEIS was completed. Also, see response to **Public Concern ID 25.16**.

Public Concern ID 25.31
The Forest Service should focus its resources on encouraging Congress to reform the Mining Act of 1872. [Cmt 171.006]

Response: This concern goes beyond the scope of this EIS.

Public Concern ID 25.32
The interests of oil and gas companies should not take precedence over environmental protections. [Cmt 63.008, 180.004, 250.001, 152.012, 165.001]

Response: See **Public Concern ID 1.01** and **5.02** responses.

Public Concern ID 25.33
Not authorizing oil and gas leasing on the Dixie National Forest now preserves oil and gas resources that could then be used in the case of future emergencies. [Cmt 211.003, 239.011]

Response: See **Public Concern ID 1.07** response for purpose and need.

Public Concern ID 25.34
Table 5.1-1 should include historical trends for aerial application of fire retardant, historical motorized travel, the designated energy corridors FEIS, and the wild and scenic river suitability FEIS. Blanks in this table should also be filled in. [Cmt 282.018]

Response: **Table 5.1-1** included only projects in the official planning stages on the Dixie National Forest. Data on historical trends is summarized in the narrative of **Section 5.1.2.1**. Blanks in the table are for projects where the estimated disturbance is unknown or not available. The comment NA has been added to these blanks to avoid confusion. The results of the FEIS for the Wild and Scenic Rivers Suitability Study for National Forest System Lands in Utah have been included in **Sections 1.8.3, 3.3, and 4.3** of the **FEIS**.

Public Concern ID 25.35
The inconsistency in the estimate of oil and gas leased acreage between Section 5.2.2 and page 5-3 should be corrected (26,670 vs. 13,454 acres). [Cmt 282.019]

Response: The estimate of oil and gas leased acreage on **Page 5-3** of the **DEIS** describes leases only within the analysis area (1,631,216 acres) while the estimate in **Section 5.2.2** is within the Visual Resources CEA (1,952,051 acres).

Public Concern ID 25.36
The SIR does not appear to do anything to address the impacts of climate change in the context of oil and gas leasing on the Dixie National Forest. Specifically, the SIR does not address the

USFS Chief direction to Regional Offices to develop and implement landscape conservation plans with specific outcomes, strategies, and actions to address the impacts of climate change on Forest resources, especially watersheds. [Cmt 284.060, 284.061]

Response: In January 2009, the U.S. Forest Service (USFS) issued guidance on including climate change in the environmental analyses for future planning decisions. In accordance with this direction and in response to public comment, the Forest prepared a new appendix to the EIS (an SIR) that considers the effects of the proposed oil and gas leasing on climate change and the effects of climate change on the proposed action. The SIR fulfills the direction to analyze climate change at the project level; the development of landscape and conservation plans is separate direction and not relevant to this project.

Public Concern ID 25.37
The USFS should disclose who prepared the SIR and their relevant air quality and climate expertise and scientific background. [Cmt 284.070]

Response: The main JBR preparers of the SIR include:

1) David Strohm (BS, Meteorology; seven years professional experience air quality modeling),
2) Brian Buck (MS, Geological Engineering; prior climate change analysis training and climate change analysis on previous Environmental Impact Statements),
3) Jon Schulman (MS, Environmental Engineering; climate change analysis on previous Environmental Impact Statements), and
4) Laura Arneson (MS, Biology; climate change analysis on previous Environmental Impact Statements).

7.4.26 Appendix A

Public Concern ID 26.01
The RFDS lacks information about the projected volumes of actual energy production that may occur on the Dixie National Forest. Without this information it is difficult to balance the value of energy with the natural, recreational, and economic values and, as a result, oil and gas development should be subservient to these other values. [Cmt 1.009]

Response: The RFDS predicts the potential discovery of one new oil field. Based on the Upper Valley Field, production was estimated at 2,000 barrels per day. The production life was estimated at 30 years, with production at this level or a reduced level due to draw-down (**Appendix A**, page 20). See **Public Concern ID 1.02** response.

Public Concern ID 26.02
The estimate of one oil field per ranger district in the next 15 years does not appear to have a logical basis and can only be tested through drilling. [Cmt 5.001, 12.013]

Response: The RFDS predicted that only one new oil field would be discovered somewhere in the analysis area in the next 15 years, but it is not possible to determine exactly where it could occur. That can only be determined through actual exploration, as stated in the comment. Since there were no areas identified with zero potential, and our knowledge of geologic conditions which can lead to discoveries changes over time with testing and scientific/technological advancements, the ID Team analyzed each Ranger District as if there were some potential (even if low) for a discovery. The potential for a discovery is obviously higher in areas identified as having high potential, but other areas also have some potential greater than zero. The

RFDS did not exclude any areas from the possibility of exploration activities except Designated Wilderness Areas, National Park Service lands, and adjacent Grand Staircase Escalante National Monument lands. This approach was used to assure that the analysis for each area would be based on the possibility of activities and associated ground disturbance with the discovery and development of a field. It is also recognized in the cumulative effects analysis that there would most likely be one new oil field discovered.

Public Concern ID 26.03
More specific details concerning the impacts from a single oil field of typical size should be included. [Cmt 5.002]

Response: The details of a potential new field, including predicted facilities and the associated surface disturbances, are presented on pages 18-21 of **Appendix A**. The analysis of impacts was based on this information.

Public Concern ID 26.04
The rationale for the projection that post-lease production would last for 30 years is not given and appears inaccurate given the current production life of the Upper Valley Field. [Cmt 5.003]

Response: The production life was estimated based on the Upper Valley Field, considering current advanced technology (**Appendix A** page 18-20). The Upper Valley field was discovered in 1964 and uses older technology.

Public Concern ID 26.05
The lack of leasing on the Dixie National Forest has negatively impacted the oil and gas industry's ability to explore for oil and gas on the Dixie National Forest and, as a result, the RFDS is based upon conjecture. [Cmt 10.005]

Response: The RFDS was completed by the BLM considering current industry practices, lease nominations, and the most current information available from BLM records, the US Geological Survey, Utah Division of Oil, Gas and Mining, and Utah Geological Society regarding the geologic conditions present in the area, and past drilling and production activities in this and other areas with similar geologic conditions. As the title indicates ("reasonably foreseeable"), it is an estimate of potential post-lease oil and gas activities based on the best available data at the time it was completed.

Public Concern ID 26.06
If a major discovery occurs or is expected to occur on the Dixie National Forest, there is the potential for more seismic surveys to be conducted than currently estimated by the RFDS and discussed in the DEIS. [Cmt 12.012, 12.015, 12.017]

Response: See **Public Concern ID 26.05**. The RFDS is an estimate of possible activities based on current knowledge, including the potential discovery of a new field. Additional seismic surveys outside of the RFDS would be required to undergo site-specific analysis at the time specific activities are proposed, as stated in the Forest Service Manual (Part 2862.3 – Geophysical Activities).

Public Concern ID 26.07
Due to the high cost of helicopter supported seismic surveys, more buggy assisted surveys may occur than currently projected by the RFDS. [Cmt 12.014]

Response: The Forest Service has discretionary authority regarding seismic surveys on National Forest System lands and to specifically require reasonable mitigations to minimize effects to National Forest System lands and resources. Buggy-assisted surveys would only be allowed where they can be conducted without causing long-term damage to resources. Areas of concern include steep slopes, unstable soils, and other areas with sensitive resources. Overall, considering the rugged topography of the Forest, it is not likely that buggy-assisted surveys would be practical or permitted on more than half of the area surveyed.

Public Concern ID 26.08
The assertion that the northern 2/3rds of the Dixie National Forest has a low hydrocarbon potential may be inaccurate due to the presence of attractive hydrocarbon reservoir rocks and current industry interest. [Cmt 12.016, 12.018]

Response: See **Public Concern ID 26.02** and **26.05**.

Public Concern ID 26.09
There remain too many unknowns concerning the potential for oil and gas discoveries to accurately anticipate the level of oil and gas activity that may occur on the Dixie National Forest. [Cmt 12.019]

Response: See **Appendix A** for an explanation of how the RFD was developed. The RFD Scenario is a reasonable, technical and scientific estimate of anticipated oil and gas activity using the best information and data currently available. See **Public Concern ID 1.07.**

Public Concern ID 26.10
The DEIS should consider a longer time period than 15 years or provide a rationale for why a longer time period was not considered. [Cmt 5.004]

Response: A 15-year time period was used because it is considered by BLM to be a reasonable period of analysis for the preparation of Reasonable Foreseeable Development Scenarios for oil and gas activities. Considering potential rapid advancements in technology and increased knowledge of geologic conditions which could occur from the predicted post-lease exploration activities (within and adjacent to the project area), it is not reasonable to predict such activities very far into the future. BLM Instruction Memorandum 2004-089 states that "The period covered by the RFD report is usually 15 to 20 years or the planning timeframe for the Resource Management Plan (RMP). Because it is speculative to project oil and gas activity far into the future, the RFD is not expected to cover the entire lifespan of an area's development." In addition, the 15-year period coincides with the 15-year standard planning period used by the Forest Service.

7.4.27 Appendix C

Public Concern ID 28.01
Appendix C should be dynamic and subject to annual review and revision, and should incorporate cutting edge developments in oil and gas industry environmental protection, and should reflect lessons learned during adaptive management strategies on the Dixie National Forest. [Cmt 282.003]

Response: The Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements incorporated into the action alternative selected and will be

made part of the Decision. It can be modified by the Dixie National Forest to reflect cutting edge technologies and adapt to management changes.

Public Concern ID 28.02
Appendix C should be modified to include recommendations made by the National Park Service [listed in **Public Concern ID 22.23**] and consultation with the National Park Service in addition to Utah Division of Air Quality. [Cmt 283.004, 283.005]

Response: Appendix C in the FEIS was modified to include the NPS recommendations and consultation in Operating Standard 40(a).

Public Concern ID 28.03
There is no reason the USFS cannot standardize cost-effective methane control technologies and practices that reduce VOCs, such as Process Optimization Reviews, to ensure protection of air quality and climate. [Cmt 284.056]

Response: The purpose of this leasing action EIS was to determine the potential impacts of a theoretical development that may or may not result from the leasing decision. As a result, it would be premature to develop project specific, requirement based alternatives. These alternatives would best be developed once oil and gas development has been proposed. At that time, additional analyses (which are already stipulated in the **FEIS Appendix C**) would allow for accurate and targeted alternatives to be developed to minimize air impacts. Additionally, the USFS has been proactive in requiring that broad based emissions controls measures that can be enforced for all proposed developments have been included. Specifically, **Appendix C** of the **FEIS** details equipment requirements for on-site engines including both well pumps and drill rig engines.

Public Concern ID 28.04
The SIR does not propose to mitigate climate change impacts to watersheds or other National Forest resources. This is of great concern given the availability of a number of cost-effective options for reducing greenhouse gases, and we request that the USFS develop mitigation measures to reduce the harmful effects of climate change on Dixie National Forest resources, particularly watersheds. [Cmt 284.063, 284.064]

Response: In accordance with the requirements under NEPA, the USFS has developed an analysis to fully disclose the reasonably foreseeable impacts leasing decision. The analysis was designed to ensure that a conservative assessment was developed and that the results of such an assessment would help characterize total potential impacts. At the leasing stage it would be difficult to develop specific mitigation measures that would be appropriate for any proposed development scenario. As a result, such alternative and mitigation measures are best developed during project specific analyses which are required by the current language of **Appendix C** of the **FEIS**.

Additionally, given the current lack of regulatory limitations on greenhouse gases it is difficult to perform an assessment of alternatives that could result in legally enforceable lease stipulation.

7.4.28 Appendix D

Public Concern ID 29.01
The Dixie should develop a stipulation for sensitive trout restoration habitat similar to the stipulation for occupied sensitive trout habitat. [Cmt 7.004, 8.040]

Response: Under Alternative C, streams suitable for trout restoration (see **Public Concern ID 16.31** response) are covered by an NSO stipulation in the FEIS under "suitable habitat." Suitable habitats, as defined in the FEIS, are all areas currently identified by Conservation Teams, UDWR, and/or the Dixie National Forest as having the potential for reintroductions within the next ten years.

Public Concern ID 29.02
The Dixie should develop a 500-ft-buffer NSO stipulation (with no road crossings) for Blue Ribbon Fisheries similar to the stipulation for occupied trout habitat. [Cmt 7.022, 8.057]

Response: Alternative C contains a 500-foot NSO buffer for streams with "suitable habitat" for sensitive trout, and no road crossings would be allowed in suitable fisheries habitat under Alternative C. See **Public Concern ID 15.25** response regarding Blue Ribbon Fisheries.

Public Concern ID 29.03
The Dixie should develop different stipulations for occupied vs. unoccupied drainages. Specifically, a 500-ft-buffer NSO stipulation with no road crossings is appropriate for cutthroat-occupied streams or Blue Ribbon Fisheries, and a 500-ft-buffer NSO with limited road crossings is appropriate for streams that do not support or have the potential to support native trout or Blue Ribbon Fisheries. [Cmt 7.014, 8.049]

Response: In the FEIS, Alternative C contains a 500-foot NSO buffer with no road crossings for streams with both occupied and "suitable habitat" for sensitive trout. See **Public Concern ID 29.01** response for definition of suitable habitat. See **Public Concern ID 29.02** and **15.25** responses regarding Blue Ribbon Fisheries.

Public Concern ID 29.04
Under Alternative B, a 300-ft NL buffer around waterbodies and municipal watersheds is unnecessary because the same level of protection can be achieved through a 500-ft NSO buffer. [Cmt 7.015, 8.050]

Response: A 300-foot NL buffer around waterbodies and municipal watersheds was analyzed under Alternative B to assess potential impacts from on-lease seismic activities allowed under NSO.

Public Concern ID 29.05
CSU language for IRAs (Alternative D2) creates a loophole to allow surface disturbance into roadless areas, and needs to be modified. [Cmt 8.071]

Response: See response to **Public Concern ID 12.09**. Alternative D2 could not be selected unless the 2001 RACR is no longer in effect. If the 2001 RACR is upheld in federal court, the non-appropriate alternatives (Alternatives D2 and E2) would be dropped from consideration.

Public Concern ID 29.06
CSU language for Wild and Scenic Rivers is open to being challenged in court or skirted, and needs to be modified. [Cmt 12.030]

Response: See **Public Concern ID 13.05** response.

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8.1 List of References

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8.2 List of Acronyms & Abbreviations

AQRV	Air Quality-Related Values
AO	Approval Order (permit-to-construct)
APD	Application for Permit to Drill
AQI	Air Quality Index
ATV	All-Terrain Vehicle
BE	Biological Evaluation
B_{ext}	Beta Extinction
BLM	Bureau of Land Management
BMP	Best Management Practice
BACT	Best Available Control Technology
BCT	Bonneville Cutthroat Trout
BO	Biological Opinion
BOE	Barrels of Oil Equivalent
CAA	1970 Clean Air Act
CCFO	Cedar City Field Office
CEA	Cumulative Effects Area
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMAQ	Community Multi-Scale Air Quality
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide equivalent
COA	Conditions of Approval
CP	Colorado Plateau
CRCT	Colorado River Cutthroat Trout
CSU	Controlled Surface Use
CWCS	Comprehensive Wildlife Conservation Strategy
CWS	Community Water System
DBH	Diameter at Breast Height
DDW	Division of Drinking Water
DOI	Department of Interior (also USDI)
DVC	Design Values (Current)
DVF	Design Values (Future)
DWSPZ	Drinking Water Surface Protection Zone
EIS	Environmental Impact Statement
ENBB	Electronic Notification Bulletin Board
EPA	Environmental Protection Agency
FLAG	Federal Land [Managers'] Air Guidance
FLM	Federal Land Managers
FSH	Forest Service Handbook
FSM	Forest Service Manual
FY	Fiscal Year
GHG	Greenhouse Gases
GIS	Geographic Information System
HFRA	Healthy Forests Restoration Act
HUC	Hydrologic Unit Code
IM	Interagency Memorandum
IPAMS	Independent Petroleum Association of the Mountain States

IPCC	Intergovernmental Panel on Climate Change
IRA	Inventoried Roadless Area
LN	Lease Notice
MATS	Modeled Attainment Test Software
MIS	Management Indicator Species
MOU	Memorandum of Understanding
MTP	Motorized Travel Plan
NA	Not Available for Leasing
NAAQS	National Ambient Air quality Standards
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NL	No Lease
NOI	Notice of Intent (air permit application)
NO_x	oxides of nitrogen
NP	National Parks
NPS	National Park Service
NTNCWS	Non-Transient Non-Community Water System
NSO	No Surface Occupancy
NSPS	New Source Performance Standards
NWR	National Wildlife Refuge
O&G	Oil and Gas
O_3	ozone
OHV	Off-Highway Vehicle
OMRD	Open Motorized Road Density
PAC	Protected Activity Center
Pb	Lead
PCIF	Permanent Community Impact Fund
PFA	Post Fledgling Area
PILT	Payments in Lieu of Taxes
PM	Particulate matter (airborne)
PM_{10}	Particulate matter less than 10 microns in diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
PWS	Public Water System
RD	Ranger District
RFDS	Reasonable Foreseeable Development Scenario
RHR	Regional Haze Rule
RMP	Resource Management Plan
RNA	Research Natural Area
ROS	Recreation Opportunity Spectrum
ROW	Right-of-Way
SIO	Scenic Integrity Objective
SIP	State Implementation Plan (Utah)
SIR	Supplemental Information Report
SITLA	State of Utah Institutional Trust Lands Administration
SLT	Standard Lease Terms and conditions
SMP	Smoke Management Plan
SMS	Scenery Management System
SO_2	Sulfur Dioxide

SUPO	Surface Use Plan of Operations
TDS	Total Dissolved Solids
TEC	Threatened, Endangered, or Candidate
TES	Threatened, Endangered, and Sensitive
TESP	Threatened, Endangered, Sensitive, and Proposed
TL	Timing Limitation
Tpy	tons per year (air emissions)
TNCWS	Transient Non-Community Water System
UAA	Unmonitored Analysis Area
UBAQS	Uinta Basin Air Quality Study
UDAQ	Utah Division of Air Quality
UDEQ	Utah Department of Environmental Quality
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
$\mu g/m^3$	micrograms per meter cubed
UGS	Utah geological society
USDA	United States Department of Agriculture
USDI	United States Department of Interior (also DOI)
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VMS	Visual Management System
VOC	Volatile organic compounds
VQO	Visual Quality Objective
WA	Wilderness Areas
WRAP	Western Regional Air Partnership
WSA	Wilderness Study Area
WSR	Wild and Scenic River

8.3 Glossary

Acre-feet: The volume required to cover 1 acre to a depth of 1 foot, which is equivalent to 43,560 cubic feet.

Affected environment: The natural, physical, and human-related environment that is sensitive to changes from the alternatives.

Air quality: The composition of air with respect to quantities of pollution therein; used most frequently in connection with standards of maximum acceptable pollutant concentrations.

Allotment (grazing): An area designated for the use of a certain number and kind of livestock for a prescribed period of time according to an Allotment Management Plan.

Ambient: Surrounding, existing, background conditions.

Best Available Control Technology: A pollution control standard mandated by the Clean Air Act and determined by the Environmental Protection Agency for specific pollutants and limits.

Best Management Practices (BMPs): A practice or combination of practices that are the most effective and practical means of achieving resource protection objectives during resource management activities.

Big game: Those species of large mammals normally managed as a sport hunting resource.

Biological Assessment (BA): Information prepared by or under the direction of the federal agency concerning listed species that may be present in the action area and the evaluation of potential effects of the action on such species and habitats. The purpose of the biological assessment is to evaluate the potential effects of the action on listed or proposed species or designated or proposed critical habitat, and determine whether any such species and habitats are likely to be adversely affected by the action. Biological Assessments are conducted for major federal construction projects requiring an EIS.

Biological Evaluation (BE): A Forest Service document of activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Biological soil crust: A thin crust made up of mosses, lichens, algae, and bacteria, known collectively as cryptogams. Cryptogams function as soil builders, forming a spongy layer that helps protect soil from erosion, absorbs moisture, and provides nitrogen and other nutrients for plant growth. These soils or crusts are also referred to as cryptobiotic, cryptogamic, microbiotic, or microphytic.

Capability: The potential of an area of land to produce resources, supply goods and services, and allow resource uses. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices such as protection from insects and disease.

Cave: Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and large enough to permit a person to enter, whether the entrance is excavated or naturally-formed. Such term shall include any natural pit, sinkhole, or other opening that is an extension of a cave entrance or that is an integral part of the cave (36 CFR 290).

Cave resources: Any materials or substances occurring in caves including, but not limited to, biotic, cultural, mineralogic, geologic, hydrologic, and paleontological resources (36 CFR 290).

Code of Federal Regulations (CFR): A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the federal government.

Community: A group of one or more populations of plants and/or animals in a common spatial arrangement; an ecological term used in a broad sense to include groups of various sizes and degrees of integration.

Conifer: Any of a group of needle and cone bearing evergreen.

Conservation agreement: A requirement under section seven of the Endangered Species Act for federal agencies to consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service with regard to federal actions that may affect listed threatened and endangered species or critical habitat.

Corridor: A natural or restored pathway for a population of organisms to use in order to breed and/or remain contiguous.

Cover: The present vegetation and litter of an area.

Critical (Crucial) Habitat: Habitat that is present in minimum amounts and is a determining factor for population maintenance and growth.

Cultural resources: The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) having scientific, prehistoric, or social values.

Cultural site: Any location that includes prehistoric and/or historic evidence of human use, or that has important sociocultural value.

Cumulative effect: The impact on the environment that results from the incremental impact of the action when added to other actions over time and space. Individual impacts can either amplify or negate each other depending on the location, timing, and types of interactions involved. Individually minor but collectively significant actions can result from cumulative effects.

Cumulative effects area (CEA): An area with a mapable boundary where individual impacts can accumulate and result in cumulative effects. Cumulative effects areas are often different for each resource or plant and animal species, and often require consideration of more than one spatial temporal scale.

Developed recreation: Recreation that requires facilities and results in the concentrated use of an area (e.g., campgrounds or ski resorts).

Direct effects: Effects on the environment that occur at the same time and place as the initial cause of action.

Dispersed campsite: Temporary undeveloped campsites that are typically created and maintained by forest users. Existing temporary campsites can be distinguished by evidence of rock fire rings, old tent sites, and tracks from earlier vehicle accesses. On the Dixie National Forest, motorized vehicles are used to access most of these sites.

Dispersed recreation: Recreation that occurs outside a developed setting (e.g., hunting, scenic driving, or backpacking).

Disturbance: Any event that alters the structure, composition, or function of an ecosystem, including grazing, human trampling, logging, foraging by wildlife ungulates, wind, flood, insects, disease, and fire.

Diversity: The relative distribution and abundance of different plant and animal communities and species within an area.

Down woody debris: Dead woody material, such as limbs and large roots, on the ground or in streams.

Drinking Water Source Protection Zone: Areas delineated by the State of Utah to identify portions of watersheds (for surface water) or aquifers (for groundwater) that influence the quality of water used for culinary purposes.

Ecosystem: A naturally occurring, self-maintained system of varied living and non-living interacting parts that are organized into biophysical and human dimension components.

Effects: Environmental consequences (the scientific and analytical basis for comparison of alternatives) because of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable of cumulative.

Endangered species: "…[A]ny species which is in danger of extinction throughout all or a significant portion of its range…" which is designated by the Secretary of the Interior or the Secretary of Commerce (Endangered Species Act of 1973 Sec. 3(6)).

Environment: The aggregate of physical, biological, economic, and social factors affecting organisms in an area.

Environmental impact statement (EIS): A detailed statement prepared by the responsible official when a major federal action that significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and effects analyzed.

Erosion: Detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural, or geologic erosion, primarily because of the influence of activities of people, animals, or natural catastrophes.

Even-aged stand: A group of trees of a single age class.

Floodplain: The low and relatively flat areas adjacent to rivers and streams. A 100-year floodplain is that area subject to a 1 percent or greater chance of flooding in any given year.

Forage: Plant material (usually grasses, forbs, and brush) that is available for animal consumption.

Forest road or trail: A road or trail wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (36 CFR 212.1).

Fragmentation: The process by which aquatic or terrestrial habitats are increasingly subdivided into smaller units, resulting in their increased insularity as well as losses of total habitat area.

Geographic Information System (GIS): A computer software platform designed to facilitate the assembly and analysis of diverse data sets pertaining to specific geographic areas using spatial locations.

Habitat: The place where a plant or animal lives and grows.

Hibernacula: A place where bats or other animals hibernate during the winter to conserve energy.

Hydrologic Unit Code (HUC): The U. is divided and sub-divided into successively smaller hydrologic units, which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system (http://water.usgs.gov/GIS/huc.html).

Indirect effects: Secondary effects that occur in locations other than the location of the initial action or significantly later in time.

Interdisciplinary team: A group of resource professionals with different expertise that collaborates to develop and evaluate resource management decisions.

Intermittent stream: Stream that flows only part of the time or during part of the year; some segments of the stream may flow year-round.

Inventoried Roadless Area (IRA): Any area identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps.

Invasive plants: Nonnative aquatic and terrestrial species that have the capacity to dominate, overwhelm, and replace native vegetation. A species is considered invasive if it is nonnative to the ecosystem under consideration, and if its introduction causes or is likely to cause economic or environmental harm or harm to human health. Noxious weeds are a subset of invasive plants.

Irretrievable impact or commitment: The elimination of a resource, its productivity, and/or its utility for the life of the project.

Irreversible impact: The start of a chemical, biological, and/or physical process that could not be stopped. As a result, the resource or its productivity and/or its utility would be consumed, committed, or lost forever.

Landscape: The aspect of the land that is characteristic of a particular region or area.

Leasable minerals: Minerals subject to exploration and development under leases, permits, and licenses under various mineral leasing acts. Leasable minerals include oil, gas, coal, and geothermal resources. The Forest Service determines which lands are available for leasing and under what conditions, while the Bureau of Land Management (BLM) determines whether or not to offer the lease.

Lek: A specific location where male grouse congregate and strut to attract and breed with female grouse. Most male grouse return to the same lek every year.

Life history: Biological traits of an organism or population that form a strategy for persistence in a varied environment.

Locatable minerals: Minerals subject to appropriation under the General Mining Law of 1872. Locatable minerals include gold, silver, copper, gypsum, uranium, and other hard rock minerals. The BLM is responsible for subsurface rights, while the Forest Service is responsible for the surface rights. By agreement with the BLM, the Forest Service administers locatable mining activities on National Forest System lands.

Land and Resource Management Plan (LRMP): Document that established direction for future decisions of the use of lands and resources in the planning area to best meet human needs over time, according to the land and resource capabilities.

Macroinvertebrate: An invertebrate animal (an animal without a backbone) too small to be seen without magnification.

Management direction: A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Management Indicator Species (MIS): A species of wildlife, fish, or plant whose health and vigor are believed to accurately reflect the health and vigor of other species having similar habitat and protection needs to those of the selected indicator species.

Mitigation: Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

Monitoring: The process of collecting information to evaluate if objectives and anticipated results of a management action are being realized or if implementation is proceeding as planned.

National Ambient Air Quality Standards: Standards for maximum acceptable concentrations of pollutants in the ambient air to protect public health.

National Environmental Policy Act of 1969 (NEPA): An act mandating an environmental analysis and public disclosure of federal actions.

National Forest Management Act (NFMA): A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of regional and forest plans and the preparation of regulations to guide that development.

Nest area (for northern goshawk): The nest tree and stand(s) surrounding the nest that contain prey handling areas, perches, and roosts.

Off-highway vehicle (OHV)/off-road vehicle (ORV): Any motor vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain (36 CFR 212.1). Vehicle types include but are not limited to sport utility vehicles, jeeps, ATVs, mini-bikes, amphibious vehicles, over-snow vehicles, off-highway motorcycles, go-carts, motorized trail bikes, and dune buggies. Wheelchairs that are designed solely for use by a mobility-impaired person for travel are not included in this definition.

Operational Maintenance Level: The maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained (FSH 7709.58 Sec 12.3 – Transportation System Maintenance Handbook).

Perennial stream: A stream that flows throughout the year and from source to mouth.

Population: A community of individuals that share a common gene pool.

Post-fledgling Area (PFA) (for northern goshawk): An area of concentrated use by the goshawk family after the young leave the nest.

Prescribed fire: Any fire ignited by management actions to meet specified objectives.

Ranger District: An administrative subdivision of a national forest, supervised by a district ranger who reports to the forest supervisor.

Raptor: A bird of prey (e.g., eagles, hawks, falcons, and owls).

Record of Decision (ROD): A concise public document disclosing the decision made following preparation of an EIS and the rationale use to reach that decision.

Recreation Opportunity Spectrum (ROS): A framework for stratifying and defining classes of outdoor recreation based on environments, activities, and experience opportunities. The settings, activities, and opportunities for obtaining experiences are arranged along a continuum or spectrum divided into seven classes: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Roaded Modified, Rural, and Urban. The Dixie National Forest does not contain any Roaded Modified, Rural, or Urban ROS classes.

Recreation residence: A residence on National Forest System lands generally located in an established tract and built for recreation purposes with agency approval. These residences are authorized by special use permit.

Research Natural Area: "Research Natural Areas are part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. Research Natural Areas are principally for non-manipulative research, observation, and study. They also may assist in implementing provisions of special acts, such as the Endangered Species Act of 1973 and the monitoring provisions of the National Forest Management Act of 1976" (FSM 4063).

Right-of-way: An accurately located strip of land with defined width, beginning of point, and point of ending. It is the area within which the user has the authority to conduct operations approved or granted by the landowner in an authorizing document, such as a permit, easement, lease, license, or Memorandum of Understanding.

Riparian: Related to, living, or located in conjunction with a wetland, on the bank of a river or stream, or at the edge of a lake or tidewater.

Rock garden community: A localized herbaceous plant community occurring on unshaded rock outcrops in shallow soils.

Scoping: Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sediment: Any material carried in suspension by water that will ultimately settle to the bottom. Sediment has two main sources: from the channel area itself and from disturbed sites.

Sensitive species: Those species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population numbers or density, or habitat capability that would reduce a species' existing distribution.

Significant: As used in NEPA, requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Snag: A standing dead tree.

Species: A unit of classification of plants and animals consisting of the largest and most inclusive array of sexually reproducing and cross-fertilizing individuals, which share a common gene pool.

Stipulation (lease): Special provisions placed in mineral leases specifying requirements or restrictions for lease development. The Forest Service has authority to require the addition of stipulations in federal leases by the leasing agency for the protection of non-mineral interests on National Forest System lands.

Summer range: A range, usually at higher elevation, used by deer and elk during summer. A summer range is usually much more extensive than a winter range.

Threatened species: Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Unauthorized road or trail: A road or trail that is not a Forest System road or trail or a temporary road or trail and that is not included in a Forest Transportation Atlas (36 CFR 212.1). The term "unclassified" was used in some of the earlier project file documentation that predated the Travel Rule.

Ungulate: A hoofed mammal.

Water right: A water claim that has been put to beneficial use and has been perfected or decreed according to state law.

Watershed: Drainage basin for which surface water flows to a single point.

Wetland: Area inundated by surface water or groundwater with a frequency sufficient to support vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wilderness: As defined by the Wilderness Act of 1964, "an area where earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value" (16 USC 1131).

Wilderness area: An area designated by Congress as part of the National Wilderness Preservation System, according to the criteria established in the Wilderness Act of 1964.

Wildfire: An unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Wildland urban interface: The line, area, or zone where structures and other human developments meet or intermingle with undeveloped wildland or vegetative fuels.

Winter range: A range, usually at lower elevation, used by migratory animals such as deer and elk during the winter months; usually better defined and smaller than summer ranges.

Woodland: Forested areas largely composed of tree species such as pinyon, juniper, and oak. The term is used to distinguish these areas from forests of tree species normally favored for commercial timber harvest such as ponderosa pine, Engelmann spruce, and Douglas-fir.

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Appendix A – Reasonably Foreseeable Development Scenario

Reasonably Foreseeable Development Scenario for Oil and Gas

Dixie National Forest

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SUMMARY

A reasonably foreseeable development scenario for oil and natural gas is developed based on the assumption that all potentially productive areas can be open under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation or executive order. It covers a time period of 15 years[1] and includes all lands within the boundaries of the Dixie National Forest regardless of ownership and adjacent non forest lands where oil and gas activity may impact Forest lands.

Several oil and gas plays, mostly hypothetical, cover the area of interest but exploration of Forest lands has been minimal and results of activity on surrounding lands have been modest. The discovery of the Upper Valley Oil Field in 1964 in the southern part of the Escalante Ranger District stimulated exploration of other similar structures in the area and oil shows were encountered but no commercial production established. Several wells drilled later encountered carbon dioxide gas in Paleozoic and lower Mesozoic formations leading to the recognition of an area including a large part of the forest where oil and natural gas have been removed by carbon dioxide gas flushing. Uncertainties about source rocks, migration paths and timing have also negatively impacted exploration during the past 15 years.

Oil and gas occurrence potential in the northern half of the Cedar City, Powell and Escalante Ranger Districts is rated as low with a low degree of certainty. The southern part of the three districts is given a high potential rating for oil and gas occurrence with a low degree of certainty. A narrow zone near the center of the districts is given a moderate potential, based mostly on the possibility of natural gas in Cretaceous sandstones and coals, again with a low certainty rating. The entire Pine Valley Ranger District is given a moderate potential for occurrence with a low degree of certainty resulting from the hypothetical Upper Paleozoic Basin and Range Play.

The Pine Valley Ranger District and the northern half of the Cedar City, Powell and Escalante districts are given a low potential for development. The southern parts of the latter three districts have a high degree of potential for development and a thin zone near their centers have moderate development potential.

It is estimated here that 60 exploration wells will be drilled during the next 15 years possibly resulting in the discovery of one new oil field with 20 production wells. Total (gross) surface disturbance associated with the exploration and production drilling is estimated to affect approximately 1,673 acres. It is further estimated that seismic exploration will impact 422 acres resulting in a total disturbance of approximately 2,095 acres.

[1] From the approval date of the FEIS

1.0 INTRODUCTION

The recently signed Memorandum of Understanding (MOU) between the Bureau of Land Management (BLM) and the Forest Service (FS) states that BLM has sole responsibility to provide Reasonably Foreseeable Development Scenarios (RFD) for oil and gas leasing on NFS lands, if requested, and outlines what should be included in the RFD. The MOU further states that the RFD will follow the Interagency Reference Guide "Reasonably Foreseeable Development Scenarios and Cumulative Effects Analysis". Following this, the BLM Utah State Office is preparing a RFD for oil and gas for the Dixie National Forest (DNF).

The RFD will draw heavily from the report "*The Oil, Gas, Coalbed Gas, Carbon Dioxide, and Geothermal Resources of the Dixie National Forest, Southwestern Utah"* prepared by the Utah Geological Survey (UGS, 2003) but will include some additional resource information. It will be consistent with BLM Handbook 1624-1 and BLM Instructional Memorandum (IM) 2004-089 as well as the Interagency Reference Guide. IM 2004-089 requires that the RFD project a baseline scenario of activity assuming all potentially productive areas are open to leasing under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation or executive order. The RFD Scenario presented here is a reasonable, technical, and scientific estimate of anticipated oil and gas activity using the best information and data currently available. The baseline scenario will be adjusted according to each alternative developed in the planning process in order to determine cumulative impacts from oil and gas activity.

The area administered by the DNF consists of four separate Ranger Districts (RDs), Pine Valley, Cedar City, Powell and Escalante from west to east (Map 1). The baseline scenario will be for all lands, regardless of ownership, within each of the four RDs. a reasonable distance outside their boundaries where the cumulative effects of oil and gas activity may impact National Forest System (NFS) lands and for a period of 15 years[2]. The scenario presented later in this discussion (4 exploration wells/year with one new field with 20 production wells) is restricted to the area administered by DNF but it is possible that the new field would extend onto adjacent lands. Earlier estimates of activity on the DNF, BLM Kanab Field Office and counties including the DNF are given so that the reader can get a feel for historical activity levels in this part of Utah. The number of wells projected here is slightly higher than some of the other projections due, in part, to the assumptions stated in the Baseline Scenario section. The Forest Service will use this baseline scenario to develop alternatives so that cumulative effects of oil and gas leasing and subsequent activities may be analyzed on both National Forest and other lands within a reasonable distance from the National Forest.

[2] From the approval date of the FEIS

2.0 DESCRIPTION OF GEOLOGY

The Utah Geological Survey report referenced above gives a detailed description of the general geology of the DNF and surrounding area. A brief summary is given here and the interested reader is referred to the referenced UGS (2003) report, Stokes (1987) and Hintze (1988) for a more detailed discussion of geological relationships.

Most of the DNF lies within the Basin and Range/Colorado Plateau Transition Zone Physiographic Province but the eastern part of the Escalante RD extends into the Colorado Plateau proper. Elevations are generally greater than 6000 feet and include the Pine Valley Mountains and the Kolob-Markagunt, Sevier-Paunsagunt and Aquarius-Kaiparowits Plateaus (UGS, 2003). The intervening valleys separating the RDs consist of BLM, private and State of Utah lands.

2.1 Stratigraphy, Source Rocks and Reservoirs

Figure 1 shows the general stratigraphy in the area of interest. Much of southern Utah is underlain by Early Proterozoic metamorphic rocks which are in turn overlain by Late Proterozoic sedimentary rocks (not shown in figure 1). A typical Cambrian sequence of basal sandstone, shale and carbonate rocks overlie the Late Proterozic rocks. The Late Proterozoic rocks probably underlie the Escalante RD (UGS, 2003) and may contain petroleum source rocks. A major unconformity separates Cambrian and Devonian age rocks with Ordivician and Silurian rocks being absent within the DNF. Middle and Late Devonian rocks present throughout most of the area were deposited in a shallow marine environment near a fluctuating shoreline and consist of carbonate rocks, shales and sandstones.

Marine conditions existed in the DNF area during the Mississippian Period when the Redwall Limestone was deposited. This limestone and dolomitized limestone unit thickens from about 700 feet on the east side of the forest to 1,200 feet at the west side. It has good reservoir characteristics in some areas and has been a major producer of oil and gas at the Lisbon Field in northern San Juan County, Utah. Organic-rich and phosphatic units of Mississippian age in western Utah and eastern Nevada have been recognized as promising petroleum source rocks (Sandberg and Gutschick, 1984). During late Mississippian time, the sea retreated and a regolith of reddish soils formed on the exposed limestone. Early Pennsylvanian seas transgressed the area resulting in a significant unconformity separating the upper Mississippian regolith and lower Pennsylvanian shallow marine sediments. Later, the marine Callville Limestone was deposited in the western part of the DNF area while the eastern half was on the margin of the Paradox Basin where interbedded carbonate and sand deposition produced the Hermosa Formation. Both of these units may contain viable reservoir beds. The

entire DNF area was exposed to erosion during latest Pennsylvanian time. As a result of the repeated transgressions and regressions, rocks of Pennsylvanian age show considerable variations in thickness ranging from 400 to 800 feet. Crustal instability continued throughout the Permian Period producing a series of eastward marine transgressions and subsequent withdrawals across the area of interest resulting in numerous east- west facies changes. The oldest Permian rocks (Pakoon Dolomite and Halgaito Shale) were deposited in a marine and marginal marine environment respectively and are overlain by an alternating sequence of continental and marine sandstones. The marine Kaibab Limestone is the youngest Permian unit in the area and has been a prolific oil producer at the Upper Valley Field in Garfield County.

Figure 1 Stratigraphic columns at SW and NE corners of DNF.

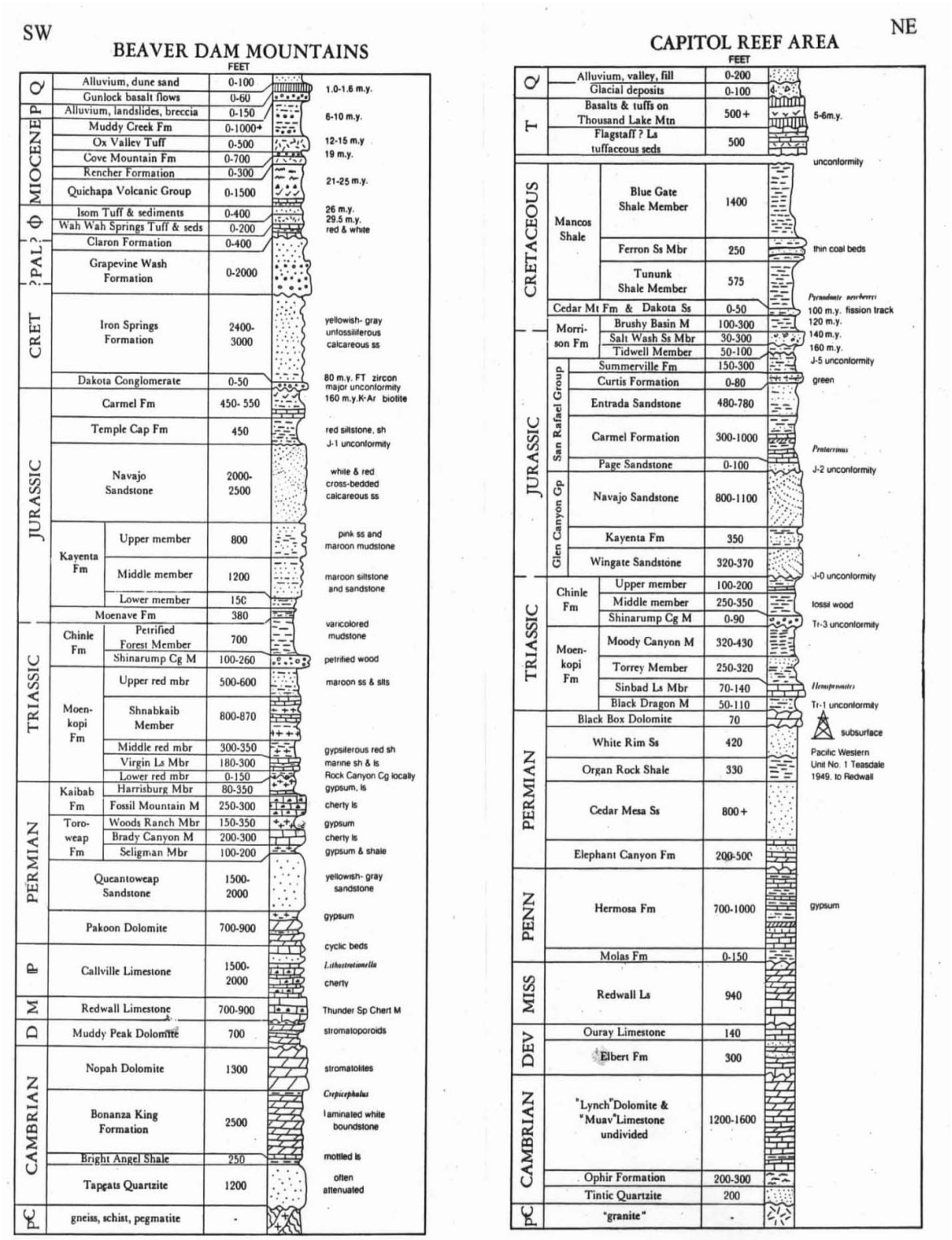


Figure 1. Stratigraphic Columns at SW and NE corners of DNF. Hintze, 1988.

The Kaibab Limestone is unconformably overlain by the Moenkopi Formation of Triassic age which consists of as many as six members in south central Utah including limestone and generally red siltstone and fine-grained ripple-marked sandstone. The clastic units represent fluvial material deposited in a flood plain to tidal-flat environment. The Moenkopi thickens to the west and becomes more marine in character. Hydrocarbons have been produced from Moenkopi reservoirs in the Virgin, Upper Valley and Grassy Trail fields. A major unconformity separates the Moenkopi from the Late Triassic Chinle Formation which consists of continental red-bed deposits with channel sandstones. The lower part of the Chinle is named the Shinarump Member and represents discontinuous channel deposits cut into the upper part of the Moenkopi. It possesses good reservoir characteristics in some areas. The upper, Petrified Forest Member contains colorful mudstones and muddy sandstones of continental origin. A period of Late Triassic/Early Jurassic erosion separates Chinle and Jurassic units. The thick (1,200 to 5,500 feet) Jurassic section includes, in ascending order, the Wingate-Moenave, Kayenta, Navajo, Temple Cap, Carmel, Entrada, Summerville-Curtis and Morrison formations but all units may not be present at a given location and they vary considerably in thickness. Several of the units are eolian sandstones (Wingate, Navajo and Entrada) exhibiting spectacular cross-bedding at certain locations and formed in arid coastal environments. The Carmel, Curtis and Summerville formations, where present, represent shallow marine deposition. Wolverine Gas and Oil's discovery of oil in the Navajo Sandstone at the Covenant Field near Sigurd in 2004 sparked a revival of leasing and exploration activity in the surrounding area and discoveries of gas in the Wingate and Entrada formations at Flat Rock and Peter's Point fields have increased interest in the Jurassic eolian sandstones as exploration targets. The late Jurassic Morrison Formation, a producer in northern Grand County, is separated from the underlying Curtis and Summerville formations by an unconformity.

Rocks of Cretaceous age in southern Utah were deposited in a basin separated from the familiar northern basin and generally have a different nomenclature. Sedimentation in the southern basin, as in the northern basin, was strongly affected by transgressions and regressions of the Cretaceous seaway and is characterized be east-west facies changes. The oldest Cretaceous unit is the Cedar Mountain Formation which consists of a basal conglomerate overlain by a series of channel sandstones, overbank mudstones and terrestrial carbonate deposits. The Cedar Mountain Formation is generally uncomformably overlain by the Dakota Sandstone but is missing in some areas so that the Dakota directly overlies Jurassic rocks. The Dakota Sandstone represents sedimentation near the northwestward transgressing shoreline of the Cretaceous sea and contains coal deposits in some areas. The Tropic Shale underlies most of the DNF becoming thicker toward the southeast and represents the full incursion of the Cretaceous Western Interior Seaway into eastern Utah. The Tropic Shale is absent in the western part of the DNF and the Iron Springs Formation directly overlies the Dakota Sandstone. Facies changes toward the east cause the Iron

Springs Formation to be replaced by the Straight Cliffs, Wahweap and Kaiparowits Formations, in ascending order. Coal beds occur in the John Henry Member of the Straight Cliffs Formation.

Upper Cretaceous rocks are unconformably overlain by the Paleocene-Eocene Claron Formation which consists of colorful fluvial and lacustrine deposits. This unit is over 3,000 feet thick near the southern boundary of the DNF and thins toward the north. Oligocene and lower Miocene felsic and intermediate volcanic units cap the Tertiary section in much of the area. The presence of volcanic rocks probably has had little affect on exploration interest in the area as productive reservoirs underneath volcanic rocks are relatively common but if it is discovered that igneous activity also included the formation of large intrusive bodies the accompanying heat may have "cooked" and destroyed any existing hydrocarbons. The physical properties of the volcanic rocks must be known to obtain useful seismic data. Quaternary alluvial deposits and local basalt flows represent the youngest rocks in the forest.

2.2 Structure

The DNF area is generally characterized by gently warped strata cut in places by north-south trending high angle faults resulting in a series of relatively high plateaus: Aquarius-Kaiparowits, Sevier-Paunsagunt and Kolob-Markagunt, from west to east. Structural complexity increases toward the west where Mesozoic thrust faulting and Cenozoic extensional faulting become more significant. Finer structural details are obscured in many areas by Oligocene and Miocene volcanic deposits.

2.3 Summary of Oil and Gas Plays

Several oil and gas plays described by the U. S. Geological Survey (USGS) or the Utah Geological Survey (UGS) extend into the DNF area and are listed below.

USGS 1995 National Assessment Plays:

2106- Permo-Triassic Unconformity Play.
1902- Late Paleozoic Play (hypothetical).
2403- Late Proterozic and Cambrian Play (hypothetical)

UGS 2003 Plays:

2100- Cretaceous Coalbed Gas Plays.
2107- Cretaceous Sandstone Play*
2108- Paleozoic Devonian through Pennsylvanian Play.
* This play is an extension of the USGS (1995) Upper Cretaceous Conventional

Play in the Uinta-Piceance Province.

2.3.1 USGS PLAYS (1995)

The plays defined by USGS (1995) in the DNF and surrounding area are shown in Map 2. The Late Proterozic and Cambrian Play (2403) is a hypothetical play based on the discovery of shales rich in organic carbon in the Late Proterozic Chuar Group in the Grand Canyon. These potential source rocks extend into the subsurface of southern Utah and the play, as defined, covers the Escalante, Powell and extreme southeastern portion of the Cedar City RDs. Potential reservoirs are siltstones within the Chuar group, basal Cambrian sandstones and possibly other Paleozoic units. Tests of these units in the Circle Cliffs and Kaiparowits Basin encountered carbon dioxide gas but no hydrocarbons. The hypothetical Late Paleozoic Play (1902) includes only the Pine Valley RD. It is based on the possibility of reservoirs, traps and seals in upper Paleozoic units in western Utah where sparse exploration drilling has not produced promising results to date.

The Permo-Triassic Unconformity Play (2106) is so named because all known accumulations, shows and oil staining are associated with this unconformity, either above or below. The play covers a large area including the Escalante, Powell and Cedar City RDs. Several potential source rocks of Precambrian and Paleozoic age have been recognized but no single one has been positively identified with this play and reservoirs include the Kaibab Limestone (Permian) and the Timpoweap member of the Triassic Moenkopi Formation. The discovery of the Upper Valley field in Garfield County in 1964 stimulated a period of exploration in the area which yielded numerous oil shows but no other commercial production. Several wells drilled in the 1980s in and near the DNF encountered carbon dioxide gas in reservoirs above and below the unconformity but no hydrocarbons.

2.3.2 UGS PLAYS (2003)

Utah Geological Survey Play 2108 (Paleozoic Devonian-Pennsylvanian Play) is based on oil shows and small amounts of production from mid Paleozoic reservoirs (primarily the Redwall and Callville limestones). The play is subdivided into an oil and a gas portion and a carbon dioxide portion with most of the DNF included in the latter. Only the extreme southern and eastern parts of the forest are within the oil and gas portion of the play (UGS, 2003, figure 1.7).

The Cretaceous Sandstone Play is an extension of USGS Play 2107 in the Uinta-Piceance Province as it relates to similar units deposited in the southern Cretaceous Basin and includes the southern parts of the Cedar City, Powell and Escalante RDs. Potential source rocks are coal and carbonaceous shale that intertongue with the sandstones.

Sandstone reservoirs may be present in the Straight Cliffs, Dakota, Cedar Mountain and Morrison formations. The UGS Cretaceous Coalbed Gas Plays (2100) is based on potential coalbed sources and reservoirs in the Dakota and

Straight Cliffs formations and includes the southern parts of the Cedar City, Powell (Dakota) and Escalante (Straight Cliffs) RDs.

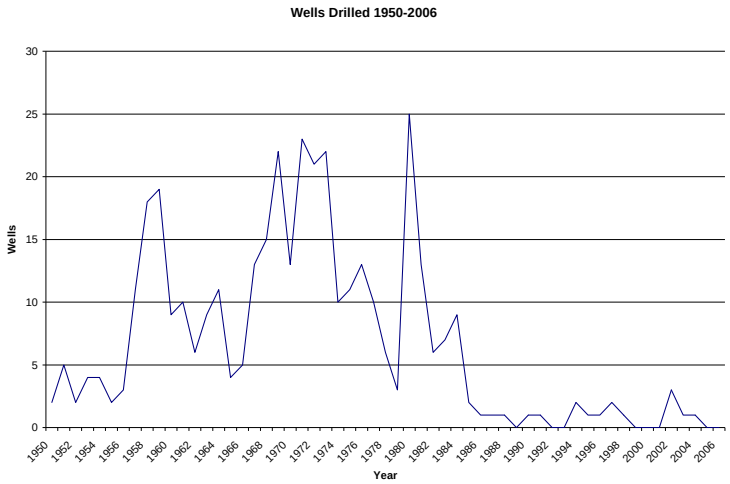
As noted above UGS (2003) subdivided their play 2108 into a hydrocarbon portion and a carbon dioxide portion. They similarly show the same carbon dioxide area, which includes a large part of DNF, within USGS (1995) plays 2106 and 2403. This is based on the existence of several wells in the central and southern part of the state that encountered carbon dioxide gas in Paleozoic and lower Mesozoic reservoirs and is usually attributed to flushing of oil and gas by carbon dioxide gas generated by volcanic heating of carbonate rocks during the Tertiary (anonymous, 1984). At this point, too few wells have been drilled in this large area to definitively show which areas have been flushed and how efficient the flushing process has been.

3.0 PAST AND PRESENT OIL AND GAS EXPLORATION ACTIVITY

BLM file maps indicate that numerous seismic surveys have been conducted on the Cedar City, Powell and Escalante RDs and especially on BLM, private and State of Utah lands that separate the RDs. The maps show fewer surveys in the Pine Valley RD. No data are available as to when the surveys were conducted but it is thought that they were done in the 1970s and 1980s.

UGS (2003) reported that 62 wells were drilled in the DNF between 1947 and 1986 with one field (Upper Valley) discovered in 1964. A search of BLM oil and gas lease records produced the result that 14 leases containing 18,116.3 acres currently exist in the DNF however several of the leases near the forest boundary also include adjacent BLM lands so the actual forest acreage is 12871.43 These are old leases that were issued before 1987 after which single leases were not issued with mixed Federal ownership. No leases have been issued in the forest in the last 20 years which has probably reduced the number of exploratory wells that would have otherwise been drilled. Topography, absence of infrastructure and distance to markets have also negatively impacted exploration activity.
Drilling data for the counties where DNF lands are located (Iron, Washington, Garfield, Wayne and Kane) indicates that 385 wells were drilled between 1950 and 2006 (IHS Energy, 2006) but this number includes 47 development wells in the Virgin Field and 50 development wells in the Upper Valley Field. This indicates that approximately 288 exploration wells were drilled between 1950 and 2006 resulting in two field discoveries (Upper Valley and Anderson Junction) for a success rate of 0.7 percent. Figure 2 shows drilling activity in the 5 counties during the period 1950-2006. When all 385 wells are considered a drilling rate of 6.9wells/year is derived. If 97 development wells at Upper Valley and Virgin fields are excluded the number of exploration wells/year equals five.

Figure 2 Wells drilled each year between 1950 and 2006. IHS Energy data.



Phillips Petroleum Company drilled two wells on the Escalante Anticline in 1960 and 1961which reportedly encountered carbon dioxide gas. In 1975 the Shell Oil Company Harvey-Federal (10-32S-1E), approximately 12 miles to the northwest, encountered carbon dioxide gas in the Shinarump Member of the Chinle Formation. Midcontinent Oil and Gas Company drilled the Charger 1, 2 and 4 wells near the Phillips wells on the Escalante Anticline and reported large volumes of carbon dioxide gas in several Permian and Triassic age formations. No hydrocarbons were found in any of these wells.

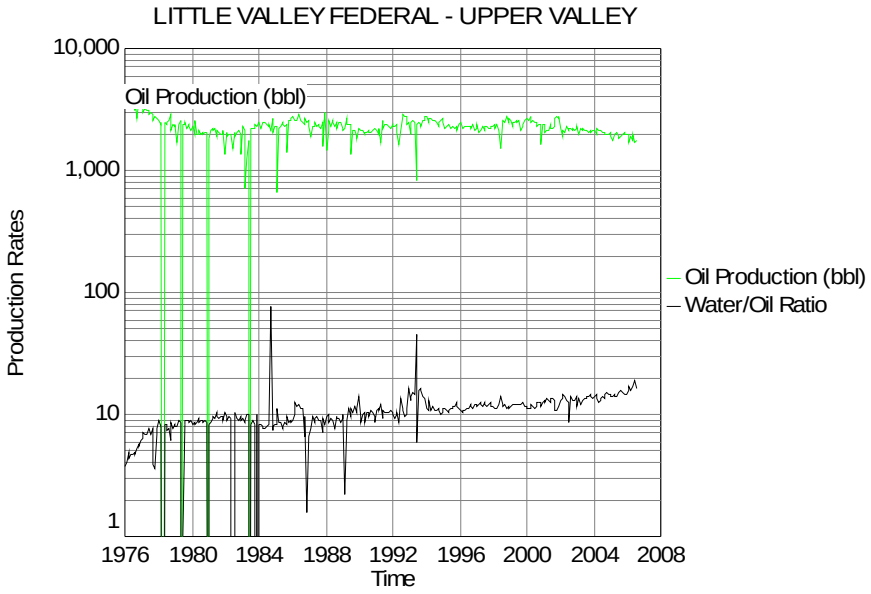
The Upper Valley Oil Field, located along the southeastern boundary of the Escalante RD, was discovered in 1964 with the Tenneco Oil Company Unit No. 2 well in section 13, T. 36 S., R. 1 E. (Allin,1993). Most of the subsequent production has been from the Kaibab Limestone but the Timpoweap Member of the Moenkopi has also contributed oil. The field is unusual in that the oil column is offset onto the western flank of the Upper Valley Anticline by a strong hydrodynamic drive. According to Utah Division of Oil, Gas and Mining Production data (June, 2006) the field had produced 27,219,013 barrels of oil (BO), 61,623 thousand cubic feet of gas (MCFG) and 451,757,376 barrels of water (BW) and is still producing.

More recently in 2002, Legend Energy of Utah drilled 3 wells on private lands near the southern tip of the Cedar City and Powell RDs to test coals in the Dakota Sandstone. All three wells encountered coal at depths ranging from 1200 feet to 4640 feet and gas shows were reported in cores from one of the wells (IHS Energy Well Data) but all three wells were plugged.

4.0 PAST AND PRESENT OIL AND GAS DEVELOPMENT ACTIVITY

The Upper Valley Oil Field, in the southeastern corner of the Escalante RD, represents the only development activity in the DNF. The field was discovered by Tenneco Oil Company in 1964 when the Unit No. 2 well was completed with an initial production rate of 300 barrels of oil per day (BOPD) with no water. IHS Energy's well histories database lists 52 wells for the field including producing oil wells, plugged and abandoned wells and secondary recovery injection wells. The north-northwest trending elongate elliptical productive area is approximately 8 miles by 3 miles and the average distance between wells is about 0.3 miles. A peripheral, updip water injection pressure maintenance program was initiated in 1969 and was later replaced by a tertiary polymer flood (Allin, 1993). The field has produced very little gas and, according to Allin (1993), oil API gravity ranges from 18.5 to 27 degrees. Figure 3 shows the production history for the Little Valley Number 1 well (SWSE of section 18, T. 37 S., R. 2 E.) as representative of the field. The long term stable production rate and water/oil ratio should be noted. After oil is separated from produced water a ten-mile long pipeline carries oil off-lease to a transfer site adjacent to Highway 12 about eight miles east of Henrieville. From there the oil is trucked to markets in Salt Lake City. Water is reinjected and surface impacts related to these activities are discussed in the section considering surface disturbance.

Figure 3. Little Valley No. 1 well production history (IHS Energy, September, 2006).



Two abandoned oil fields, the Virgin Field and Anderson Junction Field, were located in Washington County a short distance southeast of the Pine Valley RD. The Virgin Field was discovered in 1907 and was the first discovery in the state. Production was from the Timpoweap Member of the Moenkopi Formation (USGS Permo-Triassic Unconformity Play; 2106) which was encountered at depths of less than 1000 feet in the field. According to Heylmun (1993) the oil collected in synclinal pockets and structural terraces on the east flank of a broad northeast plunging structural nose, under the influence of gravity. Several hundred wells were drilled in the field and Heylmun (1993) stated that reported cumulative production exceeded 200,000 barrels of oil but noted that the figure is suspect. The abandoned Anderson Junction Field was located 6 miles northwest of the Virgin Field and was discovered in 1968. Harris (1993) reported that 2 producing wells and 3 dry holes were drilled in the field. Production was from the Callville Limestone of Pennsylvanian age (UGS Paleozoic Devonian through Pennsylvanian Play; 2108) was reported as 2,733 BO, 16,388 MCFG and 3,744 BW (Harris, 1993).

5.0 OIL AND GAS OCCURRENCE POTENTIAL

An oil and gas RFD prepared by the Utah Geological Survey (UGS, 2006) for the BLM Kanab Field Office included the Escalante, Powell and the southeastern half of the Cedar City RDs. These areas were rated as having moderate or high potential for oil and gas occurrence for all of the identified plays although the northern parts of the RDs are shown as carbon dioxide gas areas. This is based on several wells in the area that tested carbon dioxide and the theory that carbon dioxide gas was generated by Tertiary age igneous activity and flushed oil from the area (anonymous, 1984). USGS plays 2403 and 2106 cover the Powell, Cedar City, and Escalante RDs as does UGS play 2108. UGS (2006) maps indicated that the northern two thirds of the four RDs had oil removed by flushing and pore fluids in these areas are likely to be carbon dioxide gas. Potential gas-bearing reservoirs exist in the Cretaceous sandstones and coal beds that underlie the southern parts of the Escalante, Powell and Cedar City RDs (UGS play 2100 and extension of USGS play 2107). Only one identified play covers the Pine Valley RD; the hypothetical USGS Basin and Range Play 1902 (Late Paleozoic).

BLM Handbook 1624-1 recommended that all areas within USGS or other defined plays should be given a high potential rating for oil and gas occurrence. The only play among those considered here with significant production is USGS Play 2106, Permo-Triassic Unconformity Play and the production has all been from the Upper Valley Field. Minor production has been reported from UGS Play 2108 (Paleozoic Devonian-Pennsylvanian Play) at the Upper Valley Field (UGS, 2003, p.23) and at the abandoned Anderson Junction Field (Harris, 1993). All of the Paleozoic and lower Mesozoic plays have been affected by carbon dioxide gas flushing in the area of the DNF (Anonymous, 1984; UGS, 2003 and 2006) but the extent and paths of flushing are poorly constrained. The Cretaceous Sandstone Play (UGS 2107) was defined in the northern Cretaceous Basin and is hypothetical in the DNF area as no production has occurred in the southern basin. Similar reasoning can be applied to the Cretaceous Coalbed Gas Plays (UGS 2100) even though coal is known to occur in the Straight Cliffs and Dakota formations.

When the above factors are considered along with the small number of existing leases, few recent seismic surveys, and limited exploratory drilling it becomes difficult to define meaningful occurrence potential for the various RDs. Map 3 is an attempt. The Pine Valley RD is included in only the hypothetical USGS Late Paleozoic Play (1902) which covers western Utah and eastern Nevada. The geology in the play is complex and the area lightly explored. Consequently the oil and gas occurrence potential is rated as only moderate with a low degree of certainty (M/B). The northern portions of all the other RDs are given low oil and gas occurrence potential rating with a low degree of certainty (L/B) based on evidence that oil and natural gas have been flushed from potential Paleozoic and lower Mesozoic reservoirs in this area by carbon dioxide gas. Several wells

within this area have encountered significant amounts of the gas but no hydocarbons. The configuration of the flushed area is poorly constrained because of the small amount of drilling that has occurred and the outline in map 3 is adapted from maps in UGS (2003 and 2006). A narrow strip crossing the Cedar City, Powell and Escalante RDs is given a moderate rating with low degree of certainty (M/B) based on the potential for gas in Cretaceous sandstones and coal in this area. The remainder of the DNF is rated as having high potential for oil and gas occurrence with a moderate certainty (H/C) based on the existence of overlapping Paleozoic and Mesozoic plays in these areas.

6.0 OIL AND GAS DEVELOPMENT POTENTIAL

Two recent studies have addressed potential oil and gas development within the Dixie National Forest and some surrounding areas (UGS, 2003 and 2006). Several factors have combined to discourage past development activity in this part of the state. The area's remoteness, rugged topography and lack of infrastructure have made oil and gas exploration both difficult and expensive so that detailed geological information is generally lacking. No oil and gas leases have been issued in the past 20 years in the DNF, although leases covered about 75 percent of the forest in 1986. Currently only 12,871.43 acres are under lease after most leases terminated when no activity occurred on them during their 10 year term. Map 4 shows the locations of existing oil and gas leases on BLM lands near the DNF. The large group of leases northwest of the Cedar City RD probably results from the discovery of the Covenant Field to the northeast and may have only minor significance relative to leasing interest within the DNF itself. Lands in the Cedar City, Powell and western Escalante RDs have been nominated for inclusion in BLM competitive lease sales during 2005 and 2006 (Map 5) and indicate industry interest in these areas.

Proven oil reserves are known only at the Upper Valley Field where no additional development is anticipated although production from existing wells will continue in the near future. Any other oil and gas development will depend, in large part, on the results of whatever exploration activity the DNF permits in the future. Map 6 shows the estimated development potential of the DNF and surrounding area based on occurrence potential estimates and consideration of topography, infrastructure, potential markets, past activity, industry interest and other relevant factors.

7.0 RFD BASELINE SCERARIO ASSUMPTIONS AND DISCUSSION

BLM Interim Memorandum 2004-089 provided guidance relative to what a RFD scenario for oil and gas should be. The initial assumption is that **all potentially productive areas can be open under standard lease terms and conditions except those areas designated as closed to leasing by law, regulation or executive order.** Following this assumption several large areas within the DNF would be excluded from the RFD: Pine Valley Mountain, Ashdown Gorge and Box-Death Hollow wilderness areas, and Cedar Breaks National Monument. Significant areas contiguous to the DNF that are designated closed to oil and leasing are Bryce Canyon National Park and the Escalante-Grand Staircase National Monument. Other factors that may negatively impact future drilling such as remoteness, topography, etc. have been discussed in above sections.

UGS (2003) estimated that 30 new wells will be drilled in the DNF during the next 15 years (equal to 2 wells/year) with the Permo-Triassic Unconformity Play (2106) representing the favored target. UGS (2006) later projected 55 new exploration wells (3.7/year) would be drilled within the BLM Kanab Field Office which includes much of the eastern DNF and other lands to the south. They also project one small field with 20 production wells resulting in a total of 75 wells (5/year). The same plays cover much of the two areas and Play 2106 is again projected to be the major target although a single well can test reservoirs associated with multiple overlapping plays. Historical drilling rates for the five county area that includes the DNF were discussed in the sections on past and present exploration and production activity. Table 1 summarizes these data.

Table 1. Past and projected future drilling rates for DNF and surrounding area. Data areFrom IHS Energy and UGS 2003 and 2006.

Five county 1950-2006 drilling rate (exploration wells):	5/year
Five county 1950-2006 drilling rate (all wells):	7/year
Dixie N F 1947-2003 drilling rate (all wells)	1/year
Dixie N F projected rate (exploration wells):	2/year
BLM Kanab F O projected rate (exploration wells):	3.7/year
BLM Kanab F O projected rate (all wells):	5/year

No leases have been issued in the DNF in recent years, which accounts in part for the low drilling rate (1/year). When surrounding non-forest areas are considered along with the DNF rates are considerably higher but still low relative to other areas of the state. Several factors have contributed to the low rate including remoteness of the area, lack of infrastructure, distance to markets and rugged topography in some areas. Geological factors, such as low drilling success rate, complex geology, poorly defined plays and uncertainties about source rocks, migration paths and carbon dioxide flushing have also contributed.

It is projected here that an average of 4 exploration wells/year will be drilled in the National Forest and adjacent areas, or 60 total wells during the 15 years covered by this RFD. It should be stressed that this is a hypothetical forecast based on the assumption that all potentially productive areas would be open to leasing under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation or executive order. The 60 wells projected here are similar in number to the 55 projected for the BLM Kanab Field Office (UGS, 2005), which includes the southeastern portion of the DNF and other lands to the south and east, during the same time period. It is possible that this exploration will lead to the discovery of one new oil field with 20 development wells. The field would most likely be discovered within the area of high development potential (Map 6), but it is also possible for the discovery to be made in areas of moderate or low development potential.

The following section will estimate surface disturbance resulting from the exploration and production activity based on reasonable assumptions as to how the seismic exploration, exploratory drilling, development drilling and construction of production facilities will proceed.

8.0 SURFACE DISTURBANCE DUE TO OIL AND GAS ACTIVITY ON ALL LANDS

8.1 SEISMIC EXPLORATION

Any future major exploration activity in the DNF and surrounding area will likely begin with seismic surveys of some type. The purpose in conducting these surveys is to determine the configuration of subsurface rock layers as an aid in locating structures that can trap hydrocarbons. This is accomplished by generating seismic waves at or near the earth's surface which then penetrate the subsurface rocks. Some of the seismic energy is reflected back to the surface by "reflector" beds and returned to the surface where it is recorded by instruments called geophones. The time required for seismic energy to travel downward to a given reflector bed, and then back to the surface (two way travel time) combined with physical properties of subsurface rocks permits calculation of the depth of the reflector beds. Mapping the determined depths over the area of interest depicts the configuration of the subsurface beds.

Seismic energy used in seismic surveys is usually generated in one of two ways: high frequency vibrations (Vibroseis method) or explosions. Vibroseis utilizes large trucks with vibrator pads which can be lowered to the ground and thus induce energy into the subsurface. The Vibroseis method is usually only used along existing roads on National Forest System lands.

The explosion method involves drilling shallow small-diameter shot holes, placing an explosive charge in the hole and covering it. The charge is detonated to generate seismic energy for the survey. Drill rigs mounted on trucks are used to drill the holes in areas with roads or trails but portable rigs may be transported by helicopter in rugged terrains or areas of environmental concern. Off-road buggies mounted with drill rigs are being increasingly used where possible as they are less expensive than helicopters.

UGS (2003) estimated that 700 line miles of seismic data will be acquired during the next 15 years and that half the data would be obtained using buggy-mounted drill rigs and half by using helicopter-portable equipment. Based on other recent surveys in the state UGS estimated that buggy mounted acquisition usually disturbs 1.2 acres/mile whereas helicopter surveys disturb 0.007 acres/mile. **Total surface disturbance** from seismic surveys is then equal to **422.5** acres (350 x 1.2+ 350 x 0.007). If the ratio of buggy/helicopter is greater than 1:1, the number of acres disturbed obviously will increase.

8.2 EXPLORATION DRILLING

This RFD projected that 60 exploration wells will be drilled during the next 15 years (assuming that all potentially productive areas are open under standard

lease terms and conditions except those areas designated as closed to leasing by law, regulation or executive order). The two major sources of surface disturbance resulting from exploratory drilling are drill pad construction and access road construction.

Drill Pads

Drill pads vary in size depending on topography, depth of well (rig size), duration of drilling and possibly other factors and are usually between 2.5 and 5 acres in area. Drilling pads in the Uinta Basin are usually between 3.7 and 5 acres, including roads which would be a small part of the disturbance there (McKee, 2006). Pads constructed on National Forests would probably tend to be larger than those in the Uinta Basin because the factors listed above would all tend toward larger pads. Another factor is the recent trend of using larger drill rigs and employing directional drilling to minimize new road construction in rugged topography or sensitive areas. A drill pad disturbance area of 5.9 acres is assumed here (Dixie NF O&G Engineering Report, 2007). This estimate assumes the high-end pad dimensions of 425 feet by 350 feet with additional disturbance for topsoil storage, drainage diversions, and vegetation clearing.

Pad Access Roads

New roads would be necessary to access the pads from existing National Forest System roads and other highways. It is likely that access roads would be longer on forest lands than on BLM lands because National Forests are often more remote, have more rugged topography and drill sites may be occupied for greater lengths of time requiring more supply storage space. The following parameters were used to calculate the amount of surface disturbance resulting from road construction for each well (Dixie NF O&G Engineering Report, 2007). A GIS-based analysis was used to determine the average straight line distance of all potential pad locations on the Forest from an existing National Forest System road or other highway. This average distance was adjusted to account for topography and road grade.

Average adjusted road length	0.66 miles
Width of area disturbed for road	39 feet
Curve widening etc., factor	1.25
Topsoil storage	0.25 acres/mile

Calculations using these figures yield an average disturbance of 4.1 acres per well from road construction.

Reconstruction of Existing National Forest System Roads

Additional disturbance would result from reconstruction of National Forest System roads to a standard needed to safely accommodate existing traffic, rig

mobilization, and other project traffic. The GIS-based analysis determined an average distance of 3.41 miles/well for reconstruction. This number was increased by 15% to 3.92 miles to meet Forest Service road maintenance objectives for the higher road level.

Average adjusted length	3.92 miles
Width of new disturbance	13 feet
Subtotal Disturbance	6.18 acres
Additional disturbance for turnouts	0.28 acre
Additional disturbance for curve widening	0.16 acre

Calculations yield an average disturbance of 6.6 acres per well for road reconstruction.

Total Disturbance

The total estimated disturbance per exploration well, including the pad (5.9 acres), new road (4.1 acres), and road reconstruction (6.6 acres) would be **16.6 acres.**

The total gross disturbance for exploration drilling for the 15- year period would be **996.0 acres** (60 wells x 16.6 acres/well).

Once a well is plugged and abandoned the site would be reclaimed. Reclamation includes returning the disturbed drill pad and access road to approximate original contour, replacing topsoil, and seeding the area to accomplish required standards for revegetation.

If it is assumed that wells are drilled at a constant rate of 4/year and that reclamation requires 5 years, total acres disturbed by drilling will remain constant at **332.0 acres** after the fifth year as reclamation balances new disturbance. Stated differently, the **net** disturbance from exploration wells at the end of 15 years will be **332.0 acres**.

8.3 PRODUCTION WELLS AND FACILITIES

The baseline RFD outlined above projects the possible discovery of one oil field within the DNF during the next 15 years. This field might resemble the existing Upper Valley Oil Field (figure 4) but is here estimated to be somewhat smaller considering current industry and environmental standards and available technology with a total of about 20 production wells. The discovery well would become one of the production wells and 19 more wells would be drilled for production with each pad estimated at 5.9 acres. Nineteen pads would result in a disturbance of 112.1 acres. Assuming that an access road for the discovery well drill site remains available new road construction would consist only of spur roads between the wells. Assuming that the production well spacing would be

similar to Upper Valley, a maximum road length for each well is estimated at 0.5 miles. Road construction would disturb 6.15 acres per mile (Dixie NF O&G Engineering Report, 2007) resulting in an average disturbance per well of 3.1 acres. A topsoil storage area of 0.4 acres per well is estimated. This would produce a total disturbance of 9.3 acres/well (5.9 + 3.1 + 0.25). It is possible that more than one well would be drilled from some of the pads thereby reducing surface disturbance but it would serve no useful purpose to speculate without more site specific information, so the analogy with Upper Valley seems appropriate.

Using the Upper Valley oil field as a model, it is assumed that a new overhead powerline of approximately 5 miles and occupying 25 acres, and a substation of approximately 0.4 acres, would be necessary to provide electric power for the operation. Pipelines and power lines within the new oil field would mostly be buried under access roads and the produced oil would be trucked to market. However, it might be necessary to locate some portions of the lines in other areas or adjacent to existing roads to avoid sharp bends and other features. In order to accommodate this possibility, it is assumed that an additional 50-foot wide corridor could be disturbed for a distance of 5 miles for a total of **30.3 acres**.

A central production facility would be constructed which would receive the oil and water from individual wells after which the two liquids would be separated. The oil will be stored in tanks until removed by truck or possibly moved by pipeline to a nearby loading station. The separated water would be temporarily stored in a holding facility and then piped to a water injection well. The size of central production facilities varies depending on the volumes of produced liquids, shop and office facilities required and other factors. The most recently constructed central production facility in the area is at the Covenant Field and occupies approximately 29 acres. This facility is on land owned by the operator and the facility is considerably larger than one located on National Forest lands would be. A reasonable size for the postulated facility on the DNF would be **12 acres**. One water disposal well is projected with 0.5 miles of road construction resulting in **9.0 acres** (5.9 acres + 3.1 acres). In addition, oil would most likely be piped from the central production facility to a truck-loading facility adjacent to a major highway. Construction of a truck-loading facility would involve disturbance of another **0.5 acres**.

Figure 4 Upper Valley Oil Field.

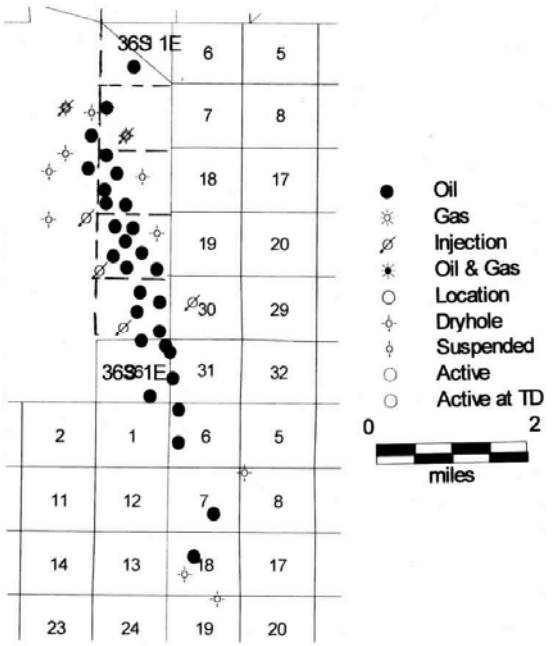


Figure 4. Upper Valley Oil Field. Modified from IHS Energy (2006).

Surface disturbance for the oil field is displayed below:

Discovery Pad and Road (Included under Exploration)	---
Production Wells and Roads and topsoil storage areas	176.7 acres
Central Production Facility	12.0 acres
Water Disposal Well and Road	9.0 acres
Overhead powerline and substation	25.4 acres
Additional Pipeline/Powerline Corridor	30.3 acres
Truck Loading Area	0.5 acres
Total Disturbance	**253.9 acres**

Based on the Upper Valley Field, oil production from the new field is estimated to be 2,000 barrels per day. The field is estimated to be productive at this level or reduced levels due to draw-down for approximately 30 years.

Water produced from the wells is assumed to be of poor quality; very high in total

dissolved solids. Reported water production at Upper Valley Field has averaged around 30,000 barrels per day (Utah Division of Oil, Gas and Mining) including reinjected water and similar rates are to be expected at the projected new field. It is assumed that water would be temporarily held in storage/evaporation ponds or tanks, then injected back into the ground; most likely to the aquifer from where it came. Water injection may also be used to enhance oil recovery by increasing reservoir pressures. Water injection/disposal is subject to regulation and permitting by the State of Utah to assure that no ground waters or surface waters are contaminated by industrial waters. Salt accumulations in the storage/evaporation ponds would be disposed of at facilities licensed to accept such wastes by the State of Utah.

Hydrogen sulfide (H2S), a toxic heavier-than-air gas, is produced with the oil at the Upper Valley Field. Releases into the air are regulated and managed using required monitoring, containment, and disposal methods. It is possible that similar concentrations of H2S could be encountered in the new field and that release into the adjacent environment would be controlled using current required and proven methods.

8.4 TOTAL ESTIMATED SURFACE DISTURBANCE

Gross Disturbance

Gross disturbance is the total of all disturbance regardless of the duration. The total estimated gross surface disturbance is displayed below by facility:

Seismic Exploration	422.5 acres
Exploration Wells	996.0 acres
Production Wells	176.7 acres
Central Production Facility	12.0 acres
Water Disposal Well	9.0 acres
Buried Pipeline and Powerline Corridors	30.3 acres
Overhead Powerline and Substation	25.4 acres
Truck Loading Facility	0.5 acres
Total Disturbance	**1,672.4 acres**

Net Disturbance

The total net or long-term surface disturbance after reclamation would be less than the total gross surface disturbance.

Surface disturbance for seismic lines is temporary, usually lasting only during the field season that operations occur. Operations are conducted by overland travel by rubber-tired vehicles or by helicopter and no road construction occurs.

Exploration well pads and roads (inherently non-productive) would be plugged,

abandoned, and reclaimed soon after drilling and revegetated, usually within 5 years.

Production pads and the water disposal well pad would be partially reclaimed to a smaller area needed for production and workover (periodic cleaning of the bore with drill rigs) operations. Approximately 1/3 of the original pad area needed for drilling would be reclaimed and cut and fill slopes would be reduced to facilitate long-term erosion control and revegetation (5.9 acres/well x 0.67 = 3.75 acres/well).

The total estimated net surface disturbance is displayed below:

Production Wells and Access Roads	144.6 acres
Central Production Facility	12.0 acres
Water Disposal Well	7.0 acres
Overhead Powerline and Substation	25.4 acres
Buried Pipeline and Powerline Corridors	30.3 acres
Truck Loading Facility	0.5 acres
Total Net Disturbance-Production facilities	**219.8 acres**

At the end of the 15-year analysis period it is assumed that the total area of surface disturbance would be 219.8 acres associated with production facilities plus the residual disturbance remaining to be reclaimed for exploration wells drilled during the final five years (332.0 acres), for a total of 551.8 acres.

9.0 BIBLIOGRAPHY

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APPENDIX A

Mineral Occurrence Potential Classification System

This report uses the mineral occurrence potential classification system found in BLM Manual 3031, *Energy and Mineral Resource Assessment.* The dual system uses a potential rating and a level of certainty rating as defined below.

Level of Potential:

0. The geologic environment, the inferred geologic processes and the lack of mineral occurrences do not indicate potential for accumulation of mineral resources.

L. The geologic environment and inferred geologic processes indicate low potential for accumulation of mineral resources.

M. The geologic environment, the inferred geologic processes and the reported mineral occurrences or valid geochemical/geophysical anomaly indicate moderate potential for accumulation of mineral resources.

H. The geologic environment, the inferred geologic processes, the reported mineral occurrences and/or valid geochemical/geophysical anomaly and the known mines or deposits indicate high potential for accumulation of mineral resources. The “known mines and deposits” do not have to be within the area being classified, but have to be within the same type of geologic environment.

ND. Mineral(s) potential not determined due to lack of useful data. This notation does not require a level of certainty qualifier.

Level of Certainty:

A. The available data are insufficient insufficient and/or cannot be considered as direct or indirect evidence to support or refute the possible existence of mineral resources in the respective area.

B. The available data provide indirect evidence to support or refute the

possible existence of mineral resources.

C. The available data provide direct evidence but are quantitatively minimal to support or refute the possible existence of mineral resources.

D. The available data provide abundant direct and indirect evidence to support
or refute the possible existence of mineral resources.

APPENDIX B

Maps

Map 1. Land Ownership

Map 2. U. S. Geological Survey Plays (1995)

Map 3. Oil and Gas Occurrence Potential

Map 4. Authorized Oil and Gas Leases

Map 5. DNF Lands Nominated for Oil and Gas Lease Sales 2005 – 2006

Map 6. Oil and Gas Development Potential

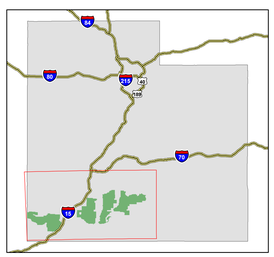
Oil & Gas Leasing EIS on Lands Administered by the Dixie National Forest

Dixie National Forest Location Map

Prepared by JBR Environmental Consultants
5 January 2007

1:240,000

Horizontal Datum = NAD 83
Coordinate System = Zone 12N



Legend

- Cities
- Minor Roads*
- Highways
- Interstates
- Water Bodies
- State Boundaries

National Forest System Lands

- Dixie National Forest
- Fishlake National Forest
- NFS Wilderness Areas

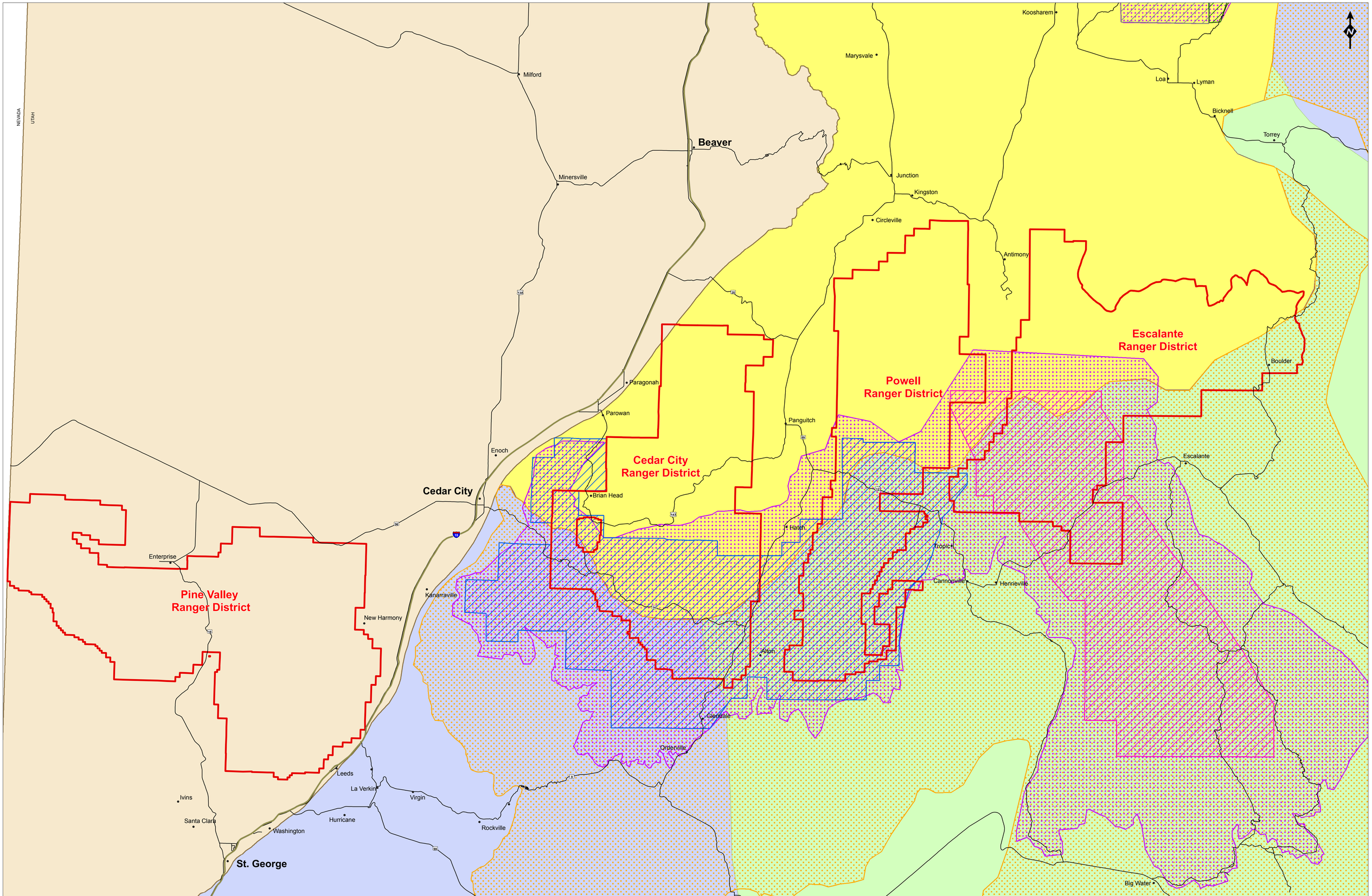
Other Land Administration

- Private
- Bureau of Land Management
- National Park Service
- State of Utah
- Tribal
- Grand Staircase-Escalante National Monument**

*Not all roads are shown. Only some roads are depicted for orientation purposes.
**Managed by the Bureau of Land Management.

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy. THIS MAP IS A PRELIMINARY DRAFT FOR SCOPING PURPOSES ONLY.

Miles
0 4 8 12 16



DIXIE OIL & GAS EIS

Oil & Gas Plays and Carbon Dioxide Plays

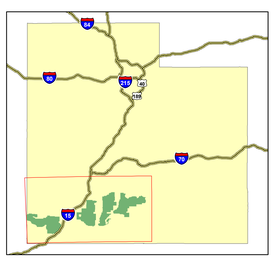
Dixie National Forest

Prepared by JBR Environmental Consultants

4 December 2006

1:230,000

Horizontal Datum = NAD 83
Coordinate System = Zone 12N



Legend

- Cities
- Major Roads
- Freeways
- State Boundaries
- Dixie National Forest (1)

Plays on Dixie National Forest (2)

- Cretaceous conventional play
- Permo-Triassic oil and gas play
- Proterozoic/Cambrian oil & gas play
- Carbon dioxide play (3)

Devonian-Pennsylvanian plays

- Basin and Range Dev.-Penn. oil and gas play
- Paradox Basin Dev.-Penn. oil & gas play

Coalbed Gas Plays

- Emery Sandstone Member play
- Dakota Formation play
- John Henry Member play
- Ferron Sandstone Member play

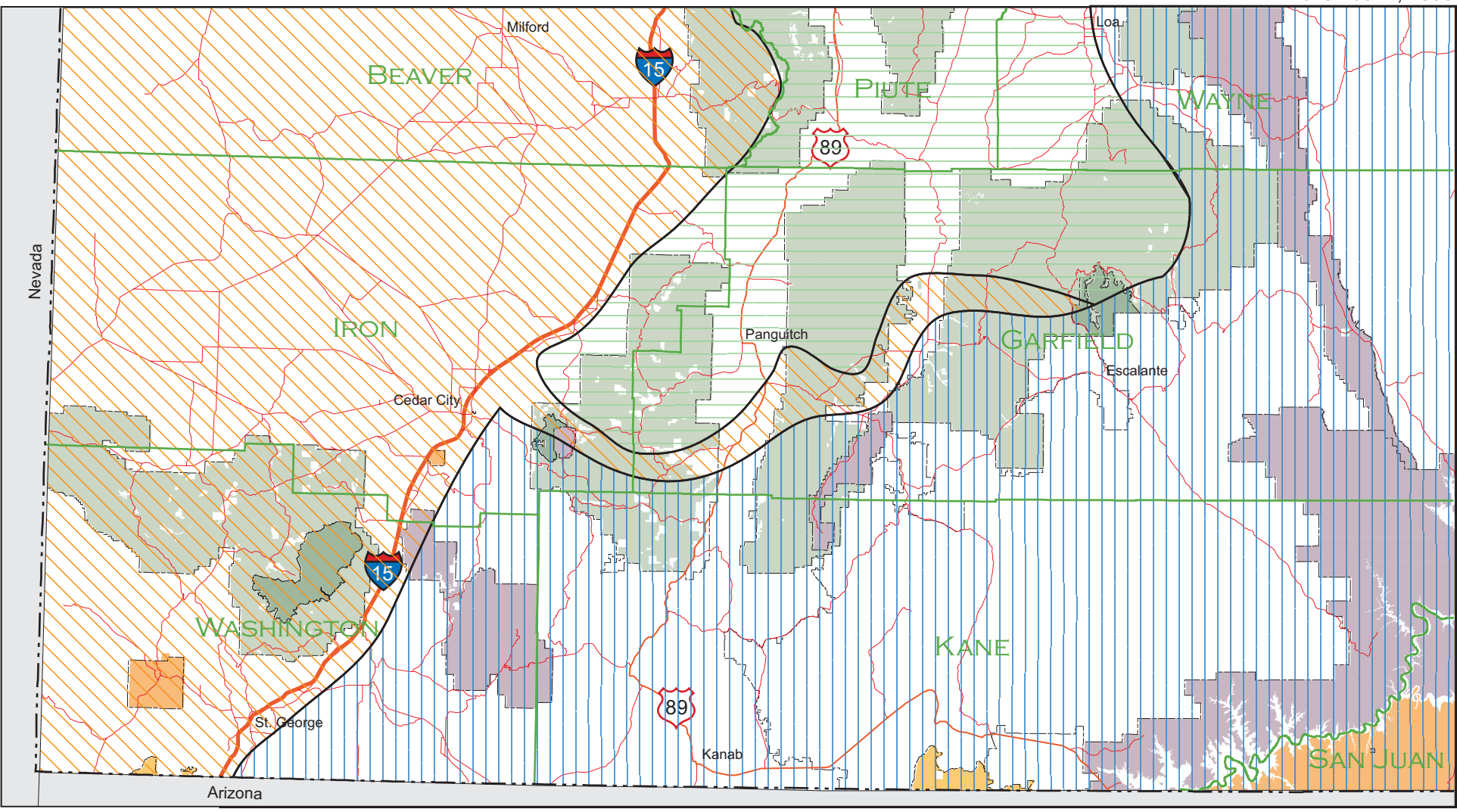
Miles: 0, 7.5, 15, 22.5, 30

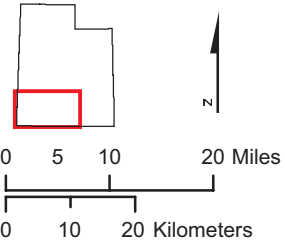
(1) Excludes Fremont Ranger District (administered by Fishlake National Forest).
(2) From Utah Geological Survey Report: The Oil, Gas, Coalbed Gas, Carbon Dioxide, and Geothermal Resources of the Dixie National Forest, Southwestern Utah. April 2004.
(3) Includes Devonian-Pennsylvanian, Proterozoic/Cambrian, and Permo-Triassic carbon dioxide plays.

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. For specific dates and/or additional digital information, contact the Forest Supervisor, Dixie National Forest, Cedar City, Utah. This map has no warranties to its contents or accuracy.
THIS MAP IS A PRELIMINARY DRAFT FOR SCOPING PURPOSES ONLY.

Oil and Gas Occurrence Potential

November 1, 2006





Low Potential / Low Certainty

High Potential / Low Certainty

Moderate Potential / Low Certainty

BLM Wilderness

Indian Reservation

National Forest Wilderness

National Forest

National Park

Map - 3

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

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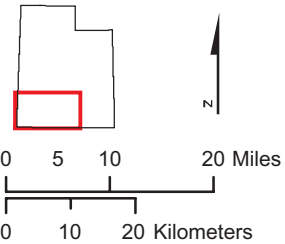
Authorized Oil and Gas Leases

November 1, 2006

Milford
Loa
BEAVER
PIUTE
WAYNE
15
89
Nevada
IRON
Panguitch
GARFIELD
Escalante
Cedar City
15
WASHINGTON
KANE
89
St. George
Kanab
SAN JUAN
Arizona

Map - 4



Authorized Oil and Gas Leases

National Park
BLM Wilderness
Indian Reservation
National Forest Wilderness
National Forest

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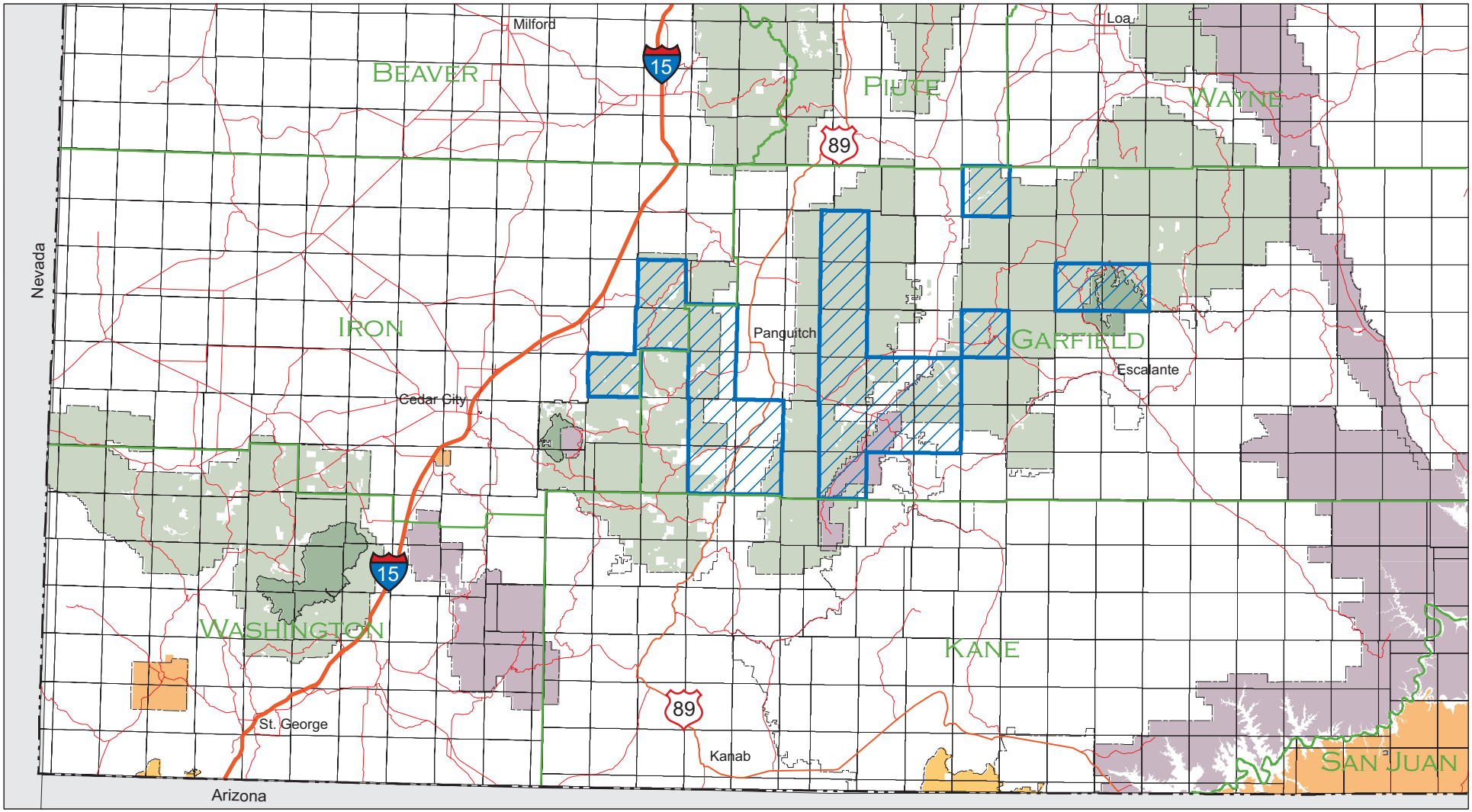
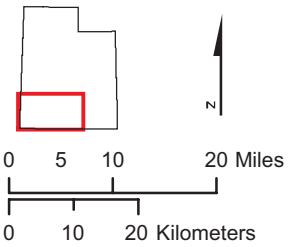
DNF Lands Nominated for Oil & Gas Lease Sales 2005 - 2006

November 1, 2006





- BLM Wilderness
- Indian Reservation
- National Forest Wilderness
- National Forest
- National Park
- Townships Where Lands Were Nominated

Map - 5

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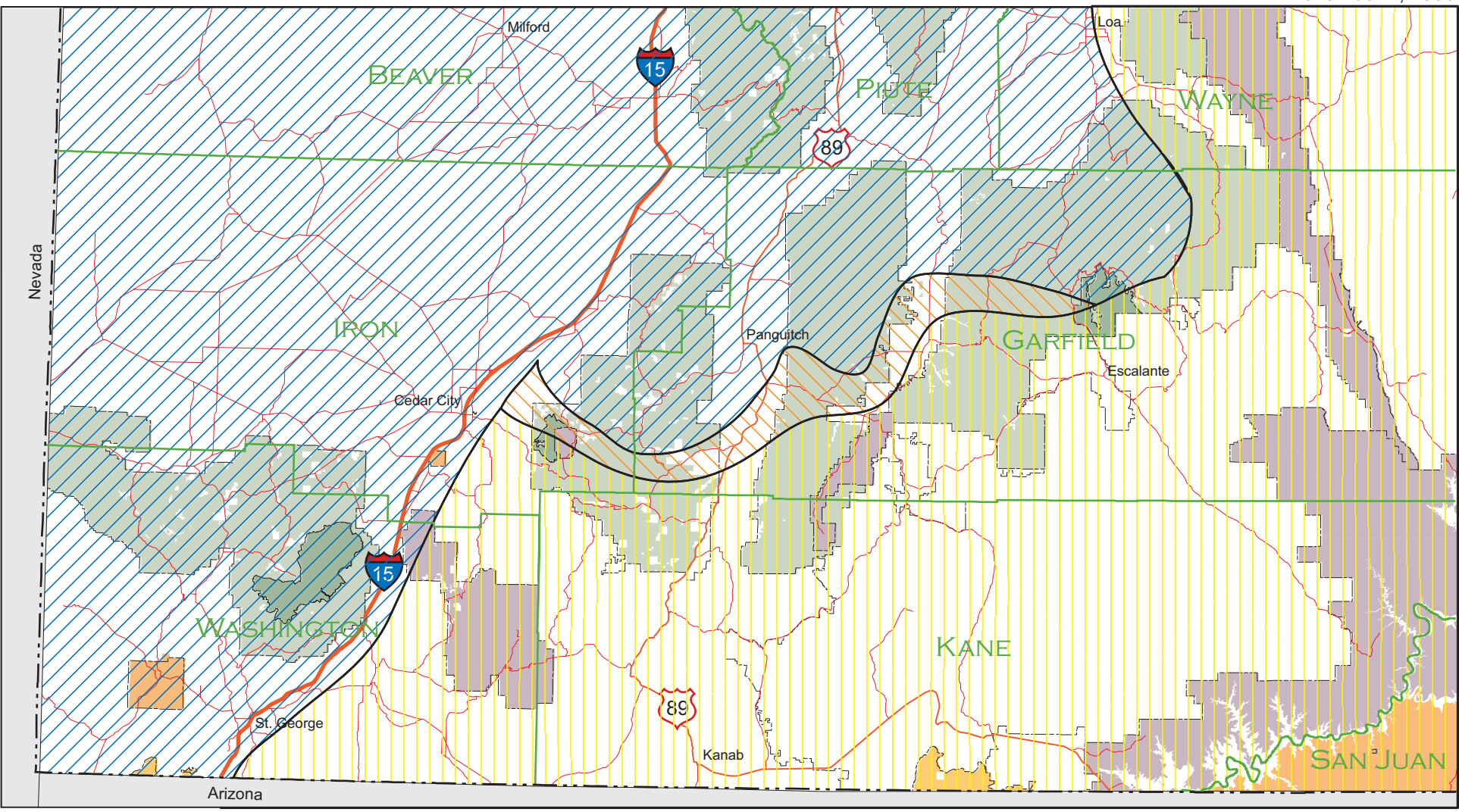
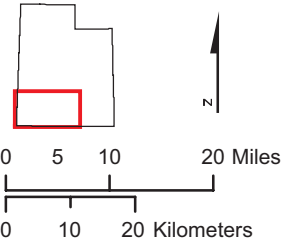
Oil and Gas Development Potential

November 1, 2006





High Potential

Moderate Potential

Low Potential

BLM Wilderness

Indian Reservation

National Forest Wilderness

National Forest

National Park

Map - 6

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Oil and Gas Engineering Report
Dixie National Forest Oil and Gas Leasing Analysis

This report provides engineering estimates of surface disturbance associated with oil and gas facilities that could be constructed following leasing on the Dixie National Forest. Assumptions and calculations are described.

Exploration Wells

Summary of Surface Disturbance:

Exploration well pads	= 5.9 acres per well
Road Construction (including topsoil storage)	= 4.1 acres per well
Road Reconstruction	= 6.6 acres per well
Total surface disturbance	= **16.6 acres per well**

Assumptions and calculations:

- *Well pad dimensions*. The well pad would be 425 feet x 350 feet with a 1 foot vertical x 3 foot horizontal ditch on the cut slope side and an 18-inch high berm 1 foot wide at the top with 1.5 horizontal to 1 foot vertical slope ratio. Clearing widths are 5 feet beyond the toe of slope and 5 feet beyond the top of cut.
- *Well pad disturbance.* Surface disturbance for well pads: On a 5% cross section slope and a 5 foot clearing width beyond top of cut and toe of fill = 4.6 acres (491 feet x 406 feet/43,560 sq feet per acre). On a 20% cross section slope with 5-feet clearing beyond the top of cut and toe of fill = 7.2 acres (616 feet x 506 feet/43,560 sq feet per acre). An average disturbance of 5.9 acres [(4.6 + 7.2) / 2] is projected for a typical well pad.
- *Topsoil storage for well pads.* Approximately 5,600 cubic yards of top soil will be stored for reclamation based on salvaging top soil on an average of 6 inch depth. The top soil storage area would represent an area approximately 85 feet x 125 feet = 0.25 acre per well pad.
- *Average road construction distance*. The Dixie used a GIS-based analysis to determine the average straight-line distance of new road construction required to reach a typical well pad is 0.52 miles (See GIS Methodology Report in Project File). The straight-line distance was plotted and laid out on a contour map at a 6% average road grade. (This analysis was conducted by the Fishlake National Forest Road Engineer and the following adjustment factor was used for both the Fishlake and Dixie). This resulted in an increase in projected new road length by a factor of 1.27. The adjusted distance of new construction necessary for a typical exploration well on the Dixie National Forest is 0.66 miles (0.52 miles x 1.27).
- *Exploration road dimensions.* The road template is 18 feet wide. This provides adequate width for a 16 foot subgrade to accommodate a road base of 6 inch depth, and a 0.5 foot deep ditch for erosion control. Road cut slope ratio is 1:1 and road fill slope ratio 1.5 horizontal to 1 foot vertical. Road side clearing is 5 feet beyond the top of cut and 10 feet below toe of fill. Ten feet below the toe of fill provides sufficient area to treat road construction slash.

- *Road construction disturbance area.* Using an average cross section slope of 20%, the surface disturbance for each mile of new road construction is 6.15 acres. An average road width of 39 feet is used (24 feet + 15 feet clearing distance). This yields an average disturbed area of 4.72 acres (39 feet x 5,280 feet per mile /43,560 square feet per acre = 4.72 acres, which is increased by a 1.25 adjustment factor to 5.9 acres for curve widening, turnouts, and adequate road widths to provide for hauling by transport equipment. To account for topsoil storage, an additional 0.25 acres per mile is added to yield an average disturbance of 6.15 acres per mile of new road.
- *Road reconstruction distance.* From the Dixie's GIS-based distance analysis (GIS Methodology Report), the average straight-line distance from a well pad to an improved road (Maintenance Level 3, 4, or 5) is 3.20 miles. The terrain adjustment factor (1.27) applied to new road construction is also applied to road reconstruction, resulting in an adjusted average distance from a typical pad to an improved road of 4.07 miles. To estimate the average length of road reconstruction needed for access to an exploration well pad, the adjusted road construction distance is subtracted from the adjusted distance to an improved road, yielding 4.07 – 0.66 = 3.41 miles. This distance is increased by 15% to meet road maintenance objectives for an improved road including larger curve radii, producing an average reconstructed road length of 3.92 miles.

  Road reconstruction disturbance area. Many of the Forest Roads are not currently constructed to the objective road maintenance level. Most lack gravel road base, turnouts, ditches, and curve widening to accommodate heavy and long loads on transport vehicles. It may be necessary to relocate portions of existing roads where the road grades exceed 8%. The surface disturbance for road reconstruction would generally be limited to excavation and clearing to widen roads for gravel, turnouts, curve widening, ditches, and in few areas modifying the road template to accommodate heavy equipment access.

  The following improvements would be made during reconstruction (assuming a cross section slope of 20%):

  - Construct 3 additional turnouts per mile of road (10 ft width 100 ft length/43,560 sq ft per acre) = 0.07 acres per mile;
  - Construct 3 additional curve widening areas per mile of road (6 ft width 100 ft length/43,560 sq ft per mile) = 0.04 acres per mile;
  - Widen the existing road subgrade to accommodate gravel road base (6" to 12" depth dependent on subgrade viability);
  - Ditch construction (1 foot depth, 3:1 slope);
  - Modify cut and fill slopes to accommodate heavy equipment access.

  The dimensions used to estimate road widening and other improvements:

  - Width of an existing primitive road of 25 feet (generally a 12 foot road without ditches + cut and fill slopes with minimal clearing beyond the road subgrade). The width of a reconstructed road is 38 feet (18 foot subgrade + 3 foot ditch + 7 foot cut and fill slope modification + 10 foot clearing for site distance). After reconstruction this would yield 13 feet

additional disturbance width (38 foot width for reconstruction – 25 foot width previously disturbed for the existing road).

This results in an average disturbed area for road widening of 6.18 acres per exploration well (13 feet x 5,280 feet per mile/43,560 sq feet per acre x 3.92 miles average reconstruction distance per well).

The total disturbance per exploration well associated with road reconstruction would be:

Road widening:	6.18 acres
Turnouts:	0.28 acres
Curve widening:	0.16 acres
Total =	6.62 acres per well

Production Wells and Facilities

Summary of Surface Disturbance:

Production Well Pads	= 5.9 acres per well
Road Construction	= 3.1 acres per well
Topsoil storage	= 0.25 acres per well
Road Reconstruction	= 0.0 acres per well
Surface disturbance from wells and roads	= **9.3 acres per well**
Central Production Facility	= 12.0 acres per field
Overhead powerline and substations	= 25.4 acres per field
Additional buried powerline/pipeline corridor	= 30.3 acres per field
Water injection well and road	= 9.0 acres per field
Truck loading area	= 0.5 acres per field

Assumptions and calculations:

- *Well pads, access roads, and topsoil storage areas*. Dimensions and disturbance areas for these facilities would be the same as those determined for exploration facilities.
- *Discovery well to production well.* One production well will have been converted from an exploratory (discovery) well.
- *Miles of new road project road construction and surface disturbance*. The access road to the discovery well will have been constructed by the exploratory well development. Based on the well spacing and distance between pads, approximately 0.5 mile of new access road would be constructed as spur roads for each of the multi-well production pads, each road represents 3.1 acres of surface disturbance (6.15 acres per mile x 0.5 mile).
- *Miles of reconstruction of forest roads and surface disturbance.* Road reconstruction would be completed during the exploration pad development for the well that led to the discovery of the field. No additional surface disturbance is anticipated when production begins.

- *Central Production Facility.* The size of central production facilities will vary depending on the volumes of produced liquids, shop and office facilities required and other factors. The most recently constructed central production facility in the area is at the Covenant Field and occupies approximately 29 acres. This facility is on land owned by the operator and the facility is considerably larger than one located on National Forest lands would be. A reasonable size for the postulated facility on the Dixie National Forest would be 12 acres.
- *Pipelines and Powerlines.* Using the Upper Valley oil field as a model, it is assumed that a new overhead powerline of approximately 5 miles and occupying 25 acres, and a substation of approximately 0.4 acres, would be necessary to provide electric power for the operation. Distance and areas were taken from special use files for those facilities at the Upper Valley field. Pipelines and power lines within the new oil field would mostly be buried under access roads and the produced oil would be trucked to market. However, it might be necessary to locate some portions of the lines in other areas or adjacent to existing roads to avoid sharp bends and other features. It is assumed that an additional 50-foot wide corridor could be disturbed for a distance of 5 miles for a total of 30.3 acres (5 miles x 50 feet/43,560 square feet per acre).
- *Water Injection Well.* A water injection well would likely be constructed with similar dimensions as an exploratory well pad (5.9 acres) and require approximately 0.5 mile of new road construction (3.1 acres) resulting in 9.0 acres of surface disturbance.
- *Truck Loading Area.* Oil would most likely be piped from the central production facility to a truck-loading facility adjacent to a major highway. Construction of a truck-loading facility would involve disturbance of another 0.5 acres.

GIS Methodology Used to Estimate Road Construction and Reconstruction Distances for the Reasonably Foreseeable Development Scenario Dixie National Forest Oil and Gas Leasing Analysis

Created grid of the forest with 5-acre parcels using the Fishnet command. Placed point at the center of each cell.

Used only roads that are "classified" or State/Federal/County on National Forest System Land.

Utilized the "near" command to determine nearest road to each point.

Selected for level 3, 4, or 5 roads, added the State, Fed, County and checked data. The exterior Forest boundary was not included in the dataset. Then started the "Near" process again (near point_cov route_cov line 202300 new_cov) and let it run.

The results are shown in Table 1.

Supplemental GIS specifics:

Generating using fishnet command:

1) Determine the coordinates for the physical extent of the area of interest.
Arc: Generate <filename>
Generate: fishnet
Fishnet Origin Coordinate (x, y): 360416.964, 4198075.246 (xmin, ymin)
Y-Axis Coordinate (x, y): 360416.964, 4380566.761 (xmin, ymax)
Cell Size (width, height): 100.584, 100.584 (distance on side, in meters)
Number of Rows, Columns: 0
Opposite corner of fishnet (x, y): 483623.386, 4380566.761 (xmax, ymax)
Generate: q

The fishnet is created as lines and as points that are placed at the center of each grid. The points are what were used for the analysis. If another (larger) base size is desired, another fishnet is created with different specifications. The larger the base size, the faster the process will run.

2) Next an identity of the fishnet was run with Forest Service ownership and reselected for the specified criteria. The final process included points on private land; but all points that were not within the Forest boundary were deleted. Also, all points in Forest Service Wilderness and Cedar Break National Monument were deleted.

3) Appropriate roads were then selected. The analysis was run twice—once with all Level 2, 3, 4 and 5 roads plus the State, Federal, County routes; and another with just the level 3, 4, and 5 routes plus State/Federal/County.

4) Finally, the "Near" command was run between the selected fishnet points and the selected travel route layer and then the output was analyzed.

The result was a point coverage with a column for the straight-line distance in meters to the nearest route.

Meters were converted to miles in the following table. The average distance was adjusted (increased) to account for the additional road length that would be necessary to maintain a 6% road grade on typical terrain over that distance. The average length of road re-construction was estimated by subtracting the average distance to Forest Maintenance Level 2, 3, 4 and 5 roads from the average distance to Level 3, 4 and 5 roads (considered *improved* roads), which was then increased by 15% to meet higher road maintenance level objectives.

Table 1.

District	Acres	Wilderness /Other	Acres	Net Acres		Average Distance to Level 2,3,4,5 Roads	Average Distance to Level 3, 4, 5 Roads
PINE VALLEY	481,212	PINE VALLEY	50,232	430,979		0.58	2.62
CEDAR CITY	404,260	ASHDOWN GORGE and CEDAR BREAKS	13,177	391,083		0.36	1.23
POWELL	388,598			388,598		0.58	7.28
ESCALANTE	436,575	BOX DEATH HOLLOW	25,564	411,011		0.54	1.87
Totals	1,710,645		88,973	1,621,672	**Area-Weighted Average Straight-line Distance**	0.52	3.20
					Adjusted Road Construction Distance (for 6% road grade)	0.66	4.07
				Average length of road re-construction		3.41	
				Average length of road re-construction (increased by 15% to meet road maintenance objectives)		3.92	

Spatially Adjusting the Dixie National Forest Reasonably Foreseeable Development Scenario for Environmental Impact Analysis

Following are the assumptions and criteria used to estimate the spatial and timing distribution of oil and gas exploration and development activities and facilities on the Dixie National Forest over the 15-year Reasonably Foreseeable Development Scenario (RFDS) analysis period.

The RFDS report projects 60 exploration wells over 15 years following leasing, or a forest-wide average of 4 wells per year. It estimates that exploration drilling during this period would result in a discovery of one oil and gas field with 20 production wells. During the same period, it is expected that 700 line miles of seismic data will be acquired on the Forest.

Exploration Drilling. The maps of the oil and gas development potential and of the lands nominated for oil and gas leases sales between 2005 and 2006 shown in the RFDS report were used to estimate the proportion of the exploration drilling that would occur on each of the four Ranger Districts (Pine Valley, Cedar City, Powell, and Escalante):

- Roughly the southern one-third to one-half of the Cedar City, Powell, and Escalante Ranger Districts have high or moderate potential for oil and gas development. The northern two-thirds to one-half of those Ranger Districts have low development potential. The entire Pine Valley Ranger District is rated as having low development potential.
- Current oil and gas industry interest, which would be reflected in the lands nominated for lease sales between 2005 and 2006, is somewhat evenly distributed among the Cedar City, Powell, and Escalante Ranger Districts. No interest was expressed for leasing lands on the Pine Valley Ranger District during that period.

Using these criteria results in the following estimates of the number of exploration wells that would occur on each Ranger District over the 15-year period:

Pine Valley:	5 wells; an average of one well every three years
Cedar City:	15 wells; an average of one well per year
Powell:	20 wells; an average of four wells every three years
Escalante:	20 wells; an average of four wells every three years

In order to fully evaluate the environmental effects of concurrent exploration activity for the analysis, it can reasonably be assumed that three exploration drilling operations could occur at one time on each of the Ranger Districts.

Oil and Gas Field. Exploration drilling is expected to result in one oil and gas field on the Forest in 15 years. For full impact analysis, the environmental consequences will be evaluated as if it were to occur on each of the Ranger Districts.

Geophysical Operations. Considering development potential and current industry interest for each of the Ranger Districts, the following prorated distances of seismic lines can be reasonably expected to occur over 15 years:

Pine Valley:	100 miles
Cedar City:	200 miles
Powell:	200 miles
Escalante:	200 miles

It is assumed based on project processing timeframes that 50 to 100 miles of geophysical surveys could occur on each of the Ranger Districts in any year.

Appendix B – Detailed Summary of Acres of each Resource Component under each Leasing Stipulation by Alternative

Table B-1: Alternative B Acres of each Resource Component under each Leasing Option by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994	1,962	13			
	CC	6,932	258	6			
	PL		531				
	ES	28,781	1,444				
	Total	85,707	4,195	18			
Retention SIO High	PV	41	49,594	4,369			
	CC	1,471	82,418	26,637			
	PL		76,356	12,369			
	ES	36	89,220	59,604			
	Total	1,548	297,588	102,979			
Partial Retention SIO Moderate	PV	2,749	118,011	19,040		20,946	
	CC	72	65,858	24,066		9,170	
	PL		100,621	32,050		6,029	
	ES	7	84,760	41,688		14,074	
	Total	2,829	369,249	116,844		50,219	
Modification SIO Low	PV	56	57,335	2,561		227	
	CC	74	30,240	5,835		296	
	PL		119,602	9,228		1,510	
	ES		32,723	26,197		7,251	
	Total	130	239,900	43,821		9,285	
Modification SIO Unassigned	PV		123,986	7,393		4,437	
	CC	154	63,436	30,184		5,318	
	PL		10,837	14,339		304	
	ES		25,321	16,313		3,287	
	Total	154	223,579	68,228		13,346	
NPS Park Protective Measure	PV						
	CC						
	PL		1,285				
	ES						
	Total		1,285				
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557	250,786				
	CC		47,842				
	PL		167,418				
	ES	2,080	99,877				
	Total	4,637	565,922				
Unroaded-Undeveloped Areas	PV	54,506	301,832	18,340		7,242	
	CC	7,572	70,325	18,270		4,402	
	PL	7	179,505	21,511		2,091	
	ES	28,451	134,364	51,358		5,863	
	Total	88,327	686,025	109,479		19,598	
Suitable Wild and Scenic Rivers	PV						
	CC		279				
	PL						
	ES	5,733					
	Total	5,733	279				
Recreation							
Developed Sites	PV	1	2,136	32			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	CC		1,074	319			
	PL		294	316			
	ES		484	268			
	Total	1	3,988	935			
ROS: Primitive	PV	50,187	17,099				
	CC	7,016	244				
	PL		529				
	ES	27,405	1,445				
	Total	84,607	19,317				
ROS: Semi-Primitive Non-Motorized	PV	2,641	209,112	13,419			
	CC	765	68,001	28,171			
	PL		164,425	33,122			
	ES	732	125,313	55,288			
	Total	4,138	566,851	130,000			
ROS: Semi-Primitive Motorized	PV	12	88,148	11,219		16,047	
	CC	435	104,030	37,572		11,106	
	PL		102,783	29,810			
	ES	461	71,377	57,933		11,106	
	Total	907	366,337	136,533		56,274	
ROS: Roaded Natural	PV	1	36,468	8,743		9,552	
	CC	480	70,039	20,952		3,678	
	PL		40,093	5,046		103	
	ES	222	35,280	30,555		3,222	
	Total	703	181,880	65,297		16,554	
Recreation Residences	PV	42	196	3			
	CC		571	8			
	PL						
	ES						
	Total	42	766	11			
Administrative Sites	PV		219	14			
	CC						
	PL		489				
	ES		64	63			
	Total		772	76			
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC		16,739				
	PL		23,268				
	ES		2,809				
	Total		42,816				
Sage Grouse Brood Rearing Habitat	PV						
	CC		3,415				
	PL						
	ES		9,562				
	Total		12,977				
Crucial and Substantial Deer and Elk Winter Range	PV	533	17,414				
	CC		33,156				
	PL		49,587				
	ES		69,759				
	Total	533	169,915				
Crucial Deer and Elk	PV	814	139,329				

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Summer Range	CC	61	95,512				
	PL		148,289				
	ES		19,214				
	Total	874	402,344				
Raptor Nests							
Goshawk Nest Areas	PV	1,890	1,927	62			
	CC	1,072	47,293	15,292			
	PL		34,178	7,588			
	ES	179	18,962	24,122			
	Total	3,140	102,361	47,064			
Goshawk PFA	PV	914	1,239	43			
	CC	700	26,555	8,371		10	
	PL		20,594	4,299		83	
	ES	106	9,860	11,467		96	
	Total	1,720	58,248	24,180		190	
Peregrine Falcon Nests	PV						
	CC	2,259	3,984	3,511			
	PL		6,428	1,673			
	ES						
	Total	2,259	10,411	5,184			
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC		4,877	1,535			
	PL		25,776	5,107			
	ES		7,610	4,723			
	Total		38,263	11,365			
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336	1,913	188			
	CC	2,782	3,429	2,980		2	
	PL		5,247	1,977		2	
	ES	701	3,600	4,372		3	
	Total	23,819	14,188	9,518		7	
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES		732				
	Total		732				
Bald Eagle Winter Concentration Areas	PV		3,612				
	CC		3,621	552			
	PL		1,244	500			
	ES		1,368	368			
	Total		9,844	1,421			
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES		18,048				
	Total		18,048				
Sensitive Species and Suitable Habitat							
Pygmy Rabbit	PV	11	7,436	4,436			
	CC		6,732	1,287			
	PL		14,204	9,826			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	ES	169	4,863	1,787			
	Total	180	33,235	17,336			
Sensitive Bats – Potential Habitat	PV	519	102	12			
	CC	42	191	49			
	PL		543	141			
	ES	554	260	38			
	Total	1,115	1,096	239			
Flammulated Owl Habitat	PV	30,559	6,490	448			
	CC	5,777	108,585	48,262			
	PL		62,574	13,033			
	ES	7,024	72,363	65,325			
	Total	43,361	250,111	420,541			
Fisheries Habitat	PV	1,264	3,632				
	CC		4,105				
	PL		7,892				
	ES		6,572				
	Total	1,264	22,201				
Boreal Toad Habitat	PV						
	CC						
	PL		47,191	2,976			
	ES						
	Total						
California Condor and Peregrine Falcon Rim Habitat	PV	35,750	24,902	3,548		1,684	
	CC	5,271	22,252	12,627		311	
	PL		79,471	22,297		1,162	
	ES	27,689	131,955	64,201		8,178	
	Total	68,710	258,580	102,673		11,335	
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC		58,585				
	PL						
	ES						
	Total		58,585				
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (500-ft buffer)	PV	20,887	185,173	16,165			
	CC	4,222	109,369	21,378			
	PL		139,976	16,077			
	ES	13,134	111,183	26,038			
	Total	38,243	545,700	79,658			
Municipal Watersheds	PV	6,791	21,008				
	CC	798	12,071				
	PL		6,471				
	ES		6,266				
	Total	7,589	45,816				
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401	1,376	81			
	CC	321	568	484			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	PL		2,154	711			
	ES	2,618	2,000	440			
	Total	9,340	6,097	1,716			
Slopes > 35 degrees	PV	39,222	80,445	6,391			
	CC	4,973	28,892	22,308			
	PL		89,662	18,814			
	ES	20,564	46,189	25,016			
	Total	64,759	245,189	72,529			
Areas of High Erosion Potential	PV	11,229	21,870	2,312			
	CC	1,031	6,732	4,322			
	PL		16,321	10,036			
	ES		13,635	8,475			
	Total	12,260	58,559	25,145			
Marginally Unstable Slopes	PV						
	CC	772	10,777	2,202		7	
	PL		7,851	190			
	ES		14,795	6,979		415	
	Total	772	33,423	9,371		422	
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (500-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2	2,053				
	CC		225				
	PL		531				
	ES	540	1,444				
	Total	542	4,253				
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL		79	124			
	ES						
	Total		79	124			
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES		5				
	Total		5				
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088	5,289	532			
	CC	1,571	12,470	5,678			
	PL		33,251	10,468			
	ES	9,099	21,184	21,380			
	Total	14,757	72,194	38,058			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Cultural							
Mountain Meadows Historic Site	PV CC PL ES	1,441	1,380				
	Total	1,441	1,380				
Long Hollow Historic District	PV CC PL ES		390				
	Total		390				
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Table B-2: Alternative C Acres of each Resource Component under each Leasing Option by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994	1,888	87			
	CC	6,932	225	39			
	PL		531				
	ES	28,781	1,444				
	Total	85,707	4,088	4,213			
Retention SIO High	PV	41	26	53,936			
	CC	1,471	35,106	73,949			
	PL			88,725			
	ES	36		148,824			
	Total	1,548	35,132	365,435			
Partial Retention SIO Moderate	PV	2,749	139	107,554		50,304	
	CC	72	10,178	59,016		29,899	
	PL			109,093		29,608	
	ES	7		102,667		37,855	
	Total	2,829	10,317	378,330		147,666	
Modification SIO Low	PV	56		58,512		1,611	
	CC	74	9,562	19,675		7,133	
	PL			118,345		11,996	
	ES			42,818		23,353	
	Total	130	9,562	239,350		44,093	
Modification SIO Unassigned	PV			127,696		8,119	
	CC	154	3,429	73,942		21,567	
	PL			24,538		942	
	ES			36,242		8,678	
	Total	154	3,429	262,418		39,306	
NPS Park Protective Measure	PV						
	CC						
	PL			1,926			
	ES						
	Total			1,926			
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557	1,359	249,427			
	CC		18,821	29,021			
	PL		531	166,887			
	ES	2,080	1,329	98,548			
	Total	4,637	22,040	543,883			
Unroaded-Undeveloped Areas	PV	54,506	2,053	306,530		18,831	
	CC	7,572	19,335	64,403		9,259	
	PL	7	531	197,619		4,956	
	ES	28,451	1,444	171,890		18,251	
	Total	88,327	23,364	740,442		51,297	
Suitable Wild and Scenic Rivers	PV						
	CC		7	273			
	PL						
	ES	5,733					
	Total	5,733	7	273			
Recreation							
Developed Sites	PV	1		2,168			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	CC		506	887			
	PL			610			
	ES			752			
	Total	1	506	4,417			
Primitive	PV	50,187	2,049	15,050			
	CC	7,016	225	19			
	PL		529				
	ES	27,405	1,443	2			
	Total	84,607	4,246	15,071			
ROS: Semi-Primitive Non-Motorized	PV	2,641	3	222,529			
	CC	765	12,950	83,221			
	PL		1	197,546			
	ES	732	1	180,600			
	Total	4,138	12,955	683,896			
ROS: Semi-Primitive Motorized	PV	12	1	76,297		39,115	
	CC	435	22,804	87,500		42,404	
	PL			102,402		37,920	
	ES	461	1	91,509		59,192	
	Total	907	22,805	357,708		178,630	
ROS: Roaded Natural	PV	1		33,881		20,882	
	CC	480	22,518	55,973	16,177		
	PL		1	40,648		4,594	
	ES	222		58,382		10,675	
	Total	703	22,519	188,883		52,328	
Recreation Residences	PV	42		198			
	CC		567	11			
	PL						
	ES						
	Total	42	567	210			
Administrative Sites	PV		14	218			
	CC						
	PL			489			
	ES			127			
	Total		14	848			
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC			16,739			
	PL			23,268			
	ES			2,809			
	Total			42,816			
Sage Grouse Brood Rearing Habitat	PV						
	CC			2,274		1,142	
	PL						
	ES			6,600		2,961	
	Total			8,874		4,103	
Crucial and Substantial Deer and Elk Winter Range	PV	553		14,085		3,329	
	CC		130	22,836		10,191	
	PL			44,625		4,962	
	ES			57,555		12,204	
	Total	553	130	139,100		30,685	
Crucial Deer and Elk	PV	814		122,463	16,866		

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Summer Range	CC	61	25,963	56,363	13,186		
	PL			133,458	14,831		
	ES			15,400	3,814		
	Total	874	25,963	327,684	48,696		
Raptor Nests							
Goshawk Nest Areas	PV	1,890		1,990			
	CC	1,072	12,534	50,051			
	PL			41,766			
	ES	179	291	42,793			
	Total	3,140	12,825	136,601			
Goshawk PFAs	PV	914		1,282			
	CC	700	5,591	28,443		903	
	PL			24,796		179	
	ES	106	35	21,054		334	
	Total	1,720	5,626	75,575		1,416	
Peregrine Falcon Nests	PV						
	CC	2,259	629	6,866			
	PL			8,101			
	ES						
	Total	2,259	629	14,967			
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC		88	6,324			
	PL			30,883			
	ES			12,333			
	Total		88	49,540			
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336	2	2,055		44	
	CC	2,782	810	5,406		195	
	PL			6,884		342	
	ES	701	189	7,654		131	
	Total	23,819	1,000	22,000		713	
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES			732			
	Total			732			
Bald Eagle Winter Concentration Areas	PV			3,612			
	CC		2,616	1,556			
	PL			1,744			
	ES			1,736			
	Total		2,616	8,648			
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES			16,653		1,395	
	Total			16,653		1,395	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Sensitive Species and Suitable Habitat							
Pygmy Rabbit	PV	11		7,014		4,857	
	CC		190	6,074		1,756	
	PL			17,592		6,438	
	ES	169		5,525		1,125	
	Total	180	190	36,205		14,176	
Sensitive Bats – Potential Habitat	PV	519		110		4	
	CC	42	104	137			
	PL			684			
	ES	554	50	247			
	Total	1,115	154	1,177		4	
Flammulated Owl Habitat	PV	30,559	39	6,748		151	
	CC	5,777	27,571	100,593		28,683	
	PL		6	59,494		16,207	
	ES	7,024	577	114,144		22,968	
	Total	43,361	28,192	280,980		68,008	
Fisheries Habitat	PV	1,264	484	3,147			
	CC			4,105			
	PL			7,892			
	ES			6,572			
	Total	1,264	484	21,717			
Boreal Toad Habitat	PV						
	CC						
	PL			38,147		12,020	
	ES						
	Total			38,147		12,020	
California Condor and Peregrine Falcon Rim Habitat	PV	35,750		27,112		3,022	
	CC	5,271	5,951	25,201		4,039	
	PL			92,789		10,141	
	ES	27,689	1,444	179,271		23,618	
	Total	68,710	7,395	324,373		40,820	
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC		58,585				
	PL						
	ES						
	Total		58,585				
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)	PV	12,635	725	125,422			
	CC	2,614	6,667	73,836			
	PL		165	95,913			
	ES	8,247	288	84,240			
	Total	23,496	7,845	379,411			
Municipal Watersheds	PV	6,791		21,008			
	CC	798		12,071			
	PL			6,471			
	ES			6,266			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	Total	7,589		45,816			
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401	20	1,437			
	CC	321		1,052			
	PL			2,865			
	ES	2,618	170	2,270			
	Total	9,340	190	7,623			
Slopes > 35 degrees	PV	39,222	627	86,209			
	CC	4,973	1,752	49,449			
	PL		108	108,368			
	ES	20,564	768	70,437			
	Total	64,759	3,256	314,462			
Areas of High Erosion Potential	PV	11,229	423	23,758			
	CC	1,031	53	11,002			
	PL		471	25,886			
	ES		681	21,429			
	Total	12,260	1,628	82,076			
Marginally Unstable Slopes	PV						
	CC	772	577	11,459		950	
	PL			8,013		28	
	ES			21,313		876	
	Total	772	577	40,785		1,855	
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2	2,053				
	CC		225				
	PL		531				
	ES	540	1,444				
	Total	542	4,253				
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL			203			
	ES						
	Total			203			
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES			5			
	Total			5			
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088	643	4,972		206	
	CC	1,571	2,675	12,531		2,941	
	PL		531	37,739		5,448	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	ES	9,099	779	35,965		5,821	
	Total	14,757	4,628	91,207		14,417	
Cultural							
Mountain Meadows Historic Site	PV CC PL ES	1,441		1,201		178	
	Total	1,441		1,201		178	
Long Hollow Historic District	PV CC PL ES			317		73	
	Total			317		73	
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Table B-3: Alternative D1 (NSO in IRAs) Acres of each Resource Component under each Leasing Option by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994		1,974			
	CC	6,932		264			
	PL			531			
	ES	28,781		1,444			
	Total	85,707		4,213			
Retention SIO High	PV	41		28,215		25,748	
	CC	1,471		46,275		62,780	
	PL			41,995		46,730	
	ES	36		54,850		93,974	
	Total	1,548		171,335		229,232	
Partial Retention SIO Moderate	PV	2,749		60,414		91,734	5,849
	CC	72		19,442		79,651	
	PL			62,786		75,915	
	ES	7		36,842		103,680	
	Total	2,829		179,484		350,980	5,849
Modification SIO Low	PV	56		50,775		9,348	
	CC	74		17,687		18,684	
	PL			92,690		37,651	
	ES			12,451		53,720	
	Total	130		173,603		119,403	
Modification SIO Unassigned	PV			112,504		23,311	
	CC	154		14,685		84,253	
	PL			2,824		22,655	
	ES			7,762		37,158	
	Total	154		137,775		167,378	
NPS Park Protective Measure	PV						
	CC						
	PL					1,926	
	ES						
	Total					1,926	
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557		250,786			
	CC			47,842			
	PL			167,417			
	ES	2,080		99,877			
	Total	4,637		565,922			
Unroaded-Undeveloped Areas	PV	54,506		247,126		79,844	444
	CC	7,572		45,778		47,218	
	PL	7		161,977		41,129	
	ES	2,907		87,311		104,274	
	Total	88,327		542,192		272,466	444
Suitable Wild and Scenic Rivers	PV						
	CC			7	273		
	PL						
	ES	5,733					
	Total	5,733		7	273		
Recreation							
Developed Sites	PV	1		194		1,974	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	CC			698		695	
	PL			131		479	
	ES					752	
	Total	1		1,023		3,900	
Primitive	PV	50,187		17,099			
	CC	7,016		244			
	PL			529			
	ES	27,405		1,445			
	Total	84,607		19,317			
ROS: Semi-Primitive Non-Motorized	PV	2,641		183,811		38,721	
	CC	765		38,122		58,050	
	PL			143,789		53,758	
	ES	732		84,155		96,446	
	Total	4,138		449,877		246,974	
ROS: Semi-Primitive Motorized	PV	12		45,053		70,360	
	CC	435		31,453		121,254	
	PL			40,689		99,633	
	ES	461		20,919		129,783	
	Total	907		138,114		421,030	
ROS: Roaded Natural	PV	1		7,909		41,004	5,850
	CC	480		28,529		66,138	1
	PL			15,654		29,587	1
	ES	222		6,822		62,229	7
	Total	703		58,914		198,958	5,859
Recreation Residences	PV	42		198			
	CC			579			
	PL						
	ES						
	Total	42		777			
Administrative Sites	PV			114		118	
	CC						
	PL			131		479	
	ES					127	
	Total			245		724	
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC			7,360			
	PL			8,804			
	ES			365			
	Total			16,529			
Sage Grouse Brood Rearing Habitat	PV						
	CC			207	3,208		
	PL						
	ES			4,344	5,217		
	Total			4,551	8,426		
Crucial and Substantial Deer and Elk Winter Range	PV	553		8,775	8,639		
	CC			6,704	26,452		
	PL			33,218	16,368		
	ES			18,711	51,048		
	Total	553		67,408	102,507		
Crucial Deer and Elk	PV	814		82,751	56,577		1

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Summer Range	CC	61		33,580	61,932		
	PL			78,042	70,247		
	ES			82,751	56,577		1
	Total	874		277,123	245,333		2
Raptor Nests							
Goshawk Nest Areas	PV	958		509		686	
	CC	615		9,904		27,156	
	PL			11,451		13,517	
	ES	88		4,657		20,542	
	Total	1,661		26,522		61,901	
Goshawk PFAs	PV	914		627		655	
	CC	700		9,157		25,780	
	PL			11,579		13,396	
	ES	106		4,812		16,612	
	Total	1,720		26,174		56,443	
Peregrine Falcon Nests	PV						
	CC	2,259		743		6,752	
	PL			2,613		5,488	
	ES						
	Total	2,259		3,356		12,239	
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC			6,412			
	PL			30,883			
	ES			12,333			
	Total			49,628			
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336		1,478		623	
	CC	2,782		943		5,468	
	PL			889		6,338	
	ES	701		1,650		6,325	
	Total	23,819		4,960		18,754	
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES			731		2	
	Total			731		2	
Bald Eagle Winter Concentration Areas	PV			1,176		2,436	
	CC			3,719		454	
	PL					1,744	
	ES					1,736	
	Total			4,937		6,328	
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES			12,014		6,033	
	Total			12,014		6,033	
Sensitive Species and Suitable Habitat							
Pygmy Rabbit	PV	11		1,167		10,704	
	CC			2,419		5,600	
	PL			9,668		14,362	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	ES	169		670		5,980	
	Total	180		13,924		36,646	
Sensitive Bats – Potential Habitat	PV	519		89		25	
	CC	42		215		25	
	PL			607		76	
	ES	554		282		15	
	Total	1,115		1,194		142	
Flammulated Owl Habitat	PV	30,559		3,679		3,259	
	CC	5,777		37,936		118,911	
	PL			15,752		59,955	
	ES	7,024		28,901		108,788	
	Total	43,361		86,268		290,912	
Boreal Toad Habitat	PV						
	CC						
	PL			599		45,975	
	ES						
	Total						
Fisheries Habitat	PV	750		1,423		834	
	CC			251		2,259	
	PL			1,747		3,093	
	ES			895		3,036	
	Total	750		4,317		9,222	
California Condor and Peregrine Falcon Rim Habitat	PV	35,750		16,888	13,247		
	CC	5,271		6,425	28,765		
	PL			42,555	60,375		
	ES	27,689		73,474	130,859		
	Total	68,710		139,342	233,246		
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC			58,585			
	PL						
	ES						
	Total			58,585			
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)	PV	12,635		75,395		50,751	
	CC	2,614		15,755		64,748	
	PL			52,652		54,426	
	ES	8,247		23,249		61,278	
	Total	23,496		167,052		220,203	
Municipal Watersheds	PV	6,791		15,410		5,597	
	CC	798		1,403		10,668	
	PL			5,303		1,168	
	ES			1,432		4,834	
	Total	7,589		23,548		22,268	
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401		1,456			
	CC	321		1,052			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	PL			2,865			
	ES	2,618		2,440			
	Total	9,340		7,813			
Slopes > 35 degrees	PV	39,222		68,123		18,713	
	CC	4,973		10,440		40,761	
	PL			67,708		40,768	
	ES	20,564		30,580		40,625	
	Total	64,759		176,851		140,868	
Areas of High Erosion Potential	PV	11,229		17,533		6,649	
	CC	1,031		1,079		9,975	
	PL			11,092		15,265	
	ES			10,029		12,081	
	Total	12,260		39,734		43,971	
Marginally Unstable Slopes	PV						
	CC	772		2,808		10,178	
	PL			7,299		741	
	ES			10,979		11,211	
	Total	772		21,086		22,130	
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2		2,053			
	CC			225			
	PL			531			
	ES	540		1,444			
	Total	542		4,253			
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL			203			
	ES						
	Total			203			
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES			5			
	Total			5			
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088		4,871		950	
	CC	1,571		3,061		15,261	
	PL			18,819		24,900	
	ES	9,099		13,873		28,692	
	Total	14,757		40,623		69,628	
Cultural							
Mountain Meadows	PV	1,441		253		1,126	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Historic Site	CC PL ES						
	Total	1,441		253		1,126	
Long Hollow Historic District	PV CC PL ES					390	
	Total					390	
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Table B-4: Alternative D2 (CSU in IRAs) Acres of each Resource Component under each Leasing Option by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994		1,974			
	CC	6,932		264			
	PL			531			
	ES	28,781		1,444			
	Total	85,707		4,213			
Retention SIO High	PV	41		8,992		44,971	
	CC	1,471		39,256		69,799	
	PL			13,433		75,293	
	ES	36		6,088		142,736	
	Total	1,548		67,769		332,798	
Partial Retention SIO Moderate	PV	2,749		948		151,200	
	CC	72		15,250		83,843	
	PL			17,895		120,806	
	ES	7		6,354		134,168	
	Total	2,829		40,447		490,017	
Modification SIO Low	PV	56		6,594		53,529	
	CC	74		9,567		26,803	
	PL			5,216		125,125	
	ES			2,246		63,925	
	Total	130		23,622		269,383	
Modification SIO Unassigned	PV			117		135,699	
	CC	154		5,272		93,666	
	PL			395		25,084	
	ES			285		44,635	
	Total	154		6,669		299,084	
NPS Park Protective Measure	PV						
	CC						
	PL					1,926	
	ES						
	Total					1,926	
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557		15,527		235,258	
	CC			19,091		28,751	
	PL			4,061		163,356	
	ES	2,080		2,937		96,940	
	Total	4,637		41,616		524,306	
Unroaded-Undeveloped Areas	PV	54,506		18,523		308,447	444
	CC	7,572		22,803		70,193	
	PL	7		5,142		197,964	
	ES	2,907		8,850		182,735	
	Total	88,327		55,319		759,339	444
Suitable Wild and Scenic Rivers	PV						
	CC			7		273	
	PL						
	ES	5,733					
	Total	5,733		7		273	
Recreation							
Developed Sites	PV	1		193		1,975	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	CC			667		726	
	PL			118		492	
	ES					752	
	Total	1		978		3,945	
Primitive	PV	50,187		17,099			
	CC	7,016		244			
	PL			529			
	ES	27,405		1,445			
	Total	84,607		19,317			
ROS: Semi-Primitive Non-Motorized	PV	2,641		1,256		221,275	
	CC	765		15,851		80,320	
	PL			4,769		192,778	
	ES	732		3,746		176,855	
	Total	4,138		25,622		671,229	
ROS: Semi-Primitive Motorized	PV	12		74		115,340	
	CC	435		25,608		127,099	
	PL			16,841		123,480	
	ES	461		5,451		145,251	
	Total	907		47,974		511,170	
ROS: Roaded Natural	PV	1		195		48,718	
	CC	480		27,896		66,771	
	PL			15,166		30,075	
	ES	222		5,763		63,288	
	Total	703		49,020		208,851	
Recreation Residences	PV	42		198			
	CC			579			
	PL						
	ES						
	Total	42		777			
Administrative Sites	PV			113		119	
	CC						
	PL			118		492	
	ES					127	
	Total			231		738	
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC			7,360			
	PL			8,804			
	ES			365			
	Total			16,529			
Sage Grouse Brood Rearing Habitat	PV						
	CC			19		3,396	
	PL						
	ES			4,344		5,217	
	Total			4,363		8,614	
Crucial and Substantial Deer and Elk Winter Range	PV	553		179	17,235		
	CC			208	32,948		
	PL			17,746	31,841		
	ES			1,285	68,474		
	Total	553		19,417	150,498		
Crucial Deer and Elk	PV	814		3,716	135,612		1

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Summer Range	CC	61		26,686	68,827		
	PL			3,255	145,034		
	ES			3,716	135,612		1
	Total	874		37,373	485,084		2
Raptor Nests							
Goshawk Nest Areas	PV	958		89		1,106	
	CC	615		7,478		29,582	
	PL			1,816		23,152	
	ES	88		1,620		23,579	
	Total	1,661		11,003		77,420	
Goshawk PFAs	PV	914		47		1,235	
	CC	700		6,227		28,710	
	PL			1,598		23,377	
	ES	106		1,591		19,833	
	Total	1,720		9,463		73,154	
Peregrine Falcon Nests	PV						
	CC	2,259		743		6,752	
	PL			212		7,889	
	ES						
	Total	2,259		955		14,640	
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC			6,412			
	PL			30,883			
	ES			12,333			
	Total			49,628			
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336		799		1,302	
	CC	2,782		907		5,504	
	PL			190		7,037	
	ES	701		281		7,693	
	Total	23,819		2,178		21,536	
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES			72		660	
	Total			72		660	
Bald Eagle Winter Concentration Areas	PV					3,612	
	CC			3,719		454	
	PL					1,744	
	ES					1,736	
	Total			3,719		7,546	
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES			929		17,119	
	Total			929		17,119	
Sensitive Species and Suitable Habitat							
Pygmy Rabbit	PV	11		307		11,565	
	CC			1,950		6,070	
	PL			6,591		17,439	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	ES	169		171		6,479	
	Total	180		9,018		41,553	
Sensitive Bats – Potential Habitat	PV	519		25		89	
	CC	42		214		26	
	PL			493		191	
	ES	554		239		58	
	Total	1,115		971		365	
Flammulated Owl Habitat	PV	30,559		1,848		5,090	
	CC	5,777		29,288		127,559	
	PL			4,812		70,895	
	ES	7,024		2,438		135,250	
	Total	43,361		38,385		338,795	
Boreal Toad Habitat	PV						
	CC						
	PL			589		45,985	
	ES						
	Total			589		45,985	
Fisheries Habitat	PV	750		524		1,733	
	CC			144		2,366	
	PL			134		4,706	
	ES			15		3,916	
	Total	750		817		12,721	
California Condor and Peregrine Falcon Rim Habitat	PV	35,750		1,655	28,480		
	CC	5,271		6,183	29,007		
	PL			2,261	100,669		
	ES	27,689		5,274	199,059		
	Total	68,710		15,373	357,215		
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC			58,585			
	PL						
	ES						
	Total			58,585			
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)	PV	12,635		5,630		120,517	
	CC	2,614		9,241		71,263	
	PL			9,374		86,703	
	ES	8,247		3,186		81,341	
	Total	23,496		27,431		359,824	
Municipal Watersheds	PV	6,791		5,629		15,379	
	CC	798		240		11,831	
	PL			27		6,444	
	ES			5		6,260	
	Total	7,589		5,901		39,915	
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401		1,456			
	CC	321		1,052			

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
	PL			2,865			
	ES	2,618		2,440			
	Total	9,340		7,813			
Slopes > 35 degrees	PV	39,222		6,902		79,935	
	CC	4,973		3,606		47,595	
	PL			3,576		104,900	
	ES	20,564		3,177		68,028	
	Total	64,759		17,261		300,458	
Areas of High Erosion Potential	PV	11,229		1,593		22,588	
	CC	1,031		836		10,219	
	PL			1,222		25,135	
	ES			1,939		20,171	
	Total	12,260		5,590		78,114	
Marginally Unstable Slopes	PV						
	CC	772		733		12,253	
	PL			1,276		6,764	
	ES			291		21,898	
	Total	772		2,300		40,916	
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2		2,053			
	CC			225			
	PL			531			
	ES	540		1,444			
	Total	542		4,253			
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL			203			
	ES						
	Total						
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES			5			
	Total			5			
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088		806		5,014	
	CC	1,571		2,887		15,261	
	PL			7,793		35,926	
	ES	9,099		6,703		35,862	
	Total	14,757		18,189		92,062	
Cultural							
Mountain Meadows	PV	1,441				1,380	

Resource Component	Ranger District[3]	Acres[1] under each Leasing Option					
		NA	NL	NSO	TL	CSU	SLT[2]
Historic Site	CC						
	PL ES						
	Total	1,441				1,380	
Long Hollow Historic District	PV CC PL ES					390	
	Total					390	
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Table B-5: Alternative E1 (NSO in IRAs) Acres of each Resource Component under each Leasing Stipulation by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994		1,387			618
	CC	6,932					264
	PL			531			
	ES	28,781		1,329			115
	Total	85,707		3,217			997
Retention SIO High	PV	41		26,322			27,641
	CC	1,471		22,489			86,566
	PL			29,500			59,226
	ES	36		50,115			98,709
	Total	1,548		128,426			272,141
Partial Retention SIO Moderate	PV	2,749		60,081			97,917
	CC	72		5,777			93,316
	PL			45,507			93,193
	ES	7		30,698			109,824
	Total	2,829		142,064			394,249
Modification SIO Low	PV	56		50,597			9,526
	CC	74		9,112			27,259
	PL			89,449			40,893
	ES			10,227			55,944
	Total	130		159,384			133,621
Modification SIO Unassigned	PV			112,429			23,387
	CC	154		10,405			88,428
	PL			2,431			23,049
	ES			7,499			37,421
	Total	154		132,814			172,339
NPS Park Protective Measure	PV						
	CC						
	PL						1,926
	ES						
	Total						1,926
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557		250,786			
	CC			47,842			
	PL			167,417			
	ES	2,080		99,877			
	Total	4,637		565,922			
Unroaded-Undeveloped Areas	PV	54,506		244,130			83,284
	CC	7,572		40,840			52,157
	PL	7		160,555			42,551
	ES	28,451		81,277			110,308
	Total	88,327		526,802			288,300
Suitable Wild and Scenic Rivers	PV						
	CC						279
	PL						
	ES	5,733					
	Total	5,733					279
Recreation							
Developed Sites	PV	1		1			2,167

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
	CC			38			1,355
	PL			13			597
	ES						752
	Total	1		52			4,871
Primitive	PV	50,187		14,586			2,513
	CC	7,016					244
	PL			529			
	ES	27,405		1,328			117
	Total	84,607		16,443			2,874
ROS: Semi-Primitive Non-Motorized	PV	2,641		183,469			41,384
	CC	765		33,953			62,219
	PL			142,025			55,863
	ES	732		81,834			98,767
	Total	4,138		441,281			255,570
ROS: Semi-Primitive Motorized	PV	12		45,000			75,712
	CC	435		11,999			140,708
	PL			24,373			116,001
	ES	461		15,620			135,081
	Total	907		96,994			462,151
ROS: Roaded Natural	PV	1		7,719			47,044
	CC	480		1,885			92,783
	PL			489			50,604
	ES	222		1,092			41,983
	Total	703		11,185			252,546
Recreation Residences	PV	42					241
	CC						579
	PL						
	ES						
	Total	42					777
Administrative Sites	PV			2			230
	CC						
	PL						489
	ES						127
	Total			2			846
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC			134			7,726
	PL			1,475			7,330
	ES						365
	Total			1,609			14,920
Sage Grouse Brood Rearing Habitat	PV						
	CC			188			3,227
	PL						
	ES						9,562
	Total			188			12,789
Crucial and Substantial Deer and Elk Winter Range	PV	533					8,731
	CC						26,660
	PL						32,637
	ES						52,111
	Total	533		49,776			120,139
Crucial Deer and Elk	PV	814					58,262

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Summer Range	CC	61					83,176
	PL						72,862
	ES						16,875
	Total	874		171,168			231,175
Raptor Nests							
Goshawk Nest Areas	PV	1,890		422			774
	CC	1,072		4,098			32,926
	PL			9,722			15,246
	ES	179		3,184			22,015
	Total	3,140		17,426			70,996
Goshawk PFA	PV	914		585			697
	CC	700		4,535			30,402
	PL			10,059			14,916
	ES	106		3,256			18,168
	Total	1,720		18,435			64,182
Peregrine Falcon Nests	PV						
	CC	2,259					7,495
	PL			2,408			5,693
	ES						
	Total	2,259		2,408			13,188
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC			753			6,227
	PL						30,473
	ES						12,176
	Total			753			48,875
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336		1,426			675
	CC	2,782		46			6,365
	PL			741			6,486
	ES	701		1,622			6,353
	Total	23,819		3,843			19,879
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES			730			2
	Total			730			2
Bald Eagle Winter Concentration Areas	PV			1,176			2,436
	CC			50			4,122
	PL						1,744
	ES						1,736
	Total			1,226			10,038
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES			11,923			6,124
	Total			11,923			6,124

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Sensitive Species and Suitable Habitat							
Pygmy Rabbit	PV	11		1,147			10,725
	CC			535			7,484
	PL			3,291			20,739
	ES	169		501			6,149
	Total	180		5,474			45,097
Sensitive Bats – Potential Habitat	PV	519		78			36
	CC	42		6			234
	PL			397			287
	ES	554		213			85
	Total	1,115		694			642
Flammulated Owl Habitat	PV	30,559		3,410			3,528
	CC	5,777		13,481			143,366
	PL			10,991			64,716
	ES	7,024		27,156			110,532
	Total	43,361		55,038			322,143
Boreal Toad Habitat	PV						
	CC						
	PL			10			50,156
	ES						
	Total			10			50,156
Fisheries Habitat	PV			1,126			1,131
	CC			108			2,402
	PL			1,616			3,223
	ES			881			3,050
	Total			3,731			9,807
California Condor and Peregrine Falcon Rim Habitat	PV	35,750		16,614			13,521
	CC	5,271		1,568			33,622
	PL			41,529			61,401
	ES	27,689		70,928			133,405
	Total	68,710		130,639			241,949
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC			18,821			39,765
	PL						
	ES						
	Total			18,821			39,765
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)	PV	20,887		74,300			51,847
	CC	4,222		7,141			73,363
	PL			44,306			51,771
	ES	13,134		20,585			63,942
	Total	38,243		146,332			240,923
Municipal Watersheds	PV	6,791		14,669			6,338
	CC	798		1,190			10,882
	PL			5,303			1,168
	ES			1,432			4,834

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
	Total	7,589		22,594			23,222
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401		1,078			378
	CC	321		59			993
	PL			1,645			1,120
	ES	2,618		1,617			823
	Total	9,340		4,400			3,413
Slopes > 35 degrees	PV	39,222		66,991			1,133
	CC	4,973		7,041			44,160
	PL			66,219			42,257
	ES	20,564		29,571			41,634
	Total	64,759		169,821			147,897
Areas of High Erosion Potential	PV	11,229		17,384			6,797
	CC	1,031		244			10.811
	PL			10,358			15,999
	ES			9,710			12,400
	Total	12,260		37,696			46,008
Marginally Unstable Slopes	PV						
	CC	772		2,101			10.885
	PL			7,126			915
	ES			10,745			11,444
	Total	772		19			23,244
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2		1,359			694
	CC						225
	PL			531			
	ES	540		1,329			115
	Total	542		3,219			1,034
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL						203
	ES						
	Total						203
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES						
	Total			5			
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088		4,592			1,229
	CC	1,571		868			17,279
	PL			11,569			32,150

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
	ES	9,099		8,116			34,448
	Total	14,757		25,145			85,106
Cultural							
Mountain Meadows Historic Site	PV CC PL ES	1,441		253			1,126
	Total	1,441		253			1,126
Long Hollow Historic District	PV CC PL ES						390
	Total						390
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Table B-6: Alternative E2 (SLT in IRAs) Acres of each Resource Component under each Leasing Stipulation by Ranger District

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Visual Resources							
Retention SIO Very High	PV	49,994					1,974
	CC	6,932					264
	PL						531
	ES	28,781					1,444
	Total	85,707					4,213
Retention SIO High	PV	41					53,963
	CC	1,471					109,055
	PL						88,725
	ES	36					148,824
	Total	1,548					400,567
Partial Retention SIO Moderate	PV	2,749					157,997
	CC	72					99,093
	PL						138,701
	ES	7					140,522
	Total	2,829					536,313
Modification SIO Low	PV	56					60,123
	CC	74					36,370
	PL						130,341
	ES						66,171
	Total	130					293,050
Modification SIO Unassigned	PV						135,815
	CC	154					98,938
	PL						25,480
	ES						44,921
	Total	154					305,153
NPS Park Protective Measure	PV						
	CC						
	PL						1,926
	ES						
	Total						1,926
Roadless Areas; Wild and Scenic Rivers							
Inventoried Roadless Areas	PV	2,557					250,786
	CC						47,842
	PL						167,417
	ES	2,080					99,877
	Total	4,637					565,922
Unroaded-Undeveloped Areas	PV	54,506					327,414
	CC	7,572					92,997
	PL	7					203,106
	ES	28,451					191,585
	Total	88,327					815,102
Suitable Wild and Scenic Rivers	PV						
	CC						279
	PL						
	ES	5,733					
	Total	5,733					279
Recreation							

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Developed Sites	PV	1					2,168
	CC						1,393
	PL						610
	ES						752
	Total	1					4,923
Primitive	PV	50,187					17,099
	CC	7,016					244
	PL						529
	ES	27,405					1,445
	Total	84,607					19,317
ROS: Semi-Primitive Non-Motorized	PV	2,641					224,853
	CC	765					96,172
	PL						197,889
	ES	732					180,601
	Total	4,138					696,851
ROS: Semi-Primitive Motorized	PV	12					115,414
	CC	435					152,708
	PL						140,321
	ES	461					150,702
	Total	907					559,144
ROS: Roaded Natural	PV	1					54,763
	CC	480					94,668
	PL						45,242
	ES	222					69,058
	Total	703					263,731
Recreation Residences	PV	42					198
	CC						579
	PL						
	ES						
	Total	42					777
Administrative Sites	PV						232
	CC						
	PL						489
	ES						127
	Total						848
Fish and Wildlife							
Sage Grouse Leks	PV						
	CC						7,360
	PL						8,804
	ES						365
	Total						16,529
Sage Grouse Brood Rearing Habitat	PV						
	CC						3,415
	PL						
	ES						9,562
	Total						12,977
Crucial and Substantial Deer and Elk Winter Range	PV	533					17,414
	CC						33,156
	PL						49,587
	ES						69,759

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
	Total	533					169,915
Crucial Deer and Elk Summer Range	PV	814					139,329
	CC	61					95,512
	PL						148,289
	ES						19,214
	Total	874					402,344
Raptor Nests							
Goshawk Nest Areas	PV	1,890					1,195
	CC	1,072					37,060
	PL						24,968
	ES	179					25,199
	Total	3,140					88,423
Goshawk PFA	PV	914					1,282
	CC	700					34,937
	PL						24,975
	ES	106					21,424
	Total	1,720					82,617
Peregrine Falcon Nests	PV						
	CC	2,259					7,495
	PL						8,101
	ES						
	Total	2,259					15,596
Threatened, Endangered, and Candidate Species and Suitable Habitat							
Prairie Dog	PV						
	CC						6,412
	PL						30,883
	ES						12,333
	Total						49,628
Mexican Spotted Owl Potential Habitat (unverified)	PV	20,336					2,101
	CC	2,782					6,411
	PL						7,227
	ES	701					7,974
	Total	23,819					23,713
Mexican Spotted Owl Protected Activity Centers (PAC)	PV						
	CC						
	PL						
	ES						732
	Total						732
Bald Eagle Winter Concentration Areas	PV						3,612
	CC						4,173
	PL						1,744
	ES						1,736
	Total						11,265
Designated Critical Habitat							
Mexican Spotted Owl Critical Habitat	PV						
	CC						
	PL						
	ES						18,048
	Total						18,048
Sensitive Species and Suitable Habitat							

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Pygmy Rabbit	PV	11					11,871
	CC						8,019
	PL						24,030
	ES	169					6,650
	Total	180					50,571
Sensitive Bats – Potential Habitat	PV	519					114
	CC	42					241
	PL						684
	ES	554					298
	Total	1,115					1,336
Flammulated Owl Habitat	PV	30,559					6,938
	CC	5,777					156,847
	PL						75,707
	ES	7,024					137,688
	Total	43,361					377,180
Boreal Toad Habitat	PV						
	CC						
	PL						50,166
	ES						
	Total						50,166
Fisheries Habitat	PV						2,257
	CC						2,511
	PL						4,840
	ES						3,931
	Total						13,539
California Condor and Peregrine Falcon Rim Habitat	PV	35,750					30,134
	CC	5,271					35,190
	PL						102,930
	ES	27,689					204,333
	Total	68,710					372,588
Migratory Birds	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Water and Watershed Resources							
Lava Fields over Sensitive Aquifers	PV						
	CC						58,585
	PL						
	ES						
	Total						58,585
Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)	PV	20,887					126,147
	CC	4,222					80,504
	PL						96,077
	ES	13,134					84,527
	Total	38,243					387,256
Municipal Watersheds	PV	6,791					21,008
	CC	798					12,071
	PL						6,471
	ES						6,266
	Total	7,589					45,816

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
Soils and Geologic Hazards							
Active Rockfall and Landslide Areas	PV	6,401					1,456
	CC	321					1,052
	PL						2,865
	ES	2,618					2,440
	Total	9,340					7,813
Slopes > 35 degrees	PV	39,222					86,837
	CC	4,973					51,201
	PL						108,476
	ES	20,564					71,205
	Total	64,759					317,718
Areas of High Erosion Potential	PV	11,229					24,181
	CC	1,031					11,055
	PL						26,357
	ES						22,111
	Total	12,260					83,704
Marginally Unstable Slopes	PV						
	CC	772					12,986
	PL						8,041
	ES						22,189
	Total	772					43,216
Cave Resources	PV	Not included in GIS analysis.					
	CC						
	PL						
	ES						
	Total						
Vegetation							
Wetlands, Floodplains, and Riparian Vegetation	PV	See Water and Watershed Resources - 'Streams, Lakes, Wetlands, Floodplains, and Riparian Areas (300-ft buffer)'					
	CC						
	PL						
	ES						
	Total						
Research Natural Area (RNA)	PV	2					2,053
	CC						225
	PL						531
	ES	540					1,444
	Total	542					4,253
Botanical and Geological Areas (Red Canyon Botanical Area)	PV						
	CC						
	PL						203
	ES						
	Total						203
Side Hollow Ponderosa Pine Provenance Study	PV						
	CC						
	PL						
	ES						5
	Total						5
Sensitive Plant Species and Suitable Plant Habitat	PV	4,088					5,821
	CC	1,571					18,148
	PL						43,718
	ES	9,099					42,565

Resource Component	Ranger District[3]	Acres[1] under each Stipulation					
		NA	NL	NSO	TL	CSU	SLT[2]
	Total	14,757					110,251
Cultural							
Mountain Meadows Historic Site	PV CC PL ES	1,441					1,380
	Total	1,441					1,380
Long Hollow Historic District	PV CC PL ES						390
	Total						390
Iron Town Historic District	PV CC PL ES	Not included in GIS analysis.					
	Total						
Boulder Area/Cedar Mtn and Concentrated Sites	PV CC PL ES	Not included in GIS analysis.					
	Total						

[1] All acreage comes from the best GIS data available; however, it is not considered 100-percent compete. Acreages are rounded.
[2] Includes acres of Lease Notice and Standard Lease Term, where applicable.
[3] Ranger District abbreviations are as follows: Pine Valley (PV), Cedar City (CC), Powell (PL), and Escalante (ES).

Appendix C - Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements

Dixie National Forest Oil and Gas Construction and Operating Standards and Well Site Design Requirements

I. INTRODUCTION

The following operating standards and well site design requirements would be required by the Dixie National Forest for oil and gas facilities and operations to assure consistency with management objectives for the Forest. These operating standards should not be confused with stipulations contained in the applicable Federal oil and gas lease(s) which specify requirements regarding surface occupancy and timing within the specific areas in the lease. Operating standards must be consistent with the rights and restrictions established in the applicable lease(s) and are applicable to all drilling and production operations, unless otherwise approved by the responsible officer based on site-specific conditions.

These operating standards supplement the general requirements of the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (Gold Book) and Best Management Practices in place by the responsible agencies at the time of approval, and the Forest Service, Region 4 Oil and Gas Roading Guidelines. Copies will be made available to operators at first notification of proposed operations.

Authority to require such standards is provided by the Mineral Leasing Act of 1920, as amended, Federal Regulations at 36 CFR 228.106-108 and Onshore Oil and Gas Orders (Submission, Review, and Approval of Surface Use Plans of Operations by the Forest Service and Submission, Review, and Approval of Drilling Plans by the BLM) and 43 CFR 3162.3 (BLM procedures for approval of post-lease applications for operations).

II. PURPOSE

These operating standards have been developed to help operators meet agency and Forest requirements when planning operations and preparing their Surface Use Plan of Operations and to assure overall consistency with Forest Service management objectives/direction. They have been developed based on experience with oil and gas operations on National Forest System lands as needed to prevent or mitigate effects and conflicts with other uses.

III. PROCESS

Approvals of proposed operations on lease are subject to the application, review, and approval provisions specified in Onshore Oil and Gas Order No. 1, other Onshore Oil and Gas Orders, and all applicable laws and regulations. Surface disturbing proposals must be evaluated under the requirements of the National Environmental Policy Act of 1969 and the Energy Policy Act of 2005. Operators are encouraged to obtain these operating standards from the Forest Service early in the planning and approval process and to incorporate them into their Surface Use Plans of Operations to help streamline the NEPA analysis and approval process. If not incorporated into the initial SUPO, the Forest Service will work with the operator to revise the SUPO to include them or may otherwise require them as Conditions of Approval (COA).

The USFS and BLM will delegate authority and responsibility as outlined in the provisions of the National BLM / U.S. Forest Service MOU *Concerning Oil and Gas Leasing and Operations,* FS Agreement No.: 06-SU-11132428-052 (2006). The USFS retains sole responsibility for making decisions with regard to the analysis of surface impacts and is ultimately responsible for the accuracy of the information. The BLM retains sole responsibility for making decisions with regard to the analysis of subsurface impacts.

Other standards or mitigations may be required based on site-specific evaluations of proposed activities. They may be modified if needed to address site-specific conditions. Operators are required to comply with all other applicable laws and regulations.

IV. OPERATING STANDARDS

These standards apply to the lease holder, contractors, and their sub-contractors. The term "operator" as used herein, includes the lease holder and/or company authorized to conduct operations on the lease or their contractors, subcontractors, and all employees or agents thereof.

1. The operator shall submit for review and approval, a detailed construction and maintenance plan for all exploration and production facilities and roads to be constructed or improved (reconstructed) for operations. Unless otherwise approved by the responsible Forest Service officer, pad designs must be consistent with requirements contained in the Dixie National Forest Well Site Requirements (see Drawing No. 1 at the back of this document). A road-use permit (or specific approval as part of the Surface Use Plan of Operations) must be obtained from the Forest Service for commercial use, improvement, and maintenance of National Forest System roads under authority of the National Forest Roads and Trails Act. Road designs must be generally consistent with the Forest Service guidelines provided in the Oil and Gas Roading Guidelines, R-4.

2. The designs for roads, pads, and other facilities are subject to approval by the Forest Service. The designs must be approved and signed by a qualified licensed engineer. Any modifications to approved plans are subject to Forest Service review and approval.

3. Existing roads will be used to the extent possible as long as the existing alignment can be used or improved to the required standard. Additional roads or rerouting of existing road segments, if needed, shall be minimized and approved by the Forest Service prior to construction. Roads or road segments replaced and/or abandoned by construction of new roads or rerouting must be reclaimed by the operator. Road locations and designs must be generally consistent with the Forest Service guidelines provided in the Oil and Gas Roading Guidelines, R-4.

4. Locate and design roads and drainage structures to prevent slope failure and minimize impacts on water quality. To the maximum extent feasible, locate facilities, including service and refueling areas, on benches upslope from streams, lakes, ponds, riparian areas, and floodplains.

5. A pre-construction meeting including the responsible company representative(s), contractors, and the Forest Service must be conducted at the project work site

prior to commencement of operations. Earthwork must be construction staked prior to this meeting. Approval of the designs and earthwork staking by responsible Forest Service official is required prior to beginning earthwork.

6. A Spill Prevention Control and Countermeasures (SPCC) Plan consistent with the current EPA Region VIII Oil and Hazardous Substances Regional Contingency Plan must be filed with the Forest Service and approved by the authorized officer prior to conducting any construction and operations on National Forest System lands. The plan must address the potential for spills to occur from haulage of materials and supplies to the construction/operations site(s) as well as drilling and production facilities. Material Safety Data Sheets (MSDS) for all potentially hazardous substances used for operations used for operations must be available on-site. Operators must be trained in MSDS protocols.

7. All surface disturbing activities, including reclamation, must be supervised by a qualified on-site responsible designated company representative(s) familiar with the approved plans as well as terms and conditions of approval. The designated representative(s) must be available for contact within the vicinity of the project area or by telephone at all times that operations are in progress. The name and contact telephone number of the designated company representative(s) must be filed with the responsible Forest Service official. A copy of all approved permits with specifications relative to operations in the project area must be available for inspection at the project site.

8. Topsoil must be salvaged from the area to be disturbed, stored, and protected from erosion and contamination until redistributed over recontoured areas during interim reclamation. The depth of topsoil to be salvaged must be determined though testing and approved by the Forest Service. Methods of topsoil handling and storage must be approved in project plans and specifications and/or appropriate project permits.

9. All vegetation removed by operations must be stored, used for reclamation, or disposed of as approved in project permits or as specified by the Forest Service. The operator must reimburse the Forest Service for the fair market value of all merchantable timber removed or damaged during operations. Prior to vegetation disturbance/removal all noxious weeds must be removed from the site and handled by approved methods needed to prevent spread of seeds.

10. Where determined appropriate by the responsible Forest Service officer, the operator may be required to bury pipelines and powerlines in or adjacent to roads to reduce surface disturbance and visibility. Designs must provide sufficient depth of cover and signs to indicate the type of pipeline(s), location, and depth to prevent damage from road maintenance and other surface disturbing activities in conformance with applicable Federal and State regulations.

11. Where feasible and appropriate, the operator will be required to centralize production facilities, use telemetry to monitor wells, and delay non-essential maintenance activities in important wildlife habitat during critical seasons of use to reduce the number of vehicle trips to the sites and activity that could disturb or stress wildlife.

12. Where needed to protect wildlife, the operator will be required to construct fences and/or nets on reserve pits or use other approved methods to prevent wildlife use or entrapment.

13. Stream crossings will be planned and constructed to minimize disturbance of the riparian and aquatic habitats by locating crossings at the most advantageous location and by crossing at or near the perpendicular. Structures must be designed to allow fish passage as needed to maintain habitat. Measures must be taken to minimize disruption of stream substrate. When no longer needed for operations, crossings must be removed and the stream and banks restored to pre-disturbance conditions/stream hydraulics. Sediment control measures must be used to minimize sediment introduction during all operations. Timing restrictions (construction and reclamation) may be needed to protect fisheries as coordinated with the Utah Division of Wildlife Resources and through permitting with the Utah Division of Water Rights, Stream Alteration Program.

14. Unless otherwise specified by the responsible Forest Service officer, new oil and gas access roads shall be closed to the public. Operators must construct and maintain gates to Forest Service design standards at intersections of project access roads with National Forest System roads or other highways to prevent unauthorized traffic from entering. A locking system will be required to allow a Forest Service lock in addition to the operator's lock.

15. Off-road vehicle travel is prohibited unless specifically approved in project permits.

16. Roads used for drilling and production operations which remain open to public traffic must be properly signed to warn the public of project traffic and associated hazards. Signs must be consistent with the Manual on Uniform Traffic Control Devises, Federal Highway Administration.

17. Vehicle operators must obey posted speed restrictions. If speed restrictions are not posted, the operator and contractors must observe safe speeds commensurate with weather and road conditions.

18. Watering and/or application of appropriate dust suppressants shall be used if dust becomes a concern for visibility and sediment transport. Suppressants and application procedures are subject to approval by the responsible Forest Service officer.

19. Unless otherwise approved by the responsible Forest Service officer, all production pads will be fenced to prevent entry by the public and livestock. Designs and specifications are subject to Forest Service approval.

20. Sediment control structures will be used to catch sediment at the base of fill slopes on exploration and production pads. If silt fences are used, they must be constructed with adequate support and maintained to assure that they function at all times, including the winter season and spring runoff.

21. Establishment of staging areas or camp areas outside of the area permitted for surface disturbing operations for project personnel (operator or contractors) on National Forest System lands is subject to Forest Service approval.

22. All permanent survey markers within the area to be disturbed, including section corners, benchmarks, geodetic survey monuments, etc. must be located and flagged for protection prior to any surface disturbance activities. Disturbance or relocation of monuments requires the approval of the agency responsible for their use and preservation.

23. Water needed for operations must be obtained in accordance with State water law. The location and design of diversions on National Forest System lands are subject to review and approval of the responsible Forest Service official.

24. The operator and all contractors shall take measures needed for the prevention of fires started as a result of their operations and to suppress fires that are started as a result of their operations. Fire suppression equipment must be available to all personnel in the project area consisting of shovels, axes, and other appropriate hand tools. At least one properly rated fire extinguisher must be available in each vehicle and around all machinery such that they are readily assessable for suppression of fires. During times of severe fire danger when fire restrictions are implemented by order of the responsible Forest Service officer, all operations must be conducted in conformance with the order. The operator may be required to submit and implement a Fire Prevention/Suppression Plan for review/approval by the responsible Forest Service official.

25. All vehicles and other gasoline/diesel-powered equipment must be equipped with properly functioning spark arresters and mufflers. Spark arresters must meet Forest Service specifications in accordance with USDA Forest Service Spark Arrester Guide.

26. The operator will be held responsible for damage and suppression costs for fires started as a result of operations. Fires must be immediately suppressed to prevent spreading and must be reported to the responsible Forest Service officer.

27. The operator must maintain structures, facilities, improvements, and equipment in a safe and neat manner and in accordance with approved permits. The operator must take appropriate measures in accordance with applicable Federal and State laws and regulations to protect the public from hazardous or conditions resulting from the operations. Such measures must include, but are not limited to, posting signs, building fences, or otherwise identifying the potentially hazardous site or condition.

28. All accidents or mishaps resulting in resource/property damage and/or serious personal injury must be reported to the responsible Forest Service officer as soon as possible.

29. The operator may be required to locate pads and facilities in areas where they can be effectively screened from view from sensitive areas. Production facilities must be located and designed to minimize visibility from sensitive viewing areas. Painting of facilities with a non-reflective paint in the color that would best blend with the background will be required. The color will be determined by the operator with approval of the responsible Forest Service officer.

30. Light pollution will be mitigated by using methods such as limiting height of light poles, timing of lighting operations, limiting wattage intensity, and constructing light shields. If a determination is made that natural barriers or view sheds will meet these mitigation objectives, the above requirements may not apply.

31. The operator must comply with all applicable laws and regulations pertaining to the storage, use, and disposal of hazardous substances and solid or liquid waste. All fluids, chemicals, and solid wastes must be properly contained on-site. Reserve pits, catchment ponds, and bermed areas must be constructed to prevent seepage into the ground or adjacent areas. A minimum of 2-feet of freeboard must be maintained in all reserve pits and ponds at all times to prevent overflow and spillage into adjacent areas.

32. Chemical containers should not be stored on bare ground or exposed to the sun or moisture. Containers and labels are subject to degradation and punctured drums could leak contents onto the ground. Chemical containers should be maintained in good condition and placed within secondary containment in case of a spill or puncture. Secondary containment facilities must be of sufficient size to contain all appropriate fluids, including diesel or other fuels.

33. Sanitary facilities must be available to operators and contractors in the project area and properly used and maintained to prevent pollution. The installation of sanitary facilities, other than self-contained chemical toilets is subject to State and Forest Service approval.

34. Unless other methods are specifically approved, all solid wastes, contaminated soil materials, drill cuttings, petroleum products, and other fluids must be properly contained on-site. Disposal of associated waste materials must be at a facility licensed by the State to accept such materials.

35. Harassment of wildlife is prohibited. Pets must be properly restrained to prevent harassment of wildlife, livestock, government officials, and the public.

36. Move-in and move-out of heavy construction and drilling equipment will not be allowed during the opening weekends of the general big-game hunts or holiday weekends (including the observed holiday) from noon the previous day until midnight on Sunday or the observed holiday. Use and maintenance of National Forest System roads is regulated under authority of the National Forest Roads and Trails Act and the National Forest Management Act.

37. Vegetation seeding methods and seed mixes (species and amounts) used for interim and final reclamation must be approved by the Forest Service. Reclamation and revegetation plans and standards for success must be approved in project plans or permits. All vegetation materials, seeds, soil amendments, and sediment control materials must be certified that no noxious weed seed or noxious weeds are present. The operator is responsible for control and eradication of noxious weeds in project area, and the control and eradication of any invasive plant species not present at the site prior to operations, until such time as reclamation standards are met and the company is relieved of further reclamation responsibilities.

38. Vehicles and equipment shall be free of mud, soil, plant materials, and other debris which could contain noxious weed seeds prior to coming onto the Forest. This is needed to avoid transporting noxious weeds, or invasive species to sites on the Forest.

39. The operator shall follow Forest guidelines designed to prevent the introduction and spread of aquatic nuisance species (Dixie and Dixie National Forest Supplement, Forest Handbook 2509.16, chapter 1.

40. Operation of mechanical equipment off of designated routes should be avoided during periods when soils are susceptible to puddling, rutting, and compaction. Operation of mechanical equipment on designated routes should be avoided during periods when routes are susceptible to puddling and the formation of ruts 6 inches deep or greater, unless mitigation is provided for such as drainage and surfacing. The purpose of these standards is to prevent excessive soil erosion, stream sedimentation, and excessive damage to road systems resulting from construction activities during saturated conditions.

41. The operator shall comply with the following practices to control impacts to ambient air quality from oil and gas exploration and production activities:

a. As appropriate, quantitative analysis of potential air quality impacts will be conducted for project-specific developments by the operator, in concert with direction from the Utah Department of Environmental Quality, Division of Air Quality (UDAQ), the Forest Service and cooperating federal land management agencies including but not limited to the National Park Service. The Forest Service will notify cooperating agencies as project specific proposals are received and additional air impact analyses are performed to ensure input from those agencies. Additional project specific air impact analyses would need to be conducted if the following project criteria are fulfilled:

i. If an exploration drilling project is proposed within 5km of an adjacent Class I area, air quality related value (AQRV) impacts would need to be addressed utilizing at a minimum the VISCREEN screening tool. Additional air impact analyses may be necessary based on the review of the initial VISCREEN analysis.

ii. If an oil and gas production project is proposed at a distance of over 60km from an adjacent Class I area and has emissions that exceed those utilized in the existing “Dixie 20-well development scenario", A quantitative air quality impact analysis would need to be conducted for the project that follows the guidance found in the FLAG modeling guidelines.

iii. If an oil and gas production project is proposed within 60km of an adjacent Class I area and has emissions that equal or exceed those utilized in the existing “Dixie 20-well development scenario", a quantitative air quality impact analysis would need to be conducted for the project that follows the guidance found in the FLAG modeling guidelines.

iv. If an exploratory drilling or oil and gas development project is proposed to occur within 60km of an adjacent Class I area and has emissions that are greater than those utilized in the existing "exploratory drilling scenario" but less than those utilized in the "Dixie 20-well development scenario", consultation with the Forest Service and cooperating Federal Agencies would be required to determine an appropriate assessment of air quality impacts. The level of

additional analysis would be predicated on the size of the proposed project.
b. Compliance with Utah Air Conservation (UAC) Regulation R446-1 would be necessary. The best air quality control technology, as per guidance from the UDAQ, will be applied to actions as needed to meet air quality standards.
c. The operator will comply with UAC Regulation R446-1-4.5.3, which prohibits the use, maintenance, or construction of roadways without taking appropriate dust abatement measures. Compliance will be obtained through special stipulations as a requirement on new projects and through the use of dust abatement control techniques in problem areas.
d. The operator will manage authorized activities to maintain air quality within the thresholds established by the State of Utah Ambient Air Quality Standards and to ensure that those activities continue to keep the area in attainment, meet prevention of significant deterioration (PSD) Class II standards, and protect the Class I air shed of the National Parks (e.g. Zion, Bryce Canyon, and Capitol Reef National Parks).
e National Ambient Air Quality Standards will be enforced by the UDEQ, with EPA oversight. Special requirements to reduce potential air quality impacts will be considered on a case-by-case basis in processing land-use authorizations.
f. The operator will utilize BMPs and site specific mitigation measures, when appropriate, based on-site specific conditions, to reduce emissions and enhance air quality. Examples of these types of measures can be found in the Four Corners Air Quality Task Force Report of Mitigation Options, November 1, 2007; EPA Natural Gas STAR Program (http://www.epa.gov/gasstar/); and US Forest Service Emission Reduction Techniques for Oil and Gas activities 2011 (http://www.fs.fed.us/air/documents/EmissionReduction-010711x.pdf).
g. The operator will comply with a Condition of Approval for Applications for Permit to Drill, which includes: (1) All new and replacement internal combustion diesel fired drilling engines must meet or exceed Tier II emissions limits as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (2) All new and replacement internal combustion diesel fired well pump engines must meet or exceed Tier II emissions limits for Particulate Matter and Tier III emissions limits for Oxides of Nitrogen and Carbon Monoxide as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (3) All new and replacement spark ignited natural gas fired internal combustion well-pump engines must meet or exceed emissions limits for Oxides of Nitrogen, Carbon Monoxide and Volatile Organic Compounds from New Source Performance Standard Subpart JJJJ for Stationary Spark Ignition Internal Combustion Engines manufactured since 2008. (4) All new and replacement internal combustion gas field engines of less than or equal to 300 design-rated horsepower must not emit more than 2 grams of NOx per horsepower-hour. This requirement does not apply to gas field engines of less than or equal to 40 design-rated horsepower. (5) All new and replacement internal combustion gas field engines of greater than 300 design rated horsepower must not emit more than 1.0 grams of NOx per horsepower-hour. (6) All diesel fuel fired internal combustion engines must utilize certified Ultra Low Sulfur Diesel fuel with a maximum sulfur content of 15 parts per million (PPM).
h. Lease holders will need to conduct detailed volatile organic compound (VOC) emissions inventories for any proposed facilities to provide necessary data to the BLM Utah State Office for their regional photochemical modeling.
i. Lease holders will need to examine the use of additional mitigations for ozone

precursors.

Dixie National Forest Well Site Requirements

V. WELL SITE DESIGN REQUIREMENTS

A. General Requirements

The operator should propose locating the well site in cooperation with Forest Service personnel on the most level location available that would accommodate the intended use. However, potential well site locations should not be evaluated on the basis of site conditions alone. Access to the well site for road and possible future pipeline locations must also be considered in determining the most suitable location. What may be gained on a good location could be lost from an adverse access route. Plan the well site from the long-term standpoint, assuming a discovery could be made. Future pipeline locations are to be proposed by the operator as a part of his proposal on each well site.

Adjust the well site layout to conform to the best topographic constraints. Avoid disturbance of drainages and locate reserve pits away from water courses. Deep vertical cuts and long fill slopes should be avoided. The cut and fill volumes should be balanced, excluding the topsoil and subsoil needed to backfill the reserve pit.

A contour map shall be developed for all well pad locations as an aid in the design of pad settings to the existing topography. This will allow the operator to plan the construction of facilities and the surface manager to evaluate impacts and calculate the bond more expeditiously and accurately. Maps should be prepared to a scale of 1 inch equals 20 feet horizontally and a contour interval of 2 feet vertically, or as otherwise directed by the responsible Forest Service officer.

Once this information is compiled, finished site elevations, cut and fill slopes and their respective catch points, drainage, balanced earth work, adequate storage area locations and other necessary construction features shall be determined and included with the drawings/specifications. Submittals shall include a well site plan (see Drawing No. 1 at the back of this document), details of berms, diversion ditches, pits, catchments and other appurtenances and design features. Provide data to support drainage structure design.

B. Clearing

The site must first be cleared of all brush and trees. All merchantable timber must be purchased by the operator prior to cutting, at the appraised price determined by the Forest Service. Grasses and small shrubs need not be removed; however appropriate measure will be required to prevent the spread of noxious weeds and nuisance species prior to starting excavations if they occur on the site. Trees and brush will be disposed of by removal from the Forest, by burning, chipping, or other approved methods needed to prevent the spread of insects. Tree trunks less than 8 inches in diameter and slash can be stockpiled at an approved location to be spread over reclaimed areas. Burning permits will be required and are issued by the Forest Service. Burning would only be permitted if the fire danger is low to moderate.

C. Topsoil Removal and Storage

Surface soil material (topsoil), if present, will be stripped from all areas where surface disturbance is necessary and stockpiled. All topsoil will be removed in a separate layer, avoiding mixing with other excavated materials, and stored in a stockpile to prevent loss from erosion or contamination, and from which topsoil may be easily recovered. The depth of surface soil material to be removed and stockpiled will be specified by the Forest Service but will generally include the A Horizon. The topsoil and subsoil stock piles must be located to prevent contamination from the blooie line, flare line, and other operations. Stockpiles shall be contained by silt fencing, ditches and traps or other containment measures to prevent erosion, contamination and loss. During interim reclamation all topsoil should be reapplied to areas not needed for operations prior to seeding.

D. Site Grading

Cut and fill slopes will be such that stability can be maintained for the life of operations. Cut and fill slopes will be constructed as follows (exceptions can be made depending on the type and competency of material encountered):

Height of Slope	Slope
0 – 5 feet	3:1
6 – 10 feet	2:1
over 10 feet	1.5:1

All fills will be free of vegetation and will be compacted in lifts no greater than 12 inches in thickness to a minimum of 90 percent Proctor dry density sufficient to prevent excessive settlement.

Only the drill site or pad surface area used for operations will be surfaced with crushed gravel to a depth sufficient to support anticipated loads throughout the life of the well. Usually a depth of 12 inches of gravel is required.

E. Site Drainage

Diversion ditches having the minimum dimensions of 3 feet horizontal to 1 foot vertical (3:1 ditch) will be constructed around the site to divert existing drainages and surface runoff from flowing onto the site. Hydraulic design for ditches is required to determine capacity. The ditch(s) will be located at the top or base of the cut slope (to be determined based on site-specific conditions) and around the toe of the fill slopes (see Drawing No. 1 – Construction Requirements for Typical Well Sites). Straw dykes, catch basins, energy dissipaters or other approved structures will be constructed in the ditch outflow to trap any sediment and dissipate erosive flows. Provide data to support drainage structure designs. A culvert might be necessary where the access road enters the site.

A berm will be constructed around the perimeter of the site to contain all precipitation, spills, and other fluids from leaving the site. The berm will be a minimum of 18 inches high, 12 inches wide at the top, and have 1.5:1 side slopes. Berms will be compacted for stability and to reduce permeability as needed to contain fluids. The site surface will

be graded at a minimum of 1 percent to drain to the reserve pit. Use silt fencing, ditches and traps or other containment at toe of fill slopes to prevent erosion and contamination.

The drainage pattern to be constructed will need to be designed for each site, depending on site-specific conditions.

F. Water Supply Wells

The following measures could be implemented to protect groundwater quality:

- All water supply wells will be required to have backflow prevention devices.
- All new water supply wells should be constructed using sanitary water well construction methods. This means using non-toxic lubricants for casing threads, use of clean casing and drill pipe, and use of clean hydrocarbon-free drilling water.
- Water quality could be tested in all new water supply wells to ensure different classes of water are not being mixed.
- Water samples could be collected in new water supply wells and analyzed for major cations, anions, and hydrocarbons.
- Electric logs could be run to characterize the near surface geology.
- Water supply wells should be completed into deeper water-bearing zones instead of using Class I water for drilling and completion.
- All water supply wells should be outfitted with locks to prevent unauthorized access.
- If the water comes from a water well drilled on the location, approval of an Application for Permit to Appropriate Groundwater would be obtained from the Utah State Engineer's Office (SEO) prior to commencement of drilling operations on the subject water well. Onshore Oil and Gas Order No. 1, Section (4.) Surface Use Plan of Operations, (e.) requires the operator to describe the location, construction details and expected production requirements for a water well drilled on the lease.
- Upon completion of the water well on location, a standard water quality analysis would be submitted to the SEO, the Forest Service, and BLM, as appropriate.
- The water well casing and cementing program should be designed on a case by case basis to prevent potential drainage/drawdown or contamination of upper aquifers.

Water Supply Well Contamination

Further opportunities for mitigation are:

- Outfit all water supply wells with locks to prevent unauthorized access,
- Minimize new water supply well installation, and
- Plug and abandon existing supply wells that are no longer necessary according to SEO procedures.

G. Produced Water Re-injection

- The disposal well must be permitted through either EPA or Utah Department of Oil, Gas and Mining (UDOGM) and cased and cemented in such a manner that damage would not be caused to oil, gas, or fresh water sources per Underground Injection Control (UIC) permitting requirements.
- Significant impact to the aquifer from drilling and completion fluids and produced water are not likely because all production wells would be cased and cemented to protect subsurface mineral and freshwater zones per Onshore Oil and Gas Order No. 2.
- Wells no longer usable for reinjection would be plugged and abandoned per UIC permitting requirements.

H. Drilling Procedures

All geologic information and drilling procedures must be submitted to the BLM in the Drilling Plan (DP) and approved prior to commencement. The DP provides the BLM information necessary to ensure that drilling is conducted with appropriate regard for protection of public health and safety, the environment, correlative rights and maximum economic recovery of hydrocarbons. The DP includes a description of the drilling program; projected completion zone locations; pertinent geologic data; estimated depths at which the top and bottom of anticipated water, oil, gas, or other mineral-bearing formations are expected to be encountered and plans for protecting such resources; expected hazards; and proposed mitigation measures to address such hazards. The 9-Point DP must include the following components:

- Formation Tops
- Depth to Oil, Gas, Water & Minerals
- Pressure Control
- Casing
- Cement
- Circulating Medium
- Testing, Coring, Logging
- Pressures, Temperatures, LCZs, H2S
- Other aspects of the proposal

Procedures for use of oil-based mud should be environmentally acceptable.

All oil-based mud drilling operations will be completed through a closed mud system and all oil-based mud will be contained in the closed system.

The closed drilling system will be equipped with appropriate drip pans, liners and catchments under probable leak sources as needed to prevent the oil-based drilling mud and cuttings from reaching the reserve pit and/or ground surface of the drill pad.

Any cuttings dropped or mud spilled will be immediately cleaned up and placed in the approved containment device. All spills in excess of one barrel outside the containment devices will be reported to the USFS within 8 hours.

All blow-out preventer equipment and all elastomers in the mud system will be suitable for oil- based mud.

Well control training of all crews on rigs utilizing oil-based mud will include coverage of the additional hazards associated with oil-based mud.

The Operator will exercise extreme caution to avoid discharging oil-based drilling mud into the reserve pit.

Submit a Sundry Notice to the USFS describing how the oil contaminated drill cuttings will be treated to assure the oil stays contained in the cuttings and where the cuttings will be ultimately be stored (i.e., buried in the flare pit, buried in a separate "on-location" pit, or removed to an approved disposal site. On-location disposal sites for oil contaminated drill cuttings will be lined with a 12 mil or stronger impervious liner compatible with oils. A liner meeting this specification will also be placed under any temporary storage area for the oil contaminated cuttings.

Prior to skidding or moving the drill rig to another well or well pad, the pumps, pump lines and tanks will be cleaned to insure that no oil-based mud is in the system during surface drilling operations of the new well.

Install and maintain siphons, catchments, and absorbent pads to keep hydrocarbons produced by the drill rig from entering the reserve pit. Ensure that hydrocarbons and contaminated pads are disposed of in an approved manner.

Any drilling fluids pit that shows indications of containing hazardous wastes will be tested for the Toxicity Characteristic Leaching Procedure constituents. If analysis proves positive, the fluids will be disposed of in an approved manner. The cost of the testing and disposal will be borne by the potentially responsible party.

Disposal of produced water from oil and gas operations is not authorized within the APD approval. A Sundry Notice detailing the proposed action must be submitted to the BLM for approval. Upon approval produced water may then be disposed of in accordance with the requirements of Onshore Oil and Gas Order No. 7.

I. Groundwater Concerns

Usable ground water resources are protected during drilling in accordance with BLM Onshore Oil and Gas Order No. 2, Drilling Operations and UDOGM Administrative Rules. Onshore Order No. 2 requires that all formations containing usable quality water (≤10,000 mg/L total dissolved solids) be isolated and protected utilizing cement. A COA would be attached to the APD that states, "If encountered while drilling, usable quality water requires protection by bringing the cement at least +/- 100' above the usable water quality zone". The COA would specify the anticipated formation and depth at which the usable quality water might be encountered. BLM petroleum engineers (PEs) and petroleum engineering technicians (PETs) conduct inspections to ensure that the operator's plans have successfully avoided environmental impacts. PETs inspect well sites during drilling, completion and production for technical and safety compliance.

In accordance with 43 CFR 3162.4-2, Samples, Tests and Surveys, "during the completion of a well, the operator shall, when required by the authorized officer (AO),

conduct, test, run logs and make other surveys reasonably necessary to determine the presence, quantity, and quality of oil, gas, other minerals, or the presence or quality of water." These tests and logs are reviewed and correlated with geologic and hydrologic data. "When needed, the operator shall conduct reasonable tests which will demonstrate the mechanical integrity of the down-hole equipment." (43 CFR 3162.4-2(b)). In order to protect fresh water and other minerals, "tests and surveys of the effectiveness of such measures (to isolate and protect usable water) shall be conducted by the operator using such procedures and practices approved or prescribed by the AO". The BLM has the authority to require companies to do reasonable testing if deemed necessary. The BLM AO may require an operator to conduct cement bond log surveys to verify cement adequacy.

J. Construction and Maintenance of Reserve Pits

Reserve pits will be constructed of sufficient size and capacity for the necessary fluids for drilling and to contain any runoff from the drill site. The pad will be graded to empty into the reserve pit or alternative pit or buried tank. Winter operations may require larger pits/tanks due to snow accumulations and runoff. Pits will not be constructed within intermittent or perennial drainage channels. If the operator has concerns that drainage from the pad could contaminate reserve pit muds, the pad can be constructed to drain into alternative lined pits or buried containment tanks. Contamination of shallow aquifers from reserve pits is unlikely because the reserve pits would be lined and would be constructed in cut areas or in compacted and stabilized fill. However, if shallow groundwater is known to be present then a semi-closed loop system would be used.

It is preferred that pits be constructed in undisturbed materials and below the natural ground level to minimize the risk of failure. Where conditions exist that require pits to be constructed of embankment materials, the following criteria are required:

1. The area on which the embankment is to be placed will be cleared of all materials including vegetation, topsoil, and unconsolidated soils and gravels.

2. A foundation keyway will be designed and constructed into native materials to dimensions based on site-specific conditions to provide adequate anchoring and sealing of the embankment.

3. The embankment will be constructed using impermeable materials on slopes of 3:1 into the pit and 2:1 outside the pit. The embankment will have a minimum of 10-foot top width. The materials will be compacted to 95 percent Proctor density.

The following are requirements for construction and maintenance of all reserve pits:

4. Pits must be constructed to contain fluids without leaks throughout the life of operations. If pit liners other than clay coatings are used they must be constructed of sufficiently durable and watertight materials to prevent leakage. Compacted bedding material consisting of sand, clay, or other grout may be required to prevent rocks from puncturing the liner and to seal cracks.

5. A minimum of 2-foot freeboard will be maintained in the pit at all times during the drilling operations. Produced water from newly completed wells may be temporarily disposed of into pits for a period of up to 90 days. Any extension of

time beyond this period requires documented approval by the BLM authorized officer (requirement in Onshore Oil and Gas No. 7).

6. The reserve pit must be fenced on three sides during drilling operations. The remaining side must be fenced immediately upon removal of the drill rig. If avian wildlife concerns exist, netting or some other approved method would be used to prevent wildlife from entering the pit.

K. Site Reclamation for Nonproductive Wells

Reclamation of the entire site will be required and will commence immediately after drilling, testing, and well plugging/abandonment are complete. The site will be restored to as nearly as practical to its original condition (approximate original contour). Cut and fill slopes will be reduced and graded to conform to the adjacent terrain.

Reserve pits must be allowed to dry before they are backfilled. Fluids that will not dry must be removed from the Forest. All polluting substances or contaminated materials, such as oil, oil-saturated soils and gravels will be removed and disposed of at a State licensed facility licensed to receive these materials. Exceptions to allow for reserve pit solidification may be made if the operator can demonstrate to the responsible Forest Service officer that this method would be effective based on site-specific conditions.

Drainages will be reestablished and temporary measures will be required to prevent erosion on the site until all reclamation and revegetation standards established for the site are met.

In general, the well identification standpipe will be set such that it can be buried by at least two feet of soil. A final determination will be made on a case-by-case basis.

After final grading and before replacement of topsoil, the entire surface of the site shall be scarified to eliminate slippage surfaces and promote root penetration. Topsoil will be spread over the site to achieve approximate uniform stable thickness consistent with the established contours.

The site will be seeded and/or planted with a seed mix as approved in the SUPO or as otherwise approved by the responsible Forest Service officer. Nutrients and soil amendments will be applied to the disturbed surface soil needed to meet the revegetation standards.

A temporary fence will be constructed around the site until reclamation standards have been met. The fence design is subject to Forest Service approval will be designed to prevent entry by livestock or wildlife as needed for the specific area. The fence must be maintained such that it is functional at all times as intended to prevent livestock use and unauthorized access by the public. The operator is responsible for damages to the reclaimed condition of the site due to unauthorized access until final reclamation standards are met and the fence is removed. The operator will be responsible for eradicating noxious weeds and nuisance species each season until the final revegetation standards have been met. Once all reclamation standards have been met, the operator is responsible for removal of the fence, gate, and associated structures and materials.

L. Site Reclamation for Producing Wells

Interim and final reclamation for producing wells will be accomplished for portions of the site not required for the continued operation of the associated facilities. All disturbed surfaces will be treated to prevent erosion and to compliment the esthetics of the area. A new site plan will be required encompassing the facilities required for operation and interim reclamation measures. Generally, the following measures will be required:

1. The reserve pit will be reclaimed as previously discussed.
2. All polluting substances and contaminated materials, including contaminated soil and gravels will be disposed of as previously discussed.
3. All cut and fill slopes and other disturbed areas not needed for production operations will be contoured to match the surrounding area, topsoiled, and revegetated as previously discussed.
4. The berm will be reestablished on the production pad where removed to accomplish the reclamation discussed in the previous item.
5. The pad perimeter and reclaimed area will be fenced. Once reclamation standards have been met for the reclaimed portion of the original pad the fence will be relocated onto the perimeter of the production pad.
6. Measures such as painting facilities an appropriate color, and other practical measures will be used to decrease visibility of the site as viewed from sensitive areas such as roads, highways, and recreation areas. Noise suppression devices and submersible pumps (if feasible) may be required as needed to meet scenic, wildlife, and recreation objectives for the area.

M. Site Maintenance

The site will require periodic maintenance to ensure that drainages remain functional and that surfaces are properly treated to reduce erosion, contamination, fugitive dust, invasion by undesirable plant species, and impacts to the adjacent areas.

All garbage, debris, and foreign materials shall be contained on site in a cage or other enclosure then will be removed to an established/licensed landfill or other recognized facility.

N. Site Reclamation for Production Wells

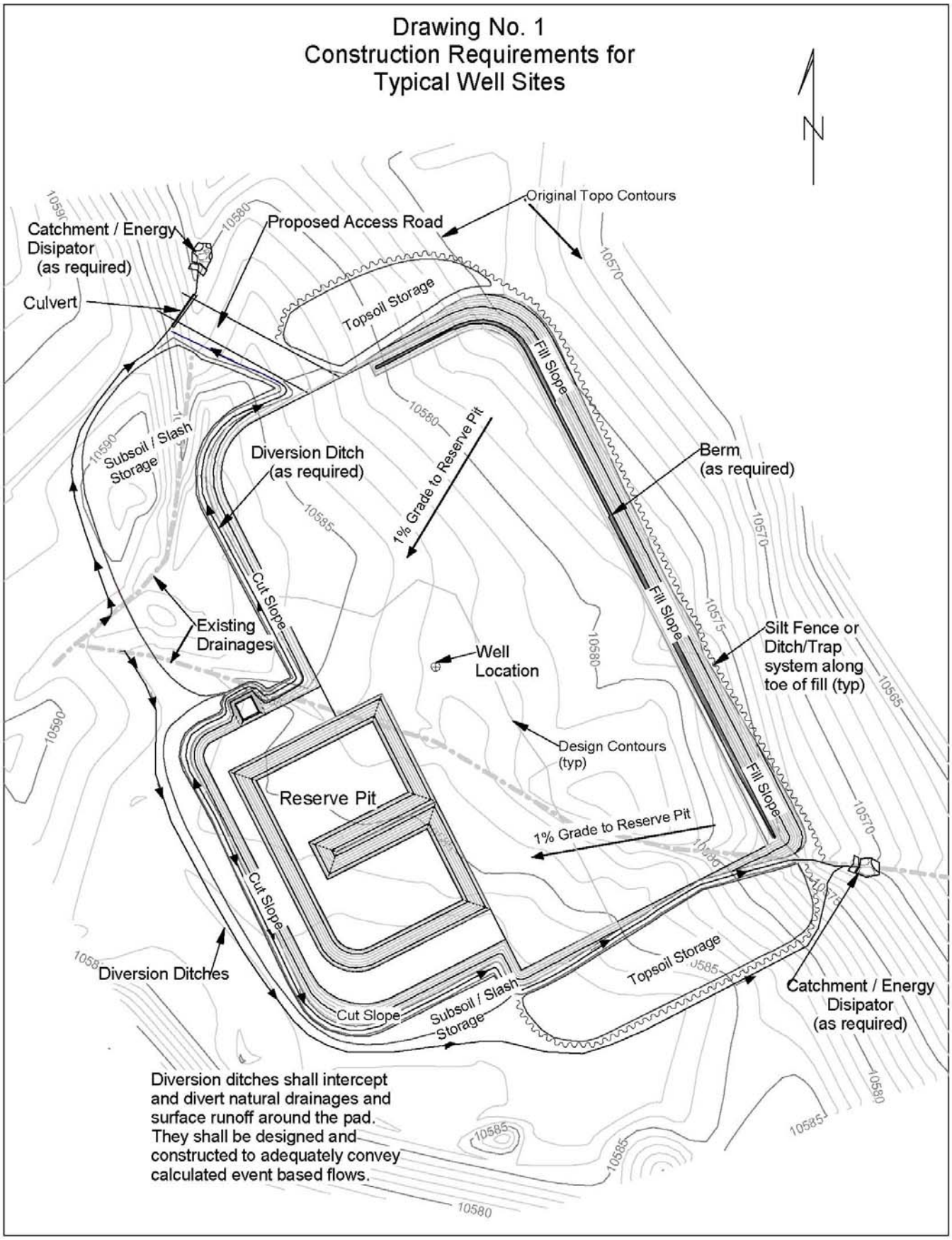
When production pads and production facilities are no longer needed, the facilities must be removed and final reclamation measures completed as previously prescribed for nonproductive wells. Abandoned or unneeded facilities will be removed/reclaimed within two years. In place abandonment of any facilities such as powerlines, pipelines, etc. will require approval of the Forest Service. If approved, appropriate measures to stabilize and decontaminate them will be required.

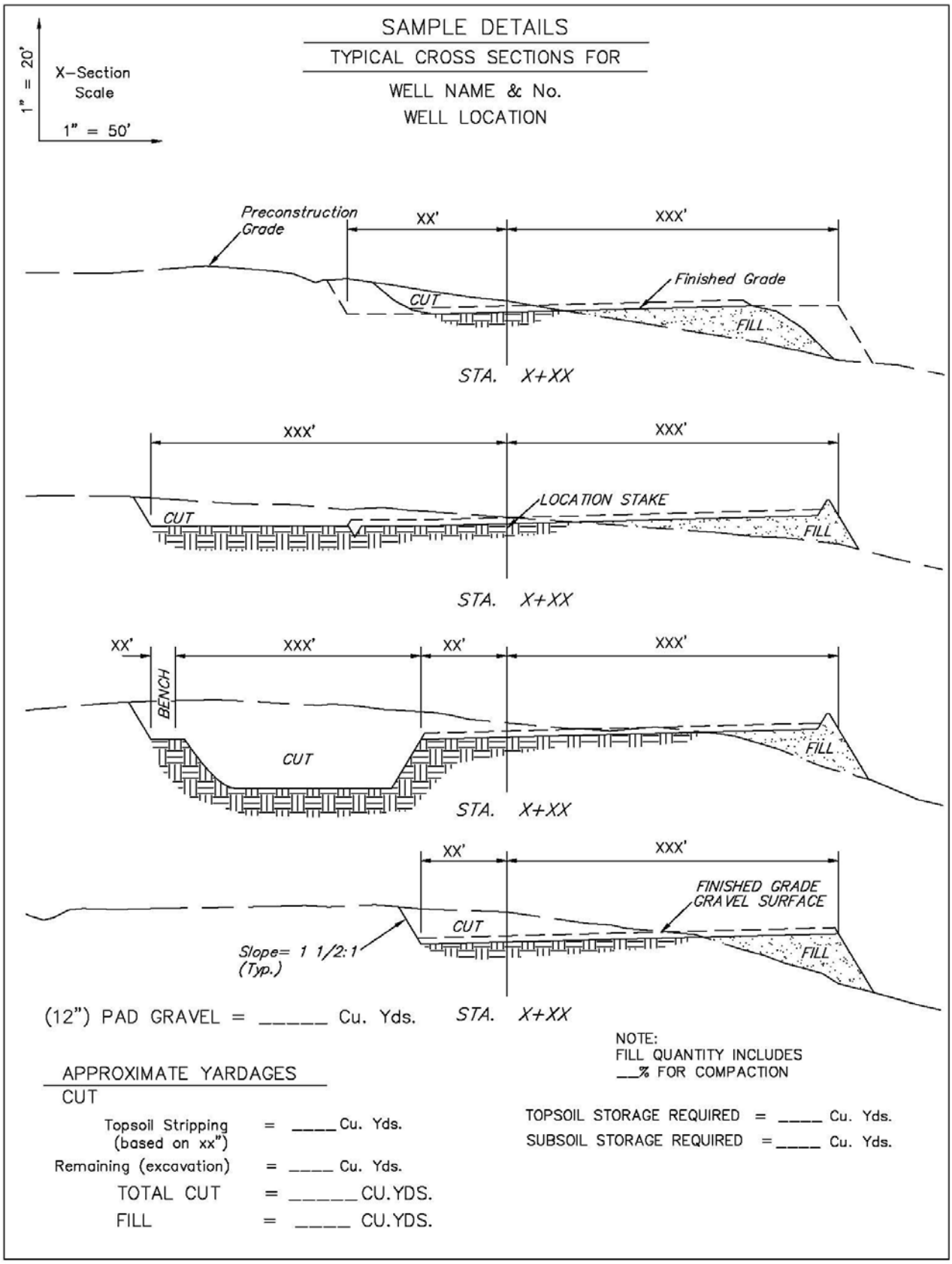
Oil and Gas Rules, Regulations and Guidelines

- United States Department of the Interior and United States Department of Agriculture. 2007. Surface Operating Standards and Guidelines for Oil and Gas Development. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management.

Denver Colorado.84 pp.

- Code of Federal Regulations 43 CFR §3160 - *Onshore Oil and Gas Operations*
- Onshore Oil & Gas Order No. 1, (43 CFR §3162)
- Onshore Oil & Gas Order No. 2, (54 FR 39528, Sept., 1989), (57 FR 3025, Jan. 27, 1992), and (43 CFR §3162.3-4)
- Onshore Oil & Gas Order No. 7, (58 FR 172, Oct. 8, 1993)


Drawing No. 1
Construction Requirements for
Typical Well Sites
N
Original Topo Contours
Proposed Access Road
Catchment / Energy
Disipator
(as required)
Culvert
Topsoil Storage
Fill Slope
Subsoil / Slash
Storage
Diversion Ditch
(as required)
1% Grade to Reserve Pit
Berm
(as required)
Cut Slope
Existing
Drainages
Well
Location
Silt Fence or
Ditch/Trap
system along
toe of fill (typ)
Design Contours
(typ)
Reserve Pit
1% Grade to Reserve Pit
Diversion Ditches
Catchment / Energy
Disipator
(as required)
Diversion ditches shall intercept
and divert natural drainages and
surface runoff around the pad.
They shall be designed and
constructed to adequately convey
calculated event based flows.



(12") PAD GRAVEL = _____ Cu. Yds.

NOTE:
FILL QUANTITY INCLUDES
__% FOR COMPACTION

APPROXIMATE YARDAGES

CUT

Topsoil Stripping (based on xx") = _____ Cu. Yds.

Remaining (excavation) = _____ Cu. Yds.

TOTAL CUT = _____ CU.YDS.

FILL = _____ CU.YDS.

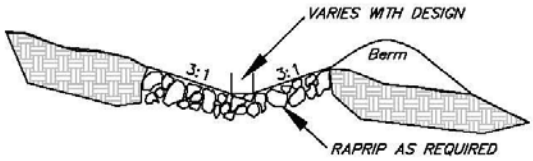
TOPSOIL STORAGE REQUIRED = _____ Cu. Yds.

SUBSOIL STORAGE REQUIRED = _____ Cu. Yds.

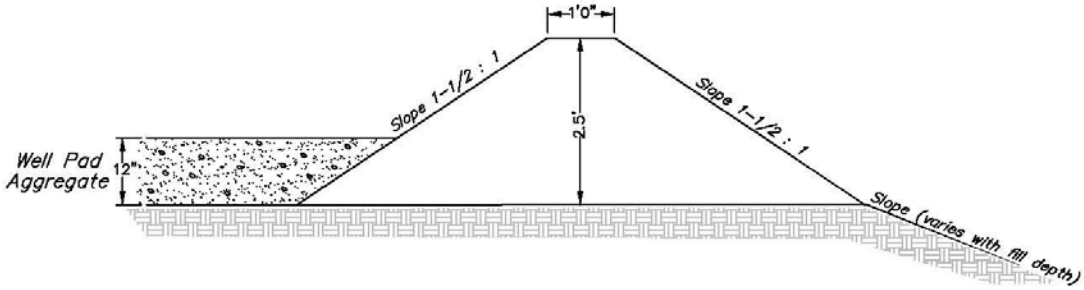
SAMPLE DETAILS

DETAIL SHEET

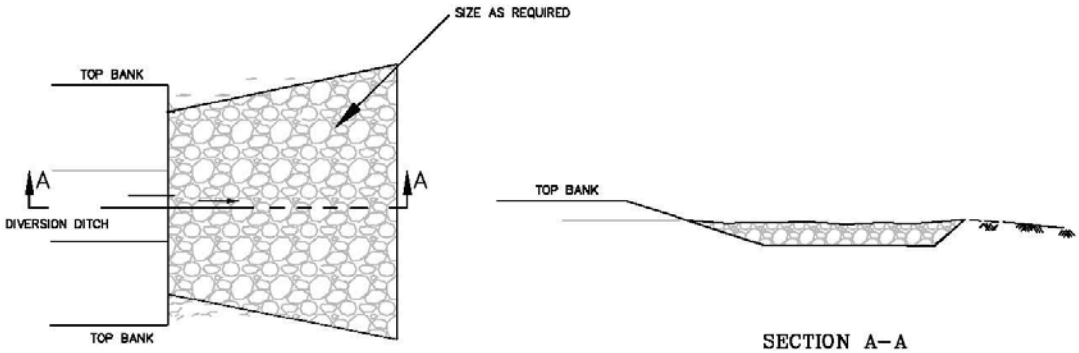
WELL NAME & No.
WELL LOCATION



DIVERSION DITCH (DETAIL)
(Only Where Specified)



BERM (EDGE OF LOCATION)
(NO SCALE)



PLAN VIEW

SECTION A–A

ENERGY DISSIPATER (DETAIL)

Appendix D – Stipulation Forms and Lease Notices

NO SURFACE OCCUPANCY STIPULATION
NSO-01
Very High Scenic Integrity Objective Areas
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within all lands designated as having a very high scenic integrity objective as shown on Figure 3.2-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preserving the existing very high scenic integrity objectives of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104) if the operator can demonstrate in a surface use plan of operations that the objectives for scenery can be met.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-02
High Scenic Integrity Objective Areas
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within all lands designated as having a high scenic integrity objective as shown on Figure 3.2-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preserving the high scenic integrity of these areas. These areas are managed as high scenic value because of their natural landscape variety and features in proximity to primary travel routes or use areas where users have a major concern for the aesthetics of the viewed landscape. Management activities should repeat form, line, color, and texture that are frequently found in the characteristic landscape. Changes should not be evident to the casual forest visitor, and all retention activities to restore the area to a naturally appearing condition should be accomplished either during the operation or immediately thereafter.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104) if the operator can demonstrate in a surface use plan of operations that the objectives for scenery can be met.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-03
Inventoried Roadless Areas (IRAs)
Alternative C, D1, and E1

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

All areas identified and mapped as Inventoried Roadless Areas and contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, as shown in Figure 3.3-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities. No timber cutting is permitted

For the purpose of:
Protecting the roadless and wilderness characteristics, as well as undeveloped values of these lands.
.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-04
Designated Dispersed Recreation Areas
Alternative B

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Designated Dispersed Recreation Areas as shown on Figure 3.4-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preventing conflicts with dispersed recreation opportunities in sites designated and managed for concentrations of dispersed recreation use.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-05
Developed Sites and Administrative Sites
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Developed sites and Administrative sites developed and managed for specific purposes such as recreation, administration, and other. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preventing conflicts with the uses for which the sites were developed and are managed and to protect the capital investment and recreation uses associated with permitted recreation residences.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-06
Recreation Residences
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within ¼ mile of recreation residences shown in Figure 3.4-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preventing conflicts with the recreation uses of these areas including visual and auditory effects.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-07
Primitive Recreation Opportunity Spectrum Areas
Alternatives C and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Primitive Recreation Opportunity Spectrum (ROS) Areas as shown in Figure 3.4-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preventing conflicts with the Primitive recreation opportunities provided by these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-08
Semi-Primitive Non-Motorized Recreation Opportunity Spectrum Areas
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Semi-primitive, non-motorized areas as shown in Figure 3.4-1. This prohibition includes all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Preventing conflicts with semi-primitive non-motorized recreation opportunities provided by these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-09
Sage Grouse Leks
Alternative C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

As shown on Figure 3.6-2, within 1 mile of sage-grouse leks (all habitats), and between 1 and 2 miles of sage-grouse leks within sagebrush habitat only.

This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

Seismic activities, including blasting, would be limited during the lekking period: March 1 – May 15.

For the purpose of:

Protecting breeding and brood rearing sage grouse from predation, displacement, habitat fragmentation, and disturbance. Preventing any loss of viability to sage grouse populations.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-10
Sage Grouse Leks
Alternative D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within 1 mile of sage grouse leks as shown on Figure 3.6-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:

Protecting breeding and brood rearing sage grouse from predation, displacement, habitat fragmentation, and disturbance. Preventing any loss of viability to sage grouse populations.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-11
Goshawk Nest Areas
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within 0.5 mile of active or occupied goshawk nests.
Prior to any surface disturbing activities in known or suspected nesting areas a two-year survey protocol would need to be completed between March 1 and September 30. If an occupied nest is found, no surface disturbing activities may take place within 0.5 mile of the nest(s). Known goshawk nest areas are confidential and are not shown on any of the maps in the EIS. Exceptions to this stipulation (i.e., a smaller buffer) can be made if topographic barriers or vegetation screening can be utilized to protect the nest site as determined by the Dixie National Forest.

For the purpose of:

Avoiding any loss of viability to goshawk populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-12
Mexican Spotted Owl Protected Activity Centers (PACs)
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Mexican spotted owl Protected Activity Centers shown in Figure 3.6-1.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:

Protecting habitat areas for Mexican spotted owl that are not fully protected by the Endangered Species Act, which include all non-Critical Habitat areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-13
Utah Prairie Dog Colonies
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within 0.5 mile of Utah prairie dog colonies. This prohibition includes all facilities such as drill pads, roads, pipelines, powerlines, etc. The locations of Utah prairie dog colonies are confidential and are not shown on any of the maps in the EIS.

For the purpose of:

Avoiding any loss of viability to Utah prairie dog populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-14
Bald Eagle Winter Concentration Areas
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Bald eagle winter concentration areas shown in Figure 3.6-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities. The USFS will not approve any ground disturbing activity until its obligations are met under applicable requirements of the Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668c.

For the purpose of:

Avoiding a loss of viability to bald eagle populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-15
Peregrine Falcon Nests
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within one mile of peregrine falcon nests. This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.
Prior to any surface disturbing activity such as construction and drilling, in areas where peregrine falcon nests are known to occur, surveys would need to be completed. If active or occupied nests are found, construction and drilling activities would not be allowed within one mile of the nest.
Exceptions to this stipulation (i.e., a smaller buffer) can be made if topographic barriers or vegetation screening can be utilized to protect the nest site as determined by the Dixie National Forest.

For the purpose of:

Avoiding any loss of viability to peregrine falcon populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-16
Sensitive Species and Suitable Habitat; Including Pygmy Rabbit, Flammulated Owl, Three-toed Woodpecker, Sensitive Bats, Boreal Toad, Bighorn Sheep
Alternative B

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).
Habitat areas for some sensitive species shown in Figure 3.6-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Avoiding a loss of viability to populations of these sensitive species on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-17
Fisheries Habitat
Alternative C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within a 500-foot buffer zone from the high waterline of streams/lakes with occupied or suitable sensitive fisheries habitat shown in Figure 3.6-2.

“Suitable” habitats are all areas currently identified by Conservation Teams, UDWR, and/or the Forest as having the potential for reintroductions within the next ten years.

This stipulation applies to all surface disturbing activities, such as roads, pads, powerlines, and pipelines. This stipulation does not allow for perpendicular crossings such as needed for roads, pipelines, and power lines.

For the purpose of:
Avoiding a loss of viability to sensitive fish populations on the Dixie National Forest and to maintain quality habitat to contribute toward maintenance and/or recovery of sensitive fish species.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-18
Lava Fields Over Sensitive Aquifers
Alternative D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Lava fields over sensitive aquifers shown in Figure 3.7-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:

Preventing any damage to water flow or water quality of these sensitive aquifers.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-19
Streams, Lakes, Springs, Wetlands, and Riparian Areas – 500-foot Buffer
Alternative B

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

A 500-foot buffer zone from the high water point of any perennial streams, lakes, springs, wetlands, and riparian areas. 100-year floodplains are not included in this stipulation. This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities. Some but not all of these features are mapped, so the actual areas of no surface occupancy would be determined based on actual ground conditions.

For the purpose of:
Minimizing the contributions of sediments to watercourses, and minimizing the potential for spills or leaks to contribute pollutants to streams or other water features.
This stipulation provides restrictions greater than in 36 CFR 228.108(j) under Standard Lease Terms due to the specific prohibition of surface occupancy within the buffer zone.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-20
Streams, Lakes, Springs, Wetlands, and Riparian Areas – 300-foot Buffer
Alternative C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).
All areas within 300-foot buffer of the high water point of all perennial streams, lakes, springs, wetlands, and riparian areas. 100-year floodplains are not included in this stipulation.

This stipulation applies to all surface disturbing activities, such as roads, pads, powerlines, and pipelines, but allows for perpendicular or near-perpendicular crossings such a needed for linear features like roads, pipelines, and powerlines as long as they are designed to minimize effects.

For the purpose of:
Reducing the contributions of sediments to watercourses, and minimizing the potential for spills or leaks to contribute pollutants to streams or other water features.
This stipulation provides restrictions greater than in 36 CFR 228.108(j) under Standard Lease Terms due to the specific prohibition of surface occupancy within the buffer zone.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-21
Municipal Watersheds
Alternative C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).
Municipal watersheds shown in Figures 3.7-1 through 3.7-4.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Preventing any effects to water flow and quality of municipal watersheds and associated water sources.

Preventing pollution and protecting the quality of drinking water.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-22
Active Rockfall, Landslide, and Unstable Areas
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Active rockfall and landslide areas and unstable areas shown in Figure 3.8-1. This stipulation applies to all surface disturbing activities such as well pads, roads, pipelines, and powerlines. Exceptions to this stipulation can be considered if a survey is conducted by a qualified geologist/engineer and it is demonstrated to the responsible Forest Officer that operations can be located in stable areas or can be designed to prevent causing landslides and damage from natural soil creep and landslides.

For the purpose of:
Ensuring that proposed activities/facilities do not cause landslides and to prevent facilities from being damaged by landslides, rockfalls, soil creep, or avalanches which could result in hazardous conditions and spills or releases of potentially contaminating materials.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-23
High Erosion Potential Areas and Steep Slopes (greater than 35 percent)
Alternatives B and C

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Areas with highly erosive soils and slopes greater than 35 percent shown in Figure 3.8-1. Not all areas are mapped and there are variable conditions within the areas shown on the map. The applicability of this stipulation to individual locations would be determined based on actual on-ground conditions. This stipulation includes all surface disturbing activities such as well pads, roads, powerlines, and pipelines.

Exceptions to this stipulation can be considered if a survey is conducted by a qualified geologist/soil scientist and it is demonstrated to the responsible Forest Officer that operations can be located in stable areas or can be designed and constructed to prevent causing excessive soil loss, landslides, or damage from natural soil creep and landslides.

For the purpose of:
Preventing excessive soil erosion and loss of productivity.
Avoiding soil damage and creating unstable/hazardous conditions.
Avoid high risk of damage to facilities from natural soil movement and landslides.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-24
Research Natural Areas
Alternative D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Within Research Natural Areas as shown in Figure 3.9-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Preventing alteration of the natural conditions managed for research and educational purposes.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-25
Botanical and Geological Areas
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).
Botanical and geological areas shown in Figure 3.9-2 (i.e., the Red Canyon Botanical Area and Side Hollow Ponderosa Pine Study Area).
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Preventing alternation of the uncommon, special, or natural attributes of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-26
Side Hollow Ponderosa Pine Provenance Study Area
Alternatives B, C, and D

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Side Hollow Ponderosa Pine Provenance Study Area shown in Figure 3.9-2.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Preventing any alternation to the natural conditions of this area that is being used in a genetic study of ponderosa pine communities.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-27
Sensitive Plant Species and Suitable Plant Habitat
Alternative B

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).
Suitable habitat and occurrences of sensitive plant species as shown in Figure 3.6-3.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities.

For the purpose of:
Maintaining viable populations of sensitive plant species on the Dixie National Forest.
To provide more protections (i.e., a buffer) that can be used to avoid individuals, populations, or clusters of sensitive plant species.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-28
Mountain Meadows Historic Site, Long Hollow Historic District, and Boulder Area/Cedar Mtn. and Concentrated Sites Area
Alternative B

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

The locations of these areas are confidential. The legal descriptions will be shown on the No Surface Occupancy stipulation forms for leases.
This prohibition includes all surface disturbing activities such as roads, well pads, and other facilities. The USFS will not approve any ground disturbing activity that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities.

For the purpose of:
Preventing effects to the cultural and historic significance, nature, and quality of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

NO SURFACE OCCUPANCY STIPULATION
NSO-29
Areas in Proximity to Bryce Canyon National Park

No surface occupancy or use is allowed on the lands described below (legal subdivision or other description).

Areas in proximity to Bryce Canyon National Park (1,925 acres). No surface occupancy is permitted including all surface disturbing activities including, but not limited to, drill pads, roads, powerlines, pipelines, and other facilities.

For the purpose of:

Protecting the dark/night sky values, scenic vistas, solitude, and soundscapes for areas adjacent to Bryce Canyon National Park. Also to prevent conflicts with the National Park resource values named above and others such as recreation (egress) and vegetation (invasive species).

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-01
High Scenic Integrity Objective Areas
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Proposed facilities will be individually located on a case-by-case basis (within up to 0.25 mile of the original site) to take advantage of vegetative or topographic screening. Alterations should be visually subordinate to the overall landscape and structures will be designed to blend with the natural landscape.

On the lands described below:

Within all lands designated as having a high scenic integrity objective as shown on Figure 3.2-1.

For the purpose of:

Maintain the natural appearing landscapes in such a manner as the landscape character appears intact. Meet the scenic integrity objectives of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-02
Moderate Scenic Integrity Objective Areas
Alternatives B and C

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Proposed facilities will be individually located on a case-by-case basis (within up to 0.25 mile of the original site) to take advantage of vegetative or topographic screening. Oil and gas-related features may make the landscape appear slightly altered, but should be visually subordinate to the overall landscape.

On the lands described below:

Within all lands designated as having a moderate scenic integrity objective as shown on Figure 3.2-1.

For the purpose of:

Maintain disturbances as visually subordinate in such a manner as the landscape character appears intact. Meet the scenic integrity objectives of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-03
Unassigned Scenic Integrity Objective Areas
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Proposed facilities will be individually located on a case-by-case basis (within up to 0.25 mile of the original site) to take advantage of vegetative or topographic screening. A visual analysis will be completed for areas of unassigned SIO and the appropriate Scenic Integrety Objective will be determined when when a specific project is proposed.

On the lands described below:

Within all lands designated as having “unassigned” scenic integrity objective as shown on Figure 3.2-1.

For the purpose of:

Protecting the scenic integrity of these areas. These areas will require a scenic integrity evaluation prior to any proposed disturbance in accordance with the Scenery Management System Amendment to the Dixie National Forest Land and Resource Management Plan (April 2000).

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-04
Protection of Inventoried Roadless Areas
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

No new temporary or permanent roads, mechanical road construction or reconstruction (as defined in 36 CFR 294.11) may occur within the lands described below. This applies to all linear disturbance regardless of classification as “roads” or “construction zones.” Travel may occur only along designated roads,* which may be cleared of vegetation to allow passage of trucks. Timber harvest would also be allowed.

*Note that a “Designated road, trail, or area” is defined in 36 CFR 1212.1 (Subpart A, Definitions) as “A National Forest System road, a National Forest System trail, or an area on National Forest System lands that is designated for motor vehicle use pursuant to 212.51 on a motor vehicle use map.”

On the lands described below:

All Inventoried Roadless Areas on the Dixie National Forest as mapped and shown in Figure 3.3-1.

For the purpose of:

Protecting the undevleoped, unroaded charateristics and wilderness attributes of the areas classified as Inventoried Roadless Areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820). .

CONTROLLED SURFACE USE STIPULATION
CSU-05
Protection of Suitable Wild and Scenic Rivers
(Ref. FSM 2820)
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints (relative to potential Wild and Scenic Rivers classification).

Proposed operations must be located or designed to maintain and protect the free-flowing character and the outstandingly remarkable values of the identified river. No new temporary roads, permanent roads, road construction or reconstruction may occur to protect the elgibility of these streams to be classified as wild. In addition, no power transmission lines or pipelines (i.e., oil, gas, water) may be constructed in accordance with direction in FSH 1909.12 Chapter 80.

On the lands described below:

Lands within one quarter mile of either bank of the suitable stream segments of the North Fork of the Virgin River, Mamie Creek, and Pine Creek. The location of these streams is shown in Figure 3.3-1.

For the purpose of:

Protection of streams to allow for suitability in the National Wild and Scenic River System as directed in FSH 1909.12 Chapter 80. To protect the free-flowing character and outstanding remarkable values of identified rivers.

A request for a waiver, exemption, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104). The objective and justification for the above stipulation, along with guidance on when a WEM would potentially be considered, are described in Section 1.8.5.9.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

CONTROLLED SURFACE USE STIPULATION
CSU-06
Developed Sites, Administrative Sites, and
Designated Dispersed Recreation Sites
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Proposed facilities will be individually located on a case-by-case basis (within up to 0.25 mile of the original site) to take advantage of vegetative or topographic screening. Development and activity would be limited to a level that facilitates the dispersed recreation experience. Measures applied would include requiring noise reduction technologies and limiting operation and maintenance use on roads during holidays and high use periods.

On the lands described below:

Those areas established as Developed Recreation sites, Forest Service Administrative sites and those areas of Dixie National Forest which have been designated as dispersed camping areas. The areas mapped are shown in Figure 3.4-1.

For the purpose of:

To preclude surface occupancy and new surface disturbance within developed sites, recreation residences, administrative sites and designated dispersed recreation sites.

Minimizing conflicts with Developed Sites, Administrative Sites, and Dispersed Recreation Sites (most are 100-200 acres) and the associated recreation opportunities provided by these sites, including the visual and auditory environments.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-07
Semi-Primitive Non-Motorized Areas
As defined in USFS Recreation Opportunity Spectrum
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Vehicular access is limited to established roadways. Proposed facilities will be individually located on a case-by-case basis (within up to one quarter mile of the original proposed site) to take advantage of vegetative or topographic screening.

On the lands described below:

Recreation Opportunity Spectrum: Semi-Primitive Non-Motorized areas shown on Figure 3.4-1.

For the purpose of:

Minimizing conflicts with the semi-primitive non-motorized character.

To maintain the natural appearing environment and unroaded nature of these areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-08
Semi-Primitive Motorized and Roaded Natural Areas
As defined by USFS Recreation Opportunity Spectrum
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activity must be located to minimize intrusive sights and sounds from facilities and roads. Proposed facilities will be individually located on a case-by-case basis (within 0.25 mile of the original proposed site) to take advantage of vegetative or topographic screening.

On the lands described below:

Recreation Opportunity Spectrum: Semi-Primitive Motorized areas and Roaded Natural Areas as shown on Figure 3.4-1.

For the purpose of:

Minimizing conflicts with the semi-primitive motorized and roaded natural characteristics.

Minimizing intrusive sights and sounds from facilities and roads.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

TIMING LIMITATION STIPULATION
TL-01
Sage Grouse Brood Rearing Habitat
Alternative D

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

May 1 to July 15. These dates may be adjusted by up to 14 days at each end of this period without a waiver, modification, or exception to this stipulation depending on local expertise (wildlife biologists).

Exceptions to this stipulation can be made if it is determined that the habitat is not being used by sage grouse due to seasonal variations or other conditions.

On the lands described below:
The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Prevent high-intensity oil and gas activities (i.e., construction and drilling) in brood rearing habitat during the primary season of use, which would otherwise decrease habitat capability and brood rearing success.

Avoiding a loss of viability to sage grouse populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-09
Sage Grouse Brood Rearing Habitat
Alternative C

Surface occupancy or use is subject to the following special operating constraints.

No activities would be allowed from May 1 to July 15. Outside these dates, surface disturbance for oil and gas operations is limited to no more than 1 percent of total habitat (1% = 130 acres), including the areas of avoidance due to human activity (i.e., roads and well pads) with radius/buffer to be determined by the Dixie National Forest. Reclaimed oil and gas disturbance which has met reclamation requirements is not included in the disturbed/avoidance area calculation.

On the lands described below:

Sage grouse brood-rearing habitat. The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

To avoid a substantial loss of sage grouse brooding habitat and to ensure brood rearing success.

To avoid a loss of viability to sage grouse populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

TIMING LIMITATION STIPULATION
TL-02
Deer and Elk Winter Range – Crucial and Substantial
Alternative D

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

December 1 to April 15. These dates may be adjusted by up to 14 days at each end of this period without a waiver, modification, or exception to this stipulation depending on local expertise (wildlife biologists).

Exceptions to this stipulation can be made if it is determined that winter range is not being used by big game due to seasonal variations or other conditions.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-4.

For the purpose of:

Preventing high-intensity oil and gas activities (i.e., construction and drilling) in crucial and substantial winter range during the primary season of use, which would otherwise decrease habitat capability.

To minimize the potential that deer and elk would avoid the area and thus minimize the potential that those population objectives for UDWR hunt units on the Dixie National Forest would not be met.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

TIMING LIMITATION STIPULATION
TL-03
Deer and Elk Summer Range – Crucial and Substantial
Alternatives C and D

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

May 15 to July 5. These dates may be adjusted by up to 14 days at each end of this period without a waiver, modification, or exception to this stipulation depending on local expertise (wildlife biologists).

Exceptions to this stipulation can be made if it is determined that the range is not being used by big game due to seasonal variations or other conditions.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-4.

For the purpose of:

To prevent high-intensity oil and gas activities (i.e., construction and drilling) in crucial and substantial summer range during the primary season of use, which would otherwise decrease habitat capability.

To minimize the potential that deer and elk would avoid the area and thus minimize the potential that those population objectives for UDWR hunt units on the Dixie National Forest would not be met.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-10
Deer and Elk Winter Range – Crucial and Substantial
Alternative C

Surface occupancy or use is subject to the following special operating constraints.

Surface disturbance for oil and gas operations is limited to no more than 1 percent of the total crucial and substantial deer and elk winter range in each ranger district. This restriction only applies to disturbed areas associated with oil and gas exploration and development and excludes reclaimed oil and gas sites where reclamation requirements have been met.

For production operations during the wintering season of use (December 1 – April 15), the operator must make all efforts to minimize maintenance activities and the number of trips to the site to those essential for assuring production and site integrity. Well maintenance should be planned in advance to avoid the need for workover rig operations during the restricted period.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-4.

For the purpose of:

Avoiding substantial loss of big game winter range.

To minimize the potential that deer and elk would avoid the area due to human presence and noise, and thus minimize the potential that population objectives for UDWR hunt units on the Dixie National Forest would not be met.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-11
Active Raptor Nests
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints.

Raptor nest surveys are required in potentially suitable habitats for all raptors, including Threatened, Endangered, Sensitive and MIS species prior to the approval of surface disturbing activities at a specific location.

If active or occupied raptor nests are located, high intensity activities such as construction and drilling will be restricted surrounding the nest(s) within an influence zone. Influence zones and duration of restrictions would depend on the raptor species of concern as determined in the guidelines set forth by the US Fish and Wildlife Service for Utah species. Influence zones are line-of-sight to specified distances. If topography or vegetation provides adequate screening needed to maintain nest viability, the distance may be reduced (to be determined by the Dixie National Forest).

On the lands described below:

All areas with suitable raptor nesting habitat (e.g., cliffs, forested areas) for raptors within 0.5 mile of proposed operations, or 1.0 mile of proposed operations if peregrine falcon or bald eagle nests are suspected.

For the purpose of:

Protecting nesting raptors by maintaining solitude and ambient noise levels during the nesting season.

To provide protections to golden eagles beyond the Bald and Golden Eagle Protection Act by avoiding injury or mortality to nestlings and adults (take) through spatial and seasonal buffers.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-12
Goshawk Nest Areas
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any surface disturbing activities in known goshawk nesting areas a two-year survey protocol would need to be completed between March 1 and September 30. If an occupied nest is found, any high intensity activity such as construction and drilling may be restricted within a 180-acre protection area (approximately 0.3-mile buffer).

Exceptions to this stipulation (i.e., a smaller buffer) can be made if topographic barriers or vegetation screening can be utilized to protect the nest site.

On the lands described below:

Goshawk nest locations are confidential. All known nest areas within the lease area would be surveyed if activities are proposed within these areas.

For the purpose of:

Protecting nesting potential for goshawks by maintaining solitude and ambient noise levels. during the nesting season.

To avoid a loss of viability to goshawk populations on the Dixie National Forest.

To avoid mitigations that would be required for goshawk nest disturbance.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-13
Goshawk Post Fledgling Areas (PFA)
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any surface disturbing activity in a goshawk PFA, a two-year protocol survey would be required and would need to be completed between March 1 and September 30. If any occupied or active nests are found within the PFA, high intensity oil and gas activities such as construction and drilling may be restricted in the area of the PFA from 1 March to 30 September or until birds have fledged as determined by District Wildlife Staff.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Providing for goshawk fledgling survivorship by maintaining solitude and ambient noise levels during the fledgling period within the PFA.

To avoid a loss of viability to goshawk populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-14
Mexican Spotted Owl Protected Activity Centers (PACs)
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any surface disturbing activity in a PAC area on the Dixie National Forest, surveys would need to be completed between March 1 and August 31. Mexican spotted owl surveys require 4 surveys each year for 2 consecutive years. If the PAC is occupied by Mexican spotted owls, high intensity activities such as construction and drilling may be limited between March 1 and August 31 within one half mile of the nest if surveys determine that proposed activities may have an adverse effect on nesting site capability.

On the lands described below:

The Protected Activity Center for which this stipulation applies is shown in Figure 3.6-1.

This stipulation would also apply to any new Protected Activity Centers discovered prior the issuance of the lease.

For the purpose of:

Protecting habitat areas for Mexican spotted owl that are not fully protected by the Endangered Species Act, which include all non-Critical Habitat areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-15
Potential Mexican Spotted Owl Habitat
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any surface disturbing activity in areas mapped as potentially suitable habitat, a site validation visit would need to be completed within 0.5 miles of proposed project activities.

If habitat is determined to be suitable, surveys would be conducted between March 1 and August 31 in accordance with Forest service protocol. If the habitat is occupied by Mexican spotted owls, construction and drilling activities will be limited within one half mile of the nest between March 1 and August 31 if surveys determine that proposed activities may have an adverse effect on nesting site capability.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-1.

For the purpose of:

To protect nesting habitat for Mexican spotted owl that are not fully protected by the Endangered Species Act, which include all non-Critical Habitat areas.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-16
Migratory Birds
Alternatives B and C

Surface occupancy or use is subject to the following special operating constraints.

Surveys for migratory birds are required in all suitable habitats on the Dixie National Forest with particular emphasis placed on the following species:

Partners in Flight Priority Species (Parrish et al. 2002).

Utah Comprehensive Wildlife Conservation Strategy Tier I and II species (UDWR 2005).

USFWS Birds of Conservation Concern (USFWS 2002a).

Survey must be conducted between 1 March - 1 September, dependant on species and habitat type. If nests for the above species are found in the vicinity of proposed operations, high intensity activities such as construction and drilling may be restricted surrounding a migratory bird nest for the duration of the species' nesting season or until birds fledge from the nest. Influence zones and duration of restrictions would depend on the bird species and number and location of nests.

On the lands described below:

All areas with suitable habitat for migratory birds (e.g., forested areas, shrub steppe, grassland) within the zone of influence for oil and gas operations.

For the purpose of:

Providing additional protections to migratory birds beyond the requirements of the Migratory Bird Treaty Act on National Forest lands, which state that management should conserve migratory bird populations and habitats. This stipulation would provide some protection to individual nests of certain migratory bird species.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-17
Bald Eagle Winter Concentration Areas
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Proposed oil and gas activities in a winter concentration area would require surveys to be completed during the late fall and early winter months. If bald eagles are found in the area, high intensity activities such as construction and drilling may be restricted between December 1 and February 15 if birds are present. For production operations in concentration areas, the operator must make all efforts to minimize maintenance activities and the number of trips to the site to those essential for assuring production and site integrity. Well maintenance should be planned in advance to avoid the need for workover rig operations during the restricted period.

The USFS will not approve any ground disturbing activity until its obligations are met under applicable requirements of the Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668c.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Avoiding a loss of viability to bald eagle populations on the Dixie National Forest.

To provide protections to bald eagles beyond those in the Bald and Golden Eagle Protection Act by implementing seasonal restrictions.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-18
Peregrine Falcon Nests
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any high intensity activity, such as construction and drilling, in areas where peregrine falcon nests are known to occur, surveys for peregrine falcon would need to be completed between February 1 and August 31. If active or occupied nests are found, construction and drilling activities may be restricted from February 1 to August 31 within one mile of the nest.

On the lands described below:

Peregrine falcon nest locations are confidential. All known peregrine falcon nest areas would be surveyed prior to activities where operations are proposed within one mile of the nest.

For the purpose of:

Protecting nesting potential for peregrine falcons by maintaining solitude and ambient noise levels during the nesting season.

To avoid a loss of viability to peregrine falcon populations on the Dixie National Forest.

To avoid mitigations that would be required if a peregrine falcon nest were disturbed.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

TIMING LIMITATION STIPULATION
TL-04
California Condor (Experimental/Nonessential Population) and Peregrine Falcon Rim Habitat
Alternative D

No surface use is allowed during the following time period(s). This stipulation does not apply to operation and maintenance of production facilities.

1 February – 31 August. These dates may be adjusted by up to 14 days at each end of this period without a waiver, modification, or exception to this stipulation depending on local expertise (wildlife biologists).

Exceptions to this stipulation can be made if it is determined that the habitat is not being used by either California condors or peregrine falcons.

If California condors are located on the Pine Valley Ranger District, Endangered Species Act guidance must be followed (see Lease Notice). If California condors are located on the Cedar City, Powell, or Escalante Ranger Districts, Endangered Species Act guidance for experimental/nonessential population must be followed.

On the lands described below:

The habitat area for which this stipulation applies has been mapped and is shown in Figure 3.6-2.

For the purpose of :

Protecting California condor habitat areas not fully protected under the Endangered Species Act, which include all non-Critical Habitat areas.

To protect peregrine falcon habitat during the primary season of use and avoid a loss of viability to peregrine populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-19
California Condor (Experimental/Nonessential Population) and
Peregrine Falcon Rim Habitat
Alternatives B and C

Surface occupancy or use is subject to the following special operating constraints.

Prior to any surface disturbing activities in rim habitat on the Dixie National Forest, surveys would need to be completed in accordance with Forest Service protocol. If active or occupied territories are located, surface disturbing activities may be limited between February 1 and August 31 within one mile of the territory if it is determined that proposed activities may have an adverse effect on nesting site capability.

If California condors are located on the Pine Valley Ranger District, Endangered Species Act guidance must be followed (see Lease Notice). If California condors are located on the Cedar City, Powell, or Escalante Ranger Districts, Endangered Species Act guidance for experimental/nonessential population must be followed.

On the lands described below:

The habitat described as potential rim habitat for California condor and peregrine falcon is shown in Figure 3.6-2.

For the purpose of:
Protecting habitat areas for California condor that are not fully protected under the Endangered Species Act, which include all non-Critical Habitat areas.

To protect peregrine falcon habitat and avoid a loss of viability to peregrine populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20A
Sensitive Bat Habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any oil and gas activities within 0.25 miles of a cave, bat surveys would need to be completed between October 1 and May 1 in accordance with USFS protocol. If winter hibernacula (winter roost sites) are located, high intensity activities such as construction and drilling may be restricted from October 1 to May 1 within a 0.25-mile buffer around cave entrances.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Avoiding a loss of viability to sensitive bat populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20B
Pygmy Rabbit Habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any oil and gas activities within suitable habitat for pygmy rabbit, surveys would need to be completed. If colonies are located, high intensity activities such as construction and drilling will be restricted year-round within a 100-meter buffer around the estimated center of the colony.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Avoiding a loss of viability to pygmy rabbit populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20C
Flammulated Owl Habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

If any oil and gas activity is requested within suitable habitat for flammulated owl, surveys would need to be completed before oil and gas activities can occur in the area. If owls are detected or nests located, any high intensity activity such as construction and drilling may be restricted within a one half mile buffer around the estimated center of the territory from April 1 to September 30.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Avoiding a loss of viability to flammulated owl populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20D
Boreal Toad Habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any oil and gas activities within suitable boreal toad habitat (see Figure 3.6-2), surveys would need to be completed. If boreal toads are located, high intensity activities such as construction and drilling will be restricted within the habitat between April 1 and July 31.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-2.

For the purpose of:

Avoiding a loss of viability to boreal toad populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20E
Bighorn Sheep Habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any oil and gas activities within suitable bighorn sheep habitat, surveys for bighorn sheep would be completed. If bighorn sheep are located, high intensity activities such as construction and drilling may be restricted within the habitat if such activities would impact the viability of bighorn sheep populations.

On the lands described below:

Suitable habitat areas for bighorn sheep.

For the purpose of:

Avoiding a loss of viability to bighorn sheep populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-20F
Three-toed woodpecker habitat
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints.

Prior to any oil and gas activities within suitable three-toed woodpecker habitat, surveys would be completed. If three-toed woodpeckers are located, high intensity activities such as construction and drilling may be restricted within the habitat if such activities would impact the viability of three-toed woodpecker populations.

On the lands described below:

Suitable habitat for three-toed woodpeckers.

For the purpose of:

Avoiding a loss of viability to three-toed woodpecker populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-21
Fisheries Habitat
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

No surface disturbing activities (with the exception of perpendicular crossings for linear facilities such as roads, power lines, and pipelines) would be approved unless the operator demonstrates that they have taken all reasonable measures to minimize soil disturbance. Special conventions beyond normal operating practices may be required in these areas.

Perpendicular stream crossings would be designed to facilitate upstream and downstream fish passage with appropriate water velocity, water depth, height (drop) of structure, and natural bottom.

This stipulation applies within all occupied and suitable fisheries habitat mapped in Figure 3.6-2. “Suitable” habitats are all areas currently identified by Conservation Teams, UDWR, and/or the Forest as having the potential for reintroductions within the next ten years.

On the lands described below:

Streams that support or that may support sensitive fish populations. The habitat area for which this stipulation applies is shown in Figure 3.6-2:

For the purpose of:

Avoiding a loss of viability to sensitive fish populations on the Dixie National Forest.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-22
Streams, Lakes, Springs, Wetlands, and Riparian Areas – 300-foot Buffer
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

Special measures may be required within 300 feet of the high waterline of perennial streams, lakes, springs, wetlands, and riparian areas to minimize soil disturbance.

Platforms or other stabilizing structures may need to be installed to avoid blading and minimize soil disturbance for the establishment of well pads, roads, and other facilities. In general, the manner in which development activities would be permitted would be more restricted than Standard Lease Terms permit. This stipulation is not intended to prohibit perpendicular or near perpendicular stream crossings for linear facilities such as roads, power lines, and pipelines which are adequately designed to minimize effects.

On the lands described below:

Within 300 feet of the high waterline of perennial streams, lakes, springs, wetlands, and riparian areas that occur across the Dixie National Forest as shown in Figures 3.7-1 through 3.7-4 and as found on the ground during evaluations of proposed activities.

For the purpose of:

This stipulation provides greater protections than under Standard Lease Terms. This stipulation would minimize soil disturbance within the buffer zone.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-23
Municipal Watersheds
Alternative D

Surface occupancy or use is subject to the following special operating constraints.

No surface disturbing operations would be permitted unless the Dixie National Forest finds that the leasee has sustained its burden of proof that the proposed activities do not create a foreseeable and substantial risk of pollution or disruption to the municipal watershed. No operation will be approved unless the operator can demonstrate that they have taken all reasonable measures to minimize surface use. Special conventions beyond normal operating procedures may be required in these areas.

On the lands described below:

Municipal Watersheds as designated at the time of lease issuance.

For the purpose of:

Protecting drinking water sources from contaminants. To protect drinking water sources from physical disruption.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-24
High Erosion Potential Areas and Areas With Slopes Greater Than 35 Percent
Alternative D

Surface occupancy or use is subject to the following special operating constraints:

(1) Well sites will be located to avoid areas defined as having high erosion potential and slopes greater than 35 percent., Exceptions can be made if the operator can demonstrate that specific areas are stable or can be stabilized by using specific design and construction measures.

(2) Special measures may be required to stabilize slopes and soil resources to prevent slope instability, excessive soil erosion and production of sediment. Measures could include construction slope support structures, sediment collection structures, water collection systems/sediment ponds, placement of gravel to prevent rutting by vehicles, use of dust suppressants, etc.

(3) Pads may be located adjacent to existing roads, projects may be routed in corridors and cut and fill may be minimized at the discretion of the USFS or BLM authorized officer. All soil identified as the O or A horizon must be salvaged to its full extent if less than one foot deep, or at least one foot depth if these soil horizons are deeper. All salvaged soil must be stockpiled to use for reclamation.

(4) Directional drilling from approved well pads may be required at the discretion of the USF/BLM authorized officer to reduce the need for additional roads and production infrastructure.

On the lands described below:

Areas identified on Figure 3.8-1 as having high erosion potential and slopes greater than 35 percent. Actual on-ground conditions will be used to determine stipulation applicability.

For the purpose of:

Protecting soil resources from excessive impacts.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-25
Marginally Unstable Slopes
Alternatives B and C

Surface occupancy or use is subject to the following special operating constraints:

A survey must conducted by a qualified geologist/engineer to determine if the areas proposed for surface disturbing operations are stable enough to accommodate the proposed facilities. The operator must demonstrated to the responsible Forest officer that operations can be located in stable areas or can be designed to prevent causing landslides and damage from natural soil creep and landslides

On the lands described below:

Areas identified on Figure 3.8-1 as having marginally unstable slopes.

For the purpose of:

Protecting soil and water resources from excessive impacts that could result from damage to facilities from land/soil movement and failures.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-26
Lava Tubes and Limestone (Karst) Cave Areas
Alternatives B, C, and D

Surface occupancy or use is subject to the following special operating constraints:

In areas with known or suspected caves, lava tubes, and karst features, surveys will be required to determine if they occur within or adjacent to the proposed project area. Surface disturbance will not be allowed within 300 meters of cave entrances, passages, or aspects of significant caves, lava tubes, or significant karst features. Waiver of this requirement will be considered when an approved plan of operations ensures the protection of lava or karst cave resources.

All casing and cementing programs must be designed to allow for a karst protection string and all strings of casing must be cemented to the surface. Upon abandonment of the well the wellbore will be cemented from the base of the cave/karst zone to the surface.

On the lands described below:
Areas identified as having potential to have lava tube or limestone cave resources below the surface. Most cave resources potential is in the Cedar City Ranger District; some areas have been mapped.

Cave resources are defined as any naturally formed void, cavity, recess, natural pit, sinkhole, or other feature that is large enough to permit a person to enter, whether or not the entrance is naturally formed or human-made. The term includes any extension or component of a cave or system of interconnected cave passages that occur beneath the surface of the earth or within a cliff or ledge, and/or natural subsurface water and drainage systems. Cave resources include any material or substance occurring naturally in caves, such as animal life, plant life, paleontological deposits, sediments, minerals, speleogens (relief features on the walls, ceiling, and floor of any cave that are part of the surrounding bedrock), and speleothems (any natural mineral formation or deposit occurring in a cave) is considered a Cave Resource.

For the purpose of:
Protecting Lava Caves and Karst Features and associated groundwater and spring resources.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-27
Sensitive Plants and Suitable Habitat
Alternative C

Surface occupancy or use is subject to the following special operating constraints.

Prior to conducting any surface disturbing activities within suitable habitat for sensitive plants , surveys would need to be completed. If sensitive plants are found, ground disturbing activities may be restricted within a 300-meter buffer around plant populations that are essential to the persistence of the species on the Dixie National Forest.

On the lands described below:

The habitat area for which this stipulation applies is shown in Figure 3.6-3.

For the purpose of:

Locating and designing operations so as to not adversely affect viability of plant species so as to maintain viable populations of sensitive plant species on the Dixie National Forest.

To provide more protections (i.e., a buffer) that can be used to avoid individuals, populations, or clusters of sensitive plant species.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE
CSU-28
Mountain Meadows Historic Site
Long Hollow Historic District
Alternatives C and D

Surface occupancy or use is subject to the following special operating constraints:

No new temporary or permanent roads, mechanical road construction or reconstruction (as defined in 36 CFR 294.11) may occur within the lands described below. This applies to all linear disturbance regardless of classification as “roads” or “construction zones.” Travel may occur along existing roads. Proposed oil and gas activity must be located so as to minimize intrusive sights and sounds to the eligible . The USFS will not approve any ground disturbing activity that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The USFS may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated. Oil and gas activities may need to be located outside the boundary of the areas listed on the National Regiter of Historic Sites.

On the lands described below:

Site listed as eligible on the National Register of Historic Places:
Mountain Meadows Historic Site
Long Hollow Historic District

For the purpose of:

Protecting eligibility of site on the National Register of Historic Places.

Preventing effects to the historic significance, nature, and quality of these areas.

To minimize impacts to cultural and historic resources from surface disturbance associated with oil and gas activities.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820).

CONTROLLED SURFACE USE STIPULATION
CSU-29
Protection of Class I Airsheds

Surface occupancy or use is subject to the following special operating constraints (Relative to protection of air resources).

Proposed operations must be located and/or designed to not cause or contribute to adverse impacts to air quality related values in Class I airsheds as determined by the potentially impacted agency. Operators will be expected to use appropriate Best Available Control Technology (BACT) to reduce impacts to air quality and air quality related values by reducing emissions from field production and operations. The future development of the lease parcels may be subject to appropriate mitigation and conditions of approval (COAs) to reduce or mitigate air resource impacts.

To ensure this, within 60km of any Class I airshed an air impact analysis would be required prior to any field development. Analysis must demonstrate that proposed operations and associated mitigating measures will not cause or contribute to adverse impacts to air quality related values as determined by the potentially impacted agency and as outlined in the most recent FLAG guidance.

Typical design and mitigation measures may include: use of Tier IV or better engines, use of low sulfur fuels, electrification of well fields, flaring hydrocarbon and gases at high temperatures in order to reduce emissions of incomplete combustion; water dirt roads during periods of high use in order to reduce fugitive dust emissions; require that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; minimize roads and re-vegetate areas of the pad not required for production facilities to reduce the amount of dust from the pads.

On the lands described below:
All lands in leasehold within 60 km of the Class I areas.

For the purpose of:
Protection of air resources in and around Class I areas to meet or exceed FLAG guidelines.

A request for a waiver, exception, or modification (WEM) to the above lease stipulation may be requested along with the submission of a Surface Use Plan of Operations (36 CFR 228.104).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, See BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Lease Notices for Oil and Gas Development on Lands of the Dixie National Forest

Under Jurisdiction of
Department of Agriculture

In conducting operations associated with this lease, the lessee/operator must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use, occupancy, and management of National Forest System (NFS) lands when not inconsistent with existing lease rights granted by the Secretary of Interior.

All matters related to this notice are to be addressed to:

Forest Supervisor
Dixie National Forest
1789 Wedgewood Lane
Cedar City, Utah 84721

Telephone: ***435 865-3700***

who is the authorized representative of the Secretary of Agriculture.

MIGRATORY BIRDS (Migratory Bird Treaty Act of 1918, as amended by P.L. 86-732; P.L. 90-578; P.L. 91-135; P.L. 93-300; P.L. 95-616; P.L. 99-645; and P.L. 105-312)

The Forest Service is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any migratory birds, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Migratory Bird Treaty Act of 1918 by detrimentally affecting these species or their habitats.

The lessee/operator may, unless notified by the Forest Service that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of a proposed action on migratory birds or their habitats.

BALD AND GOLDEN EAGLE NESTS (Bald and Golden Eagle Protection Act of 1940, as amended by P.L 86-70; P.L. 87-884; P.L. 92-535; and P.L. 95-616)

The Forest Service is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any bald eagles or golden eagles, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Bald and Golden Eagle Protection Act of 1940 by detrimentally affecting these species or their habitats.

The lessee/operator may, unless notified by the Forest Service that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of a proposed action on bald or golden eagles or their habitats.

THREATENED OR ENDANGERED SPECIES (The Endangered Species Act. (ESA), P.L. 93-205 (1973), P.L. 94-359 (1974), P.L. 95-212 (1977), P.L. 95-632 (1978), P.L. 96-159 (1979), P.L. 97-304 (1982), P.L. 100-653 (1988)).

The lessee/operator is given notice that lands in the lease area have been identified as containing potential habitat for plant and animal species listed on the USFS Intermountain Region Sensitive Species List and/or Utah Sensitive Species List (i.e., sensitive species), and that no surface use or otherwise disruptive activity would be allowed that would result in impacts to individuals or populations of these sensitive species that would result in a trend toward listing of these species under the Endangered Species Act.

Lessee will be required to survey potentially affected habitat using scientific methods approved by the USFS. If such habitat is occupied and the species may be adversely affected by exploration and/or production operations, modifications to the Surface Use Plan of Operations may be required in order to protect these resources from surface disturbing activities in accordance with Section 6 of the lease terms, National Forest Management Act, Endangered Species Act, Migratory Bird Treaty Act, and 43 CFR 3101.1-2.

If the USFS determines sensitive species may affected by fluid mineral operations, the lessee will be required to develop and implement a monitoring plan prior to and during operations. This monitoring plan will apply widely-accepted scientific methods approved by the USFS, and results of monitoring will be reported to the USFS at least annually. If unanticipated types or levels of adverse affects are observed during monitoring, the USFS will be promptly notified and conservation measures identified by the USFS will be implemented by the lessee.

(Forest Service Manual 2672.4 and BLM Manual 6840 require surveys for and management activities to be managed to prevent a trend toward federal listing of species. FS policy addresses species identified by the Regional Forester as sensitive species; Utah BLM adopts the UDWR Sensitive species).

The Forest Service is responsible for ensuring that the leased land is examined through the biological assessment process prior to undertaking any surface disturbing activities, to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened or their habitats. The finding of this biological assessment may result in some restrictions to the operators plans or even disallow use and occupancy that would be in violation of the 1973 Endangered Species Act (as amended), by detrimentally affecting endangered species or their habitats.

In order to further protect threatened and endangered species on the Dixie National Forest, the following lease notices will be attached to each lease where applicable:

LEASE NOTICE - Utah Prairie Dog

The lessee/operator is given notice that lands in this lease may contain historic and/or occupied Utah prairie dog habitat, a threatened species under the Endangered Species Act. Avoidance or use restrictions may be placed on portions of the lease. Application of appropriate measures will depend whether the action is temporary or permanent, and whether it occurs when prairie dogs are active or hibernating. A <u>temporary</u> action is completed prior to the following active season leaving no permanent structures and resulting in no permanent habitat loss. A

permanent action continues for more than one activity/hibernation season and/or causes a loss of Utah prairie dog habitat or displaces prairie dogs through disturbances, i.e. creation of a permanent structure. The following avoidance and minimization measures have been designed to ensure activities carried out on the lease are in compliance with the Endangered Species Act. Integration of and adherence to these measures will facilitate review and analysis of any submitted permits under the authority of this lease. Following these measures could reduce the scope of Endangered Species Act, Section 7 consultation at the permit stage.

Current avoidance and minimization measures include the following:

1. Surveys will be required prior to operations unless species occupancy and distribution information is complete and available. All Surveys must be conducted by qualified individual(s).
2. Lease activities will require monitoring throughout the duration of the project. To ensure desired results are being achieved, minimization measures will be evaluated and, if necessary, Section 7 consultation reinitiated.
3. Where technically and economically feasible, use directional drilling or multiple wells from the same pad to reduce surface disturbance and eliminate drilling in prairie dog habitat.
4. Surface occupancy or other surface disturbing activity will be avoided within 0.5 mile of active prairie dog colonies.
5. Permanent surface disturbance or facilities will be avoided within 0.5 mile of potentially suitable, unoccupied prairie dog habitat, identified and mapped by Utah Division of Wildlife Resources.
6. The lessee/operator should consider if fencing infrastructure on well pad, e.g., drill pads, tank batteries, and compressors, would be needed to protect equipment from burrowing activities. In addition, the operator should consider if future surface disturbing activities would be required at the site.
7. Within occupied habitat, set a 5 mph speed limit on operator-created access roads and adhere to speed limits on maintained roads.
8. Limit disturbances to and within suitable habitat by staying on designated routes.
9. Limit new access routes created by the project.
10. Unavoidable impacts to the species will be mitigated through site specific consultation with the USFWS.

Additional measures to avoid or minimize effects to the species may be developed and implemented in consultation with the U.S. Fish and Wildlife Service between the lease sale stage and lease development stage to ensure continued compliance with the ESA.

LEASE NOTICE - Mexican Spotted Owl

The Lessee/Operator is given notice that the lands in this lease contain suitable habitat for Mexican spotted owl, a federally listed species. Insert the following sentence if lease contains Designated Critical Habitat: *[The Lessee/Operator is given notice that the lands in this lease contain Designated Critical Habitat for the Mexican spotted owl, a federally listed species. Critical habitat was designated for the Mexican spotted owl on August 31, 2004 (69 FR 53181-53298).]* Avoidance or use restrictions may be placed on portions of the lease. Application of appropriate measures will depend whether the action is temporary or permanent, and whether it occurs within or outside the owl nesting season. A temporary action is completed prior to the following breeding season leaving no permanent structures and resulting in no permanent habitat loss. A permanent action continues for more than one breeding season and/or causes a

loss of owl habitat or displaces owls through disturbances, i.e. creation of a permanent structure. The following avoidance and minimization measures have been designed to ensure activities carried out on the lease are in compliance with the Endangered Species Act. Integration of, and adherence to these measures, will facilitate review and analysis of any submitted permits under the authority of this lease. Following these measures could reduce the scope of Endangered Species Act, Section 7 consultation at the permit stage.

Current avoidance and minimization measures include the following:

1. Surveys following Forest Service approved protocol will be required prior to operations unless species occupancy and distribution information is complete and available. All Surveys must be conducted by qualified individual(s).
2. Assess habitat suitability for both nesting and foraging using accepted habitat models in conjunction with field reviews. Apply the conservation measures below if project activities occur within 0.5 mile of suitable owl habitat. Determine potential effects of actions to owls and their habitat.
    a. Document type of activity, acreage and location of direct habitat impacts, type and extent of indirect impacts relative to location of suitable owl habitat.
    b. Document if action is temporary or permanent.
3. Lease activities will require monitoring throughout the duration of the project. To ensure desired results are being achieved, minimization measures will be evaluated and, if necessary, Section 7 consultation reinitiated.
4. Produced water will be managed to ensure maintenance or enhancement of riparian habitat.
5. Where technically and economically feasible, use directional drilling or multiple wells from the same pad to reduce surface disturbance and eliminate drilling in canyon habitat suitable for Mexican spotted owl nesting.
6. For all temporary actions that may impact owls or suitable habitat:
    a. If the action occurs entirely outside of the owl breeding season (March 1 – August 31), and leaves no permanent structure or permanent habitat disturbance, action can proceed without an occupancy survey.
    b. If action will occur during a breeding season, survey for owls prior to commencing activity. If owls are found, activity must be delayed until outside of the breeding season.
    c. Rehabilitate access routes created by the project through such means as raking out scars, revegetation, gating access points, etc.
7. For all permanent actions that may impact owls or suitable habitat:
    a. Survey two consecutive years for owls according to accepted protocol prior to commencing activities.
    b. If owls are found, no actions will occur within 0.5 mile of identified nest site. If nest site is unknown, no activity will occur within the designated Protected Activity Center (PAC).
    c. Avoid drilling and placing permanent structures within 0.5 mi of suitable habitat as identified by the Forest Service.
    d. Reduce noise emissions (e.g., use hospital-grade mufflers) to 45 dBA at 0.5 mile from suitable habitat, including canyon rims. Placement of permanent noise-generating facilities should be determined by a noise analysis to ensure noise does not encroach upon a 0.5 mile buffer for suitable habitat, including canyon rims.
    e. Limit disturbances to and within suitable habitat by staying on approved routes.
    f. Limit new access routes created by the project.

Additional measures to avoid or minimize effects to the species may be developed and implemented in consultation with the U.S. Fish and Wildlife Service between the lease sale stage and lease development stage to ensure continued compliance with the ESA.

LEASE NOTICE - California Condor

The Lessee/Operator is given notice that the lands located in this parcel contain potential habitat for the California condor, a federally listed species. Avoidance or use restrictions may be placed on portions of the lease if the area is known or suspected to be used by condors. Application of appropriate measures will depend on whether the action is temporary or permanent, and whether it occurs within or outside potential habitat. A temporary action is completed prior to the following important season of use, leaving no permanent structures and resulting in no permanent habitat loss. This would include consideration for habitat functionality. A permanent action continues for more than one season of habitat use, and/or causes a loss of condor habitat function or displaces condors through continued disturbance (i.e. creation of a permanent structure requiring repetitious maintenance, or emits disruptive levels of noise).

The following avoidance and minimization measures have been designed to ensure activities carried out on the lease are in compliance with the Endangered Species Act. Integration of and adherence to these measures will facilitate review and analysis of any submitted permits under the authority of this lease. Following these measures could reduce the scope of Endangered Species Act, Section 7 consultation at the permit stage.

Current avoidance and minimization measures include the following:

1. Surveys will be required prior to operations unless species occupancy and distribution information is complete and available. All Surveys must be conducted by qualified individual(s) approved by the USFS, and must be conducted according to approved protocol.
2. If surveys result in positive identification of condor use, all lease activities will require monitoring throughout the duration of the project to ensure desired results of applied mitigation and protection. Minimization measures will be evaluated during development and, if necessary, Section 7 consultation may be reinitiated.
3. Temporary activities within 1.0 mile of nest sites will not occur during the breeding season.
4. Temporary activities within 0.5 miles of established roosting sites or areas will not occur during the season of use, August 1 to November 31, unless the area has been surveyed according to protocol and determined to be unoccupied.
5. No permanent infrastructure will be placed within 1.0 mile of nest sites.
6. No permanent infrastructure will be placed within 0.5 miles of established roosting sites or areas.
7. Lessee is responsible to remove big game carrion to 100 feet from on lease roadways occurring within foraging range as feasible in coordination with the UDWR and the Forest Service. Carrion will become an unnecessary attractant.
8. Where technically and economically feasible, use directional drilling or multiple wells from the same pad to reduce surface disturbance and eliminate drilling in suitable habitat Utilize directional drilling to avoid direct impacts to large cottonwood gallery riparian habitats. Ensure that such directional drilling does not intercept or degrade alluvial aquifers.

Additional measures may also be employed to avoid or minimize effects to the species between the lease sale and lease development stages. These additional measures will be developed and implemented in consultation with the U.S. Fish and Wildlife Service to ensure continued compliance with the Endangered Species Act.

CULTURAL RESOURCES (National Historic Preservation Act of 1966 (NHPA), P.L. 89-665 as amended by P.L. 94-422, P.L. 94-458, and P.L. 96-515):

The Forest Service authorized officer is responsible for ensuring that the leased lands are examined prior to the undertaking of any ground-disturbing activities to determine whether or not cultural resources are present, and to specify mitigation measures for effects on cultural resources that are found to be present.

The lessee or operator shall contact the Forest Service to determine if a site-specific cultural resource inventory is required prior to undertaking any surface-disturbing activities on Forest Service lands covered by this lease.

The lessee or operator may engage the services of a cultural resource specialist acceptable to the Forest Service to conduct any necessary cultural resource inventory of the area of proposed surface disturbance. In consultation with the Forest Service authorized officer, the lessee or operator may elect to conduct an inventory of a larger area to allow for alternative or additional areas of disturbance that may be needed to accommodate other resource needs or operations.

The lessee or operator shall implement mitigation measures required by the Forest Service to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures.

During the course of actual surface operations on Forest Service lands associated with this lease, the lessee or operator shall immediately bring to the attention of the Forest Service the discovery of any cultural or paleontological resources. The lessee or operator shall leave such discoveries intact until directed to proceed by Forest Service.

AIR RESOURCES (Clean Air Act of 1963, as amended by P.L. 90-148, P.L. 91-604, and P.L. 101-549; National and State of Utah Ambient Air Quality Standards, National Standards of Performance for New Stationary Sources, National Prevention of Significant Deterioration Standards, National Emissions Standards for Hazardous Air Pollutants, Utah Air Conservation Regulations (R446), and Utah State Implementation Plan)

1. The operator shall comply with the following practices to control impacts to ambient air quality from oil and gas exploration and production activities:

   a. As appropriate, quantitative analysis of potential air quality impacts will be conducted for project-specific developments by the operator, in concert with direction from the Utah Department of Environmental Quality, Division of Air Quality (UDAQ), the Forest Service and cooperating federal land management agencies including but not limited to the National Park Service. The Forest Service will notify cooperating agencies as project specific proposals are received and additional air impact analyses are performed to ensure input from those agencies. Additional project specific air impact analyses would need to be conducted if the following project criteria are fulfilled:
   i. If an exploration drilling project is proposed within 5km of an adjacent Class I area, air quality related value (AQRV) impacts would need to be addressed utilizing at a minimum the VISCREEN screening tool. Additional air impact analyses may be necessary based on the review of the initial VISCREEN analysis.

ii. If an oil and gas production project is proposed at a distance of over 60km from an adjacent Class I area and has emissions that exceed those utilized in the existing “Dixie 20-well development scenario", A quantitative air quality impact analysis would need to be conducted for the project that follows the guidance found in the FLAG modeling guidelines.

iii. If an oil and gas production project is proposed within 60km of an adjacent Class I area and has emissions that equal or exceed those utilized in the existing “Dixie 20-well development scenario", a quantitative air quality impact analysis would need to be conducted for the project that follows the guidance found in the FLAG modeling guidelines.

iv. If an exploratory drilling or oil and gas development project is proposed to occur within 60km of an adjacent Class I area and has emissions that are greater than those utilized in the existing "exploratory drilling scenario" but less than those utilized in the "Dixie 20-well development scenario", consultation with the Forest Service and cooperating Federal Agencies would be required to determine an appropriate assessment of air quality impacts. The level of additional analysis would be predicated on the size of the proposed project.

b. Compliance with Utah Air Conservation (UAC) Regulation R446-1 would be necessary. The best air quality control technology, as per guidance from the UDAQ, will be applied to actions as needed to meet air quality standards.

c. The operator will comply with UAC Regulation R446-1-4.5.3, which prohibits the use, maintenance, or construction of roadways without taking appropriate dust abatement measures. Compliance will be obtained through special stipulations as a requirement on new projects and through the use of dust abatement control techniques in problem areas.

d. The operator will manage authorized activities to maintain air quality within the thresholds established by the State of Utah Ambient Air Quality Standards and to ensure that those activities continue to keep the area in attainment, meet prevention of significant deterioration (PSD) Class II standards, and protect the Class I air shed of the National Parks (e.g. Zion, Bryce Canyon, and Capitol Reef National Parks).

e National Ambient Air Quality Standards will be enforced by the UDEQ, with EPA oversight. Special requirements to reduce potential air quality impacts will be considered on a case-by-case basis in processing land-use authorizations.

f. The operator will utilize BMPs and site specific mitigation measures, when appropriate, based on-site specific conditions, to reduce emissions and enhance air quality. Examples of these types of measures can be found in the Four Corners Air Quality Task Force Report of Mitigation Options, November 1, 2007; EPA Natural Gas STAR Program (http://www.epa.gov/gasstar/); and US Forest Service Emission Reduction Techniques for Oil and Gas activities 2011 (http://www.fs.fed.us/air/documents/EmissionReduction-010711x.pdf).

g. The operator will comply with a Condition of Approval for Applications for Permit to Drill, which includes: (1) All new and replacement internal combustion diesel fired drilling engines must meet or exceed Tier II emissions limits as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (2) All new and replacement internal combustion diesel fired well pump engines must meet or exceed Tier II emissions limits for Particulate Matter and Tier III emissions limits for Oxides of Nitrogen and Carbon Monoxide as codified in 40 CFR Part 89 - "Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines". (3) All new and replacement spark ignited natural gas fired internal combustion well-pump engines must meet or exceed emissions limits for Oxides of Nitrogen, Carbon Monoxide and Volatile Organic Compounds from New Source Performance Standard Subpart JJJJ for

Stationary Spark Ignition Internal Combustion Engines manufactured since 2008. (4) All new and replacement internal combustion gas field engines of less than or equal to 300 design-rated horsepower must not emit more than 2 grams of NOx per horsepower-hour. This requirement does not apply to gas field engines of less than or equal to 40 design-rated horsepower. (5) All new and replacement internal combustion gas field engines of greater than 300 design rated horsepower must not emit more than 1.0 grams of NOx per horsepower-hour. (6) All diesel fuel fired internal combustion engines must utilize certified Ultra Low Sulfur Diesel fuel with a maximum sulfur content of 15 parts per million (PPM).

h. Lease holders will need to conduct detailed volatile organic compound (VOC) emissions inventories for any proposed facilities to provide necessary data to the BLM Utah State Office for their regional photochemical modeling.

i. Lease holders will need to examine the use of additional mitigations for ozone precursors.

CAVE RESOURCES

The Lessee/Operator is given notice that the lands located in this parcel contain potential areas with known or suspected caves, lava tubes, and karst features.

Cave resources are defined as any naturally formed void, cavity, recess, natural pit, sinkhole, or other feature that is large enough to permit a person to enter, whether or not the entrance is naturally formed or human-made. The term includes any extension or component of a cave or system of interconnected cave passages that occur beneath the surface of the earth or within a cliff or ledge, and/or natural subsurface water and drainage systems. Cave resources include any material or substance occurring naturally in caves, such as animal life, plant life, paleontological deposits, sediments, minerals, speleogens (relief features on the walls, ceiling, and floor of any cave that are part of the surrounding bedrock), and speleothems (any natural mineral formation or deposit occurring in a cave).

Surveys will be required to determine if cave resources occur within or adjacent to the proposed project area and all casing and cementing programs must be designed to allow for a karst protection string and all strings of casing must be cemented to the surface. Upon abandonment of the well the wellbore will be cemented from the base of the cave/karst zone to the surface.

Most cave resource potential is in the Cedar City Ranger District; very few areas have been mapped.

FLOODPLAINS AND WETLANDS (EO 11988; EO 11990)

The lessee is hereby notified that this lease may contain land within a riparian or wetland ecosystem.

All activities within this area may be precluded or highly restricted in order to comply with Executive Order 11988 - Floodplain Management and Executive Order 11990 - Protection of Wetlands, in order to preserve and restore or enhance the natural and beneficial values served by floodplains and wetlands.

Occupancy and use of lands within riparian or wetland areas, as proposed in a Surface Use Plan of Operations, will be considered in an environmental analysis and mitigation measures deemed necessary to protect these areas identified. These areas are to be avoided to the extent possible, or special measures such as road design, well pad size and location or directional drilling, may be made part of the permit authorizing the activity.

SENSTIVE PLANT SPECIES (Forest Service Manual 2670)

The Forest Service is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any Forest-Sensitive plant species or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would lead to a loss of viability for any sensitive plant species.

The lessee/operator may, unless notified by the Forest Service that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of a proposed action on Forest-Sensitive plants or their habitats.

DRINKING WATER PROTECTION ZONES (R309-600-7(1) Utah Administrative Code Source Protection: Drinking Water Source Protection for Groundwater Sources)

LEASE NOTICE - Groundwater Protection Zones 2-4:

This lease (or a portion thereof) is within one or more Drinking Water Source Protection Zones (DWSPZs) designated by the Utah Division of Drinking Water (DDW). Prior to a lease being offered up for sale that overlies a DWSPZ the BLM would attach IM No. UT 2010-055, Attachment F (Utah Drinking Water Source Protection Zone Lease Notice).

BLM's rules and regulations outlined in 43 CFR §3162.4-2, §3162.5-1(a) and §3162.5-2 (d) Control of wells, Onshore Oil and Gas Orders Nos. 2 and 7, and the Gold Book have been developed to address potential impacts to ground water from the drilling and completion of oil and gas wells, including the construction and use of reserve and production pits. Specifically, §3162.5-2 (d) *Protection of fresh water and other minerals* requires that the operator shall isolate freshwater-bearing and other usable water containing 5,000 ppm or less dissolved solids and Onshore Order No. 2 increases the requirement by establishing a 10,000 ppm total dissolved solids (TDS) threshold for protection of usable water.

Concurrent with submittal of an application for a permit to drill (APD), or any proposed surface-disturbing activity, the lessee/operator must provide the BLM Authorized Officer (AO) protective measures, which adequately address protection of the DWSPZ or other usable ground water zones. If operator proposed measures are considered insufficient to adequately protect the water zones, the AO will incorporate additional protective measures as condition(s) of approval (COAs). During further analysis at time of APD approval, the BLM would attach IM No. UT 2010-055, Attachment G (Utah Drinking Water Source Protection Zone COA).

Geophysical logs will be required in order to determine cement integrity and subsequent protection/isolation of usable ground water resources. Upon well completion, additional testing may be required to verify well bore integrity for protection of usable ground water resources. Testing results will be evaluated to determine if effective implementation of mitigation measures has been achieved.

LEASE NOTICE - Existing Transient Non-Community Water Systems – Zones T2 and T4:

This lease (or a portion thereof) is within Drinking Water Source Protection Zones designated as a transient non-community water system which does not serve 25 of the same nonresident persons per day for more than 6 months per year by the Utah Division of Drinking Water. The Transient System T2 protection zone for existing wells or springs is the area within a 250-day ground-water time of travel to the wellhead, spring or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. The Transient System T4 protection zone for existing wells or springs is the area within a 10-year ground-water time of travel to the wellhead, spring or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. Compliance with R309-600 is voluntary for existing transient non-community water systems. However, all new ground water sources (including transient non-community systems) must submit to the DDW a Preliminary Evaluation Report (R309-600-13(2)) and a Drinking Water Source Protection Plan (R309-600-7(1)) which designates ground water source protection zones 1 through 4. Protection of the zones T2 and T4 must also comply with **LEASE NOTICE – Groundwater Protection Zones 2-4.**

LEASE NOTICE – Surface Water Protection Zones 2-4

This lease (or a portion thereof) is within public Drinking Water Source Protection Zones 2, 3, and/or 4. Before application for a permit to drill (APD) submittal or any proposed surface-disturbing activity, the lessee/operator must contact the BLM field office and the public water system manager to determine any zoning ordinances, best management or pollution prevention measures or physical controls that may be required within the protection zone. Drinking Water Source Protection plans are developed by the public water systems under the requirements of R309-605-7, Drinking Water Source Protection for Surface Sources (Utah Administrative Code). There may also be county ordinances in place to protect the source protection zones, as required by Section 19-4-113 of the Utah Code.

Incorporated cities and towns may also protect their drinking water sources using Section 10-8-15 of the Utah Code. Cities and town have the extraterritorial authority to enact ordinances to protect a source of drinking water ... "For 15 miles above the point from which it is taken and for a distance of 300 feet on each side of such stream..." Class I cities (greater than 100,000 population) are granted authority to protect their entire watersheds.

Some public water sources qualify for monitoring waivers which reduce their monitoring requirements for pesticides and volatile organic chemicals (VOCs). Exploration, drilling and production activities within a Source Protection Zone could jeopardize these waivers, thus requiring increased monitoring. Contact the public water system to determine what effect your activities may have on their monitoring waivers. Please be aware of other state rules to protect surface and ground water, including Utah Division of Water Quality Rules R317 Water Quality Rules; and Rules of the Utah Division of Oil, Gas and Mining, Utah Oil and Gas Conservation Rules R649.
During further analysis at time of APD the BLM would attach IM No. UT 2010-055, Attachment G - Utah Drinking Water Source Protection Zone COA.

At the time of development, drilling operators will additionally conform to the BLM operational regulations and Onshore Oil and Gas Order No. 7 (which prescribes measures required for the handling of produced water to ensure the protection of surface and ground water sources) and the Surface Operating Standards and Guidelines for Oil and Gas Development, The Gold Book,

Fourth Edition-Revised 2007 (which provides information and requirements for conducting environmentally responsible oil and gas operations).

LEASE NOTICE – Sole Source Aquifers

This lease (or a portion thereof) is within Sole Source Aquifer Protection zone designated by the Environmental Protection Agency (EPA). BLM's rules and regulations outlined in 43 CFR §3162.4-2, §3162.5-1(a) and §3162.5-2 (d) Control of wells, Onshore Oil and Gas Orders Nos. 2 and 7, and the Gold Book have been developed to address potential impacts to ground water from the drilling and completion of oil and gas wells, including the construction and use of reserve and production pits. Specifically, §3162.5-2 (d) *Protection of fresh water and other minerals* requires that the operator shall isolate freshwater-bearing and other usable water containing 5,000 ppm or less dissolved solids and Onshore Order No. 2 increases the requirement by establishing a 10,000 ppm total dissolved solids (TDS) threshold for protection of usable water.

During further analysis at time of APD the BLM would attach IM No. UT 2010-055, Attachment G - Utah Drinking Water Source Protection Zone COA.

Concurrent with submittal of an application for a permit to drill (APD), or any proposed surface-disturbing activity, the lessee/operator must provide the BLM Authorized Officer (AO) protective measures, which adequately address protection of the Sole Source Aquifer and other usable ground water zones. If operator proposed measures are considered insufficient to adequately protect the water zones, the AO will incorporate additional protective measures as condition(s) of approval (COAs).

Geophysical logs will be required in order to determine cement integrity and subsequent protection/isolation of usable ground water resources. Upon well completion, additional testing may be required to verify well bore integrity for protection of usable ground water resources. Testing results will be evaluated to determine if effective implementation of mitigation measures has been achieved.

Appendix E – Estimated Traffic Volume by Type for the Fishlake National Forest

Fishlake National Forest's Estimated Traffic Volumes by Type (09/17/2007)

ACTIVITY	LIGHT TRUCKS (Round Trips)	HEAVY TRUCKS (Round Trips)
EXPLORATION WELLS (Total Traffic Volumes/Well)		
Area Reconnaissance and Surveying – Planning Pads and Wells	15	-
Mobilize Construction Equipment	2	5
Road and Pad Construction		
Equipment Mobilization	-	8
Personnel/Supplies	25	
Gravel Hauling	-	288
Drill Rig Mobilization		
Rig Components (Move-in)	-	30
(Move out)	-	30
Personnel/Supplies	25	-
Exploration Drilling		
Water Trucks	-	300
Waste Disposal	-	50
Drill Mud/Materials	-	10 – 20
Well Casing	-	10
Cement/Flyash	-	4 - 9
Misc. Equipment	-	10
Personnel/Supplies	100	-
Well Plugging and Abandonment/Reclamation of Pad and Road (No Discovery)		
Cement and Water	-	15
Construction Equipment	-	5
Remove/Haul Reserve Pit Fluids for Disposal	-	10
Personnel/Supplies	20	-
DISCOVERY/PRODUCTION WELLS (Total Traffic Volumes/Well)		
Well Completion/Completion Rig		
Rig Mobilization (Move-in)	-	4
(Move-out)	-	4
Casing/Perforation/Cementing, Fracturing	-	30
Water Trucks	-	50
Personnel/Supplies	15	-
PRODUCTION WELL PADS (Total Traffic Volumes/Pad)		
Production Construction/Development		
Haul in Facilities (Wellhead/pumps, tanks, pipeline manifolds, etc.)	-	10
	-	-
Personnel/Supplies	25	

ACTIVITY	LIGHT TRUCKS (Round Trips)	HEAVY TRUCKS (Round Trips)
CENTRAL PRODUCTION FACILITIES/ANCILLARY FACILITIES (Total Traffic Volumes/Field) 2 Fields Predicted		
Construction		
Construction Equipment Mobilization	-	8-20
Gravel Hauling to Pad	-	300
Personnel/Supplies	50	-
Buildings/Facilities (Compressors, Generators, Pipeline Manifolds, Heater-Treaters, etc.)		
Hauling to pad	-	10-100
Personnel/Supplies	200	-
Pipeline, Powerlines, Oil Loading Pad		
Haul in Equipment (excavators, pipe, welders, etc.)	-	50
Personnel/Supplies	100	-
FIELD OPERATIONS/PRODUCTION (Average Traffic Volumes/Day)		
Operations		
Haul oil to market/refinery	-	10
Dispose of water/distillates/gas	-	0-1
Workover rigs	0.1	0.1
Maintenance/Repairs	0.2	0-0.1
Personnel/Supplies	3	-
Other??	0.1	0-0.1
FIELD/WELL ABANDONMENT/REMOVAL (Total Traffic Volume/Field)		
Plug and Abandon Production Wells	20	
Remove downhole pumps, monitors, etc.		Combined with rig mobilization
Mobilize Plugging Rig (Move-in)	-	40
(Move-out)		40
Plug/Cement (Haul cement, plugging mud, water, etc.)	-	50-100
Mobilize construction equipment	-	8
Remove buildings, facilities, and contaminated gravel and soils	-	25-50
Personnel/Supplies	100	-
RECLAIM SURFACE DISTURBANCE (Total Traffic Volume/Field)		
Mobilize construction equipment	-	25
Contour disturbed area (approx. original contour), replace topsoil, and seed/mulch	-	15
Fence reclaimed pads	-	3
Personnel/Supplies	30-50	-

Based mostly on UDOT U.S. 40 Corridor Predicted Traffic Volumes and personnel communications with Wolverine Gas and Oil Co.
Gravel hauling estimated by FS based on required average aggregate depth requirements, pad sizes, and road distances.