Aquatic Biota Specialist Report

Motorized Travel Plan
Dixie National Forest

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I. Description of Affected Environment and Analysis

Introduction

The Dixie National Forest Motorized Travel Plan project involves the designation of a motorized travel system for the Forest. Following completion of the plan, motorized travel on the forest will be restricted to designated routes and areas only.

The project area is comprised of all four ranger districts on the Dixie National Forest (Cedar City, Escalante, Pine Valley, and Powell), and the Teasdale portion of the Fremont River Ranger District. In March 2006 the Teasdale Ranger District on the Dixie National Forest and the Loa Ranger District on the Fishlake National Forest were consolidated into the Fremont River Ranger District. This new ranger district is administered by the Fishlake National Forest, though the area that was the Teasdale Ranger District remains part of the Dixie National Forest.

Dixie National Forest Aquatic Biota

This section summarizes the aquatic biota that occur on the Dixie National Forest. Aquatic biota on the Forest can be broken into four broad categories: sport fish, non-game fish, aquatic macroinvertebrates, and amphibians. The more inconspicuous forms of aquatic biota such as aquatic mollusks and aquatic plants have not generally been studied across the Forest.

Sport Fish

Sport fisheries on the Dixie National Forest are generally cold-water habitats comprised of resident trout. Resident trout are Management Indicator Species (MIS). The following is a list of common sport fish on the Forest.

Native Trout

- **Bonneville cutthroat trout.** The native trout across the portion of the Forest that drains into the Bonneville Basin. It is a Forest Service Region 4 (R4) Sensitive species and is also considered an emphasis MIS. See Rodriguez (2004) for additional information on life history and Forest trend of this species. Bonneville cutthroat trout have been monitored on about a 7-year schedule. They were last monitored in 2002 and the results were summarized by the Utah Division of Wildlife Resources (UDWR) (Hepworth et al. 2003).
- **Colorado River cutthroat trout.** The native trout across the portion of the Forest that drains into the Colorado River Basin via the Fremont and Escalante river systems. It is also a Forest Service R4 Sensitive species. See Rodriguez (2004) for additional information on life history and Forest trend of this species. Colorado River cutthroat trout have been periodically monitored by the UDWR over the last 10 years. Most of the populations on the Forest were last monitored in 2006. This population data is available at the UDWR office in Cedar City, Utah.

Non-native Trout

Resident trout populations are periodically monitored by UDWR and Forest Service personnel. Common monitoring techniques include electroshocking and gill netting. Due to time and budget constraints, many locations on the Forest have limited recent data.

- **Rainbow trout.** Common non-native trout on the Forest, stocked in many lakes and occurring wild in many of the streams. The original range of this fish species is the western coast of North America. See Rodriguez (2004) for additional information on life history and Forest trend of this species.
- **Brown trout.** Non-native introduced from Europe. Occurs wild in many lower elevation streams. Able to tolerate higher water temperatures and poorer water quality than most trout, and is also more resistant to whirling disease. See Rodriguez (2004) for additional information on life history and Forest trend of this species.
- **Brook trout.** Non-native introduced from the eastern United States. Occurs wild in many upper elevation streams and stocked in many of the Boulder Mountain lakes. This species can reproduce prolifically and has a tendency to stunt in some lakes on the Forest, but can grow to trophy size in areas where reproduction is limited or absent and numbers are controlled through appropriate stocking. See Rodriguez (2004) for additional information on life history and Forest trend of this species.

Sterile Hybrid Trout

Since these fish are sterile, numbers are set by stocking rates and angler harvest and reproduction is not an issue. UDWR periodically monitors if levels of stocking and harvest are appropriate through creel surveys.

- **Splake.** This is a sterile hybrid created by crossing brook trout and lake trout. They are stocked into Navajo Lake on the Forest for sport fishing.
- **Tiger trout.** This is a sterile hybrid created by crossing brown trout and brook trout. They are planted in several lakes and reservoirs on the Forest including Panguitch Lake and several Boulder Mountain lakes. They are a popular fish with anglers.

Other Game Fish

- **Small mouth bass.** This is a popular sport fish that is present within Enterprise Reservoir. This species is non-native in Utah. Its native range includes much of central and eastern North America.
- **Arctic grayling.** This fish has been stocked into many waters on Boulder Mountain. This species is non-native to Utah. Its native range includes northern potions of North America, Europe, and Asia.

Non-game Fish

These non-game fish are often not seen by anglers. Mountain suckers and mottled sculpin are adapted to live near the stream bottom making observation and capture by electroshocking more difficult. There is not currently any data on non-game fish trend. Standard trout sampling techniques may not catch a fully representative sample.

- **Virgin spinedace.** Native minnow found in Moody Wash. Managed under a cooperative conservation strategy. State sensitive species. Distributed throughout Virgin River headwaters downstream of National Forest System lands.
- **Mountain sucker.** Common native sucker that occurs across the Forest. A relatively small sucker adapted for stream life.

- **Desert sucker.** Native sucker present within the Virgin River system. Limited distribution within the Forest boundary.
- Speckled dace. Common native dace, widely distributed across the Forest.
- **Mottled sculpin.** Native sculpin that occurs in some Forest streams, including Swains Creek and Boulder Creek.
- **Southern leatherside.** Limited distribution on Forest. Occupied habitat includes Clay Creek and Bear Creek. They are considered a state sensitive species.

Other Aquatic Biota

Amphibians

There is limited trend data for amphibians on the Dixie National Forest. Important or new sightings are documented and given to the UDWR for input into a state database. Forest personnel and the UDWR have been conducting boreal toad surveys in important habitats, which has provided a rough index of trend.

- **Boreal toad.** Occurs in upper elevation streams, wetlands, and adjacent uplands on the Paunsaugunt Plateau and Boulder Mountain. They are considered a state sensitive species.
- **Arizona toad.** On Forest this species occurs within Virgin River headwater riparian areas. Listed as a state sensitive species.
- **Boreal chorus frogs.** Occurs in upper elevation ponds and small lakes on the Markagunt Plateau and Boulder Mountain.
- **Leopard frog.** Occurs in mid-elevation zones. Most common on the Forest in the East Fork of Sevier drainage.
- **Canyon treefrog.** Common lower elevation frog within the Virgin River system.
- **Tiger salamander.** Fairly widespread across the Forest.
- **Woodhouse toad.** Common lower elevation toad.
- **Spadefoot toad.** Common lower elevation toad.
- **Red-spotted toad.** Common lower elevation toad.
- **American bullfrog.** Non-native frog with limited distribution within the Virgin River headwaters.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates include species that can be seen by the naked eye (without magnification). Aquatic macroinvertebrate communities are generally sensitive to disturbance and environmental pollution. The assemblage of macroinvertebrate species that is found within an aquatic ecosystem is representative of the overall habitat condition for the respective water body.

The document, “Life History Trend Analysis of Endangered, Threatened, Candidate, Sensitive, and Management Indicator Species of Dixie National Forest” (Rodriguez 2004) contains a comprehensive description of life histories and habitat requirements for species that occur on and near the Forest. It also provides estimates on population trends for MIS. This document is hereby incorporated by reference.

Resource Review

The Forest contains portions of 39 5th field Hydrologic Unit Code (HUC) watersheds. Within the Forest boundary, 22 of these watersheds support self-sustaining fisheries, while 17 do not provide any appreciable aquatic habitat. The following 5th HUC watersheds do not contain an appreciable amount of aquatic biota resource on the Dixie National Forest, and furthermore do not support any known self-sustaining aquatic biota populations.

Because they do not contain any appreciable aquatic habitat (i.e., no perennial streams or permanent waterbodies), their capacity to support viable populations of amphibians is greatly diminished. Macroinvertebrates can be found anywhere there is water, but there is no meaningful data to allow discussion of macroinvertebrate communities within these 17 watersheds. These watersheds will not be analyzed further in this report.

Table 1. Dixie National Forest Watersheds with Limited or No Aquatic Biota Resources

5th Field HUC Name	5th Field HUC Number	Ranger District(s)	Acres within Dixie NF
Gold Springs Wash	1603000610	Pine Valley	1,304
Pinon Park Wash	1603000611	Pine Valley	5,100
Iron Springs Creek	1603000605	Pine Valley	1,897
Shurtz Creek – Quichapa Lake	1603000604	Pine Valley	2,565
Lower Santa Clara River	1501000808	Pine Valley	20,395
Jack Rabbit Wash – Rush Lake	1603000603	Cedar City	20,671
North Fork Virgin River	1501000801	Cedar City	12,455
Pass Creek – Sevier River	1603000103	Cedar City, Powell	75,825
Kanab Creek Headwaters	1501000301	Powell, Cedar City	6,848
Upper Johnson Wash	1501000303	Powell	2,340
Upper Buckskin Gulch	1407000704	Powell	6,579
Sheep Creek	1407000702	Powell	10,069
City Creek – Sevier River	1603000106	Powell	21,740
Upper Paria River	1407000701	Escalante	24,962
Upper Wahweap Creek	1407000608	Escalante	549
Harris Wash	1407000503	Escalante	10,764
Horse Canyon – Escalante River	1407000504	Fremont River, Escalante	19,442

The aquatic biota resource for each of the 22 watersheds that do support self-sustaining fisheries are described below.

Shoal Creek Watershed (5th Field HUC 1603000613)
The Shoal Creek Watershed is located in the western portion of the Pine Valley Ranger District. The total watershed acreage is approximately 197,295, of which approximately 131,744 acres are located on the Forest. On Forest, there is approximately 1 mile of fish-bearing stream and 476 acres of fish-bearing lakes within the watershed.

Table 2. Shoal Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Upper Enterprise Reservoir	160300061302	Rainbow trout, small mouth bass	Popular sport fishing reservoir. Tributaries include: Lost Creek, Rattlesnake Creek, Pine Canyon Creek, and Rock Canyon Creek
Lower Enterprise Reservoir	160300061302	Rainbow trout, small mouth bass	Popular sport fishing reservoir. Tributaries include: Upper Enterprise Reservoir outflow and Grassy Creek.
Rock Canyon Creek	160300061302	Rainbow trout	Tributary to Upper Enterprise Reservoir. Dries up late in the summer and during periods of drought.

Upper Beaver Dam Wash Watershed (5th Field HUC 1501001001)
The Upper Beaver Dam Wash Watershed is located in the western portion of the Pine Valley Ranger District. The total watershed acreage is approximately 217,996 acres, of which approximately 19,988 acres are located on the Forest. On Forest, there are approximately 5.3 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 3. Upper Beaver Dam Wash Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Pine Park Canyon	150100100101	Rainbow trout, desert sucker, Arizona toad, American bullfrog	Valuable Arizona toad habitat. Occupied fish habitat has limited extent on Forest.

Pine Park Canyon is a perennial stream that drains into Beaver Dam Wash. This stream contains populations of rainbow trout and desert sucker. This drainage also provides valuable amphibian habitat with Arizona toad and American bullfrog both present. The Arizona toad is listed as a State of Utah Species of Concern due to limited distribution, habitat degradation, and hybridization concerns (UDWR 2006). Within Pine Park Canyon, the non-native American bullfrog is a substantial threat to the long-term persistence of the Arizona toad.

Moody Wash Watershed (5th Field HUC 1501000806)
The Moody Wash Watershed is located in the southern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 68,914 acres, of which approximately 58,498 acres are located on the Forest. On Forest, there are approximately 7 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 4. Moody Wash Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Moody Wash	150100080602	Virgin spinedace, desert sucker, speckled dace, Arizona toad, canyon treefrog, red-spotted toad, Woodhouse's toad	Uppermost distribution of Virgin spinedace within the Santa Clara River drainage. Valuable amphibian habitat.

Moody Wash below Racer Canyon provides important year-round and seasonal habitats for the Virgin spinedace, a State of Utah sensitive species. Current threats to Virgin spinedace within the drainage include livestock grazing and tamarisk invasion. Moody Wash also provides important habitat for multiple amphibian species, including Arizona toad (also a State of Utah sensitive species).

Escalante Valley – Pinto Creek Watershed (5th Field HUC 1603000614)
The Escalante Valley – Pinto Creek Watershed is located in the northeastern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 223,007 acres, of which approximately 62,584 acres are located on Forest. On Forest, there are approximately 14.5 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 5. Escalante Valley-Pinto Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Pinto Creek	160300061401	Rainbow trout, speckled dace	Marginal trout habitat. Private land use, livestock grazing, and road system are limiting habitat quality.
South Fork Pinto Creek	160300061401	Rainbow trout, speckled dace	Marginal trout habitat. Water temperature regime likely limiting trout population.

Pinto Creek is a perennial stream that originates near Pinto Spring. The South Fork of Pinto Creek is supplemented by an out-of-basin water transfer from the Santa Clara River drainage. Both of these streams contain populations of rainbow trout and speckled dace. Motorized recreation, the road system, livestock grazing, and private land impacts are adversely affecting fisheries habitat within the drainage.

In 2006, the road located within the South Fork Pinto Creek drainage bottom was obliterated. This action will improve fish habitat in over 2 miles of stream.

Upper Santa Clara River Watershed (5th Field HUC 1501000807)
The Upper Santa Clara River Watershed is located in the southern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 88,322 acres, of which approximately 73,981 acres are located on Forest. On Forest, there are approximately 27.3 miles of fish-bearing streams and 5.5 acres of fish-bearing lakes within the watershed.

Table 6. Upper Santa Clara River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Reservoir Canyon	150100080701	Bonneville cutthroat trout (BCT)	Good BCT habitat, located inside Pine Valley Mountain Wilderness Area.
Water Canyon	150100080701	BCT	Marginal BCT habitat due to road and livestock impacts.
Santa Clara River	150100080702	Brown trout, brook trout, rainbow trout	Marginal to good fish habitat. Lots of habitat impacts from Pine Valley Recreation Area use.
Forsyth Creek	150100080702	Rainbow trout	Limited habitat availability due to low stream flow. Partially located within Pine Valley Mountain Wilderness Area.
Lloyd Creek	150100080702	Presumed fishless	Perennial stream that could possibly support trout. Survey in 2004 indicated no fish present.
Pine Valley Reservoir	150100080702	Brown trout, brook trout, rainbow trout	Popular sport fishing reservoir. Located along Santa Clara River, within Pine Valley Recreation Area.

Despite the Upper Santa Clara River Watershed occurring within the Virgin River drainage, Bonneville cutthroat trout (BCT) are assumed native to a portion of the area. This subspecies of cutthroat trout is native to the Bonneville Basin of Utah, Nevada, and Idaho. However, due to a headwater capture at some point during the era of Pleistocene Lake Bonneville, BCT established some populations within the headwaters of the Santa Clara River, including Water Canyon (Behnke 2002). It is unknown to what extent the species was distributed within the Santa Clara drainage; however, the population located within Water Canyon is accepted as a true remnant population. Anecdotal evidence suggests that this population was replicated into Reservoir Canyon sometime around 1900 by local pioneers. This strain of BCT was further replicated into several drainages on the east side of the Pine Valley Mountain Wilderness Area by the UDWR during the 1980s and 1990s (Hepworth 2003).

Within the geographic area, the Santa Clara River drainage is a popular sport fishing destination. This area includes the river and Pine Valley Reservoir. Target species include rainbow trout, brown trout, and brook trout. The Santa Clara River originates within the Pine Valley Mountain Wilderness Area and travels downstream through the Pine Valley Recreation Area and town of Pine Valley before flowing off-Forest near the town of Central. Fisheries habitat within the drainage is being impacted by heavy recreational use within the Pine Valley Recreation Area and by private land use within the town of Pine Valley.

Ash Creek Watershed (5th Field HUC 1501000804)

The Ash Creek Watershed is located in the eastern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 137,577 acres, of which approximately 59,520 acres are located on Forest. On Forest, there are approximately 18.8 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 7. Ash Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
South Ash Creek	150100080405	BCT	Good BCT habitat. Flows through isolated canyon. Limited BCT distribution due to 2002 Sequoia Fire.
Mill Creek	150100080405	BCT	Habitat currently recovering from 2002 Sequoia Fire. Limited BCT distribution.
Harmon Creek	150100080405	BCT	Habitat currently recovering from 2002 Sequoia Fire. Limited BCT distribution.
Leap Creek	150100080404	BCT	Habitat currently recovering from 2002 Sequoia Fire. Limited BCT distribution.

In 2002, the Sequoia Fire burned in the headwaters of the Ash Creek watershed and severely impacted the BCT fisheries that were located in Harmon Creek, Mill Creek, South Ash Creek, and Leap Creek. Post-fire flooding and erosion eliminated all BCT within these streams. Since that time, a small number of BCT have been reintroduced into these systems and are currently expanding.

Gould Wash – Virgin River Watershed (5th Field HUC 1501000809)
The Gould Wash – Virgin River Watershed is located in the southeastern portion of the Pine Valley Ranger District. The total watershed acreage is approximately 225,613 acres, of which approximately 42,955 acres are located on Forest. On Forest, there are approximately 10.9 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 8. Gould Wash-Virgin River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Leeds Creek	150100080906	BCT	Good BCT habitat. Some impacts from road system are occurring.
Horse Creek	150100080906	BCT	Marginal BCT habitat due to low stream flow.
Spirit Creek	150100080906	BCT	Marginal BCT habitat due to low stream flow.
Pig Creek	150100080906	BCT	Marginal BCT habitat due to low stream flow.

The Gould Wash – Virgin River Watershed provides important BCT habitat. The UDWR established these populations of BCT using fish from Water Canyon and Reservoir Canyon during the 1980s and 1990s. In recent years fish from these streams have been used to reestablish BCT populations within streams affected by the 2002 Sequoia Fire.

Little Salt Lake Watershed (5th Field HUC 1603000602)
The Little Salt Lake Watershed is located in the western portion of the Cedar City Ranger District. The total watershed acreage is approximately 105,506 acres, of which approximately 21,634 acres are located on Forest. On Forest, there are approximately 12.3 miles of fish-bearing streams and 37.9 acres of fish-bearing lakes within the watershed.

Table 9. Little Salt Lake Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Center Creek	160300060202	Rainbow trout	Marginal trout habitat. Habitat is limited by road, dispersed recreation, and channel gradient.
Bowery Creek	160300060202	Brook trout, rainbow trout, cutthroat trout	Fish surveys in 2006 indicated no fish downstream of Yankee Meadow Reservoir. Limited occupied habitat upstream of reservoir.
Yankee Meadow Reservoir	160300060202	Brook trout, rainbow trout, cutthroat trout	Reservoir located on State land. Popular sport fishery. Constructed spawning channel on inlet (Bowery Creek).

Yankee Meadow Reservoir is a popular sport fishing destination. Target fish species include brook trout, cutthroat trout, and rainbow trout. Bowery Creek is the major water source for the reservoir. There is a human-made spawning channel that is located at the inlet to the reservoir. This channel was constructed to increase natural recruitment into the reservoir's fishery. This reservoir is actually on a state land inholding, surrounded by the Dixie National Forest.

Center Creek and Bowery Creek are perennial streams that support non-native trout fisheries. The road system, livestock grazing, motorized recreation, and dispersed camping are adversely affecting fish habitat within the watershed.

Fremont Wash Watershed (5th Field HUC 1603000601)
The Fremont Wash Watershed is located in the western portion of the Cedar City Ranger District. The total watershed acreage is approximately 215,384 acres, of which approximately 32,460 acres are located on Forest. On Forest, there are approximately 3.4 miles of fish-bearing streams and 40.2 acres of fish-bearing lakes within the watershed.

Table 10. Fremont Wash Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Red Creek	160300060109	Rainbow trout	Tributary to Red Creek Reservoir. Stream provides valuable spawning habitat for rainbow trout present within Red Creek Reservoir
Red Creek Reservoir	160300060109	Rainbow trout	Popular sport fishery. Fishery is maintained through rainbow trout recruitment from Red Creek.

Red Creek Reservoir is a popular sport fishing destination within the geographic area. This reservoir supports a self sustaining population of rainbow trout. These fish annually spawn in Red Creek near the lake inlet.

Bear Creek – Sevier River Watershed (5th Field HUC 1603000105)
The Bear Creek – Sevier River Watershed is located in the northern portion of the Cedar City Ranger District and northeastern portion of the Powell Ranger District. The total watershed acreage is approximately 189,157, of which approximately 90,200 acres are located on Forest.

On Forest, there are approximately 28.7 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 11. Bear Creek-Sevier River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Threemile Creek	160300010501	BCT	Good habitat present. BCT are managed as a conservation population. Some livestock and road system impacts.
Delong Creek	160300010501	BCT	Good habitat present. BCT are managed as a conservation population. Some livestock and road system impacts.
Indian Hollow	160300010501	BCT	Good habitat present. BCT are managed as a conservation population. Some livestock and road system impacts.
Bear Creek	160300010508	Brown trout, southern leatherside, mountain sucker, speckled dace	Small stream with limited fisheries habitat. Diverse composition of native non-game fish species.
Sandy Creek	160300010505	None	BCT population refounded in 1999. Marginal habitat is limiting establishment of self-sustaining fish population.
Left Fork Sanford Creek	160300010507	None	BCT population extirpated as a result of Sanford Fire in 2002. Potential future reintroduction site for BCT.

The Threemile Creek Watershed (6th field HUC 160300010501) contains approximately 10.5 miles of BCT occupied habitat within Threemile Creek, Delong Creek, and Indian Hollow. The UDWR established these populations in the mid 1990s in an effort to expand BCT distribution within the Sevier River drainage. Habitat within these streams is generally in good shape; however, the road system and livestock grazing are having some detrimental impacts. Additionally, naturally low water flow within Indian Hollow affects habitat availability, particularly for adult fish.

Panguitch Creek Watershed (5th Field HUC 1603000104)

The Panguitch Creek Watershed is located in the central portion of the Cedar City Ranger District. The total watershed acreage is approximately 83,932, of which approximately 71,386 acres are located on Forest. On Forest, there are approximately 41.5 miles of fish-bearing streams and 1,150 acres of fish-bearing lakes within the watershed.

Table 12. Panguitch Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Panguitch Creek[1]	160300010403 160300010405	Rainbow trout	Popular sport fishery. Flows out of Panguitch Lake. Good fish habitat.
Butler Creek	160300010404	Brown trout, rainbow trout	Abundant brown trout within stream. Low angling pressure due to poor access. Some grazing impacts are evident.
Clear Creek	160300010401	Rainbow trout, cutthroat trout	Flows into Panguitch Lake. Small stream with limited habitat. Lots of private land.
Ipson Creek	160300010401	Rainbow trout, cutthroat trout	Flows into Panguitch Lake. Small stream with limited habitat. Important spawning habitat for rainbow trout.
Blue Spring Creek	160300010402	Rainbow trout, brook trout, cutthroat trout	Lots of impacts from private land livestock grazing. Limited extent on Forest Service land. Flows into Panguitch Lake.
Bunker Creek	160300010402	Brook trout	Small stream with abundant brook trout. Some grazing and road system impacts.
Deer Creek	160300010402	Brook trout	Small stream with abundant brook trout. Some grazing and road system impacts.
Panguitch Lake	1603000104	Brook trout, cutthroat trout, tiger trout	Extremely popular sport fishery. Chemical renovation of fishery in spring 2006 to eliminate Utah chub. Largest lake on the Forest.

Panguitch Lake (approximately 1,234 acres) is an extremely popular sport fishery. The lake is fed by multiple small tributaries and is the source of Panguitch Creek. Target species within the lake and its associated streams include rainbow trout and cutthroat trout. In the spring of 2006, the lake and associated streams were treated with rotenone to eradicate Utah chub. Prior to the treatment, the chub population had represented over 90 percent of the total fish biomass within the lake. The treatment was successful, and the angling has improved appreciably since the treatment.

The many small streams within the watershed provide an appreciable amount of coldwater fisheries habitat. In general, habitat within these streams is in good shape and self-sustaining populations of non-native trout are common. Current threats to aquatic habitat within the watershed include livestock grazing, motorized recreation, dispersed recreation, and private land development. Private land inholdings are common within the watershed, particularly along Panguitch Creek and around Panguitch Lake.

<u>Mammoth Creek Watershed (5th Field HUC 1603000102)</u>
The Mammoth Creek Watershed is located in the central portion of the Cedar City Ranger District. The total watershed acreage is approximately 74,768, of which approximately 72,218 acres are located on Forest. On Forest, there are approximately 39.6 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

[1] Panguitch Creek occurs within one 5th field HUC, but encompasses two 6th field HUCs due to the large size of the drainage.

Table 13. Mammoth Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Castle Creek	160300010201	Brook trout	Small stream with good habitat. Very productive brook trout fishery. Boreal chorus frogs are common in nearby ponds.
Lowder Creek	160300010201	Brook trout	Small stream with good habitat. Very productive brook trout fishery.
Mammoth Creek	1603000102	Brook trout, rainbow trout	Popular sport fishery. Headwaters mostly on National Forest System (NFS) lands, lots of private land lower in the drainage.

Aquatic habitat within the Mammoth Creek Watershed is generally in good shape. However, impacts from private land development are pervasive within the private inholdings along Mammoth Creek.

Boreal chorus frogs are common within the headwaters of Mammoth Creek, particularly in the Castle Creek and Lowder Creek drainages. Occupied habitat consists mainly of small ponds associated with wet meadows.

Asay Creek Watershed (5th Field HUC 1603000101)
The Asay Creek Watershed is located in the southern portion of the Cedar City Ranger District. The total watershed acreage is approximately 89,004, of which approximately 88,549 acres are located on Forest. On Forest, there are approximately 19 miles of fish-bearing streams and 427 acres of fish-bearing lakes within the watershed.

Table 14. Asay Creek Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Duck Creek	160300010102	Rainbow trout, brook trout	Popular sport fishery. Located near Duck Creek Village. Receives a lot of angling pressure.
Swains Creek	160300010104	Brook trout, cutthroat trout, mottled sculpin, mountain sucker	Small stream with limited habitat. Diverse fishery, low density.
Navajo Lake	160300010102	Rainbow trout, brook trout, splake	Popular sport fishery. Several Forest Service campgrounds and a private lodge adjacent to the lake.
Duck Lake	160300010102	Rainbow Trout, Brook Trout	Popular sport fishery. Located adjacent to Duck Creek Village. Receives a lot of angling pressure.
Aspen Mirror Lake	160300010102	Rainbow Trout, Brook Trout	Popular sport fishery. Located adjacent to Duck Creek Village. Receives a lot of angling pressure.

Navajo Lake, Duck Lake, Aspen Mirror Lake, and Duck Creek are popular sport fisheries readily accessible from Utah State Highway 14. Target species at these waters include brook trout and rainbow trout, with splake also present at Navajo Lake. Navajo Lake is a large natural lake (approximately 600 acres). This lake is very unique in that its natural outflows consist of

sinkholes that drain into both the Great Basin via Duck Creek and into the Colorado River drainage via Cascade Falls.

East Fork Virgin River Watershed (5th Field HUC 1501000802)
The East Fork Virgin River Watershed is located in the southeastern portion of the Cedar City Ranger District. The total watershed acreage is approximately 258,634, of which approximately 26,752 acres are located on Forest. On Forest, there are approximately 7.9 miles of fish-bearing streams and no acres of fish-bearing lakes within the watershed.

Table 15. East Fork Virgin River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Stout Canyon	150100080201	Brown trout	Small stream with limited habitat.
Dairy Canyon	150100080201	Brown trout	Small stream with limited habitat.

On the Forest, aquatic habitat is very limited within the East Fork Virgin River Watershed. Stout Canyon and Dairy Canyon are small perennial streams that provide habitat for non-native brown trout. Due to the limited size and length, these streams receive very little angling pressure. Off-highway vehicles (OHVs) are currently impacting wet meadow habitat within the Dairy Canyon drainage. A small section of fence was constructed in 2007 to help control this resource damage.

Upper East Fork Sevier River Watershed (5th Field HUC 1603000204)
The Upper East Fork Sevier River Watershed is located in the southern portion of the Powell Ranger District. The total watershed acreage is approximately 187,726, of which approximately 152,304 acres are located on Forest. On Forest, there are approximately 41.6 miles of fish-bearing streams and 178.7 acres of fish-bearing lakes within the watershed.

Table 16. Upper East Fork Sevier River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
East Fork of Sevier River	1603000203	Brook trout, brown trout, cutthroat trout, rainbow trout, speckled dace, redside shiner, mountain sucker	Good fish habitat. Popular sport fishery, particularly for fly fishing. Diverse fish community with four trout species and multiple non-game fish present.
Blubber Creek	160300020302	Brook trout, cutthroat trout	Very small stream with limited fish habitat. Northern leopard frog present within the drainage.
Kanab Creek	160300020301	Brook trout, brown trout, cutthroat trout, mountain sucker	Good fish habitat. Boreal toad habitat within the drainage.
Podunk Creek	160300020301	Brook trout	Very small stream with limited fish habitat.
East Creek	160300020303	Brook trout	Very small stream with limited fish habitat.
Blue Fly Creek	160300020303	Brook trout, speckled dace	Very small stream with limited fish habitat.

Water Body	6th Field HUC	Species Present	Comments
Tropic Reservoir	160300020302	Rainbow trout, brook trout, brown trout, cutthroat trout, redside shiner	Popular sport fishery. Amphibian habitat is abundant on southern end of reservoir.

Tropic Reservoir and the East Fork of Sevier River headwaters are popular sport fishing destinations within the area. Tropic Reservoir is a put and take fishery with rainbow trout dominating the fishery. The East Fork of Sevier River headwaters provide excellent small stream fly fishing for brook trout, brown trout, cutthroat trout, and rainbow trout. Dispersed camping, motorized recreation, livestock grazing, and the road system are adversely affecting fisheries habitat within the watershed.

There are several areas on the Paunsaugunt Plateau that support breeding populations of boreal toad. However, in recent years, boreal toad abundance on the plateau has decreased substantially. This is likely due to the presence of chytrid fungus. Two known breeding sites on the Plateau have been fenced to eliminate detrimental effects associated with livestock grazing.

Middle East Fork Sevier River Watershed (5th Field HUC 1603000204)

The Middle East Fork Sevier River Watershed is located in the northeastern portion of the Powell Ranger District and the extreme western portion of the Escalante Ranger District. The total watershed acreage is approximately 210,881, of which approximately 147,589 acres are located on Forest. On Forest, there are approximately 42.3 miles of fish-bearing streams and 110 acres of fish-bearing lakes within the watershed.

Table 17. Middle East Fork Sevier River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Deep Creek	160300020410	BCT	BCT population extirpated as a result of Sanford Fire in 2002. Limited BCT distribution following small reintroduction in late summer 2006.
Deer Creek	160300020408	None	Wild non-native trout population extirpated as a result of the Sanford Fire in 2002. Future reintroduction of BCT is planned.
Cottonwood Creek	160300020406	None	Wild non-native trout population extirpated as a result of the Sanford Fire in 2002. Future reintroduction of BCT is planned.
Center Creek	160300020409	BCT	Good quality fish habitat. BCT conservation population was established following chemical treatment in 2002-03. Cold thermal regime.
Ranch Creek	160300020405	BCT	Remnant population of BCT. Some impacts associated with livestock grazing.
Horse Creek	160300020403	Brook trout	Very small stream with limited fish habitat.
Clay Creek	160300020401	Southern leatherside chub, brook trout	Small stream with limited fish habitat. Sediment load is naturally high within drainage. Northern leopard frog present within drainage.
Pine Lake	160300020401	Rainbow trout, cutthroat trout	Popular sport fishery. Outflow drains into Clay Creek.

Water Body	6th Field HUC	Species Present	Comments
Robs Reservoir	160300020409	BCT	Small reservoir located in the headwaters of Center Creek. Managed as a sport fishery for BCT.
Pacer Lake	160300020412	Brook trout, cutthroat trout, Arctic grayling	Popular sport fishery.

A large portion of this watershed was burned during the Sanford Fire in 2002. Post-fire effects, including flooding, erosion, and riparian vegetation loss, resulted in extirpation of trout populations within four streams. Additionally, fish populations were extirpated downstream of the Forest boundary within the East Fork of Sevier River. Of particular value were the BCT populations within Deep Creek. The Deep Creek population was a remnant BCT population that inhabited approximately 6 miles of stream on both Forest Service and Bureau of Land Management (BLM) lands. Immediately after the fire, all remaining BCT were salvaged from Deep Creek and transplanted into a neighboring stream on the Fishlake National Forest. This was done to preserve the unique genetic strain of BCT that was present within Deep Creek. Non-native trout populations within Deer Creek and Cottonwood Creek were also eliminated by post-fire effects. Fish habitat is recovering slowly within the affected streams. The UDWR, in cooperation with the Forest, is planning to reestablish populations of BCT within all four of these streams.

On the Escalante Ranger District, BCT are present in two small streams within the watershed – Ranch Creek and Center Creek. Ranch Creek contains a remnant population of BCT. BCT were reintroduced into Center Creek in 2003 following a chemical renovation of the stream. Additionally, Robs Reservoir, a small reservoir at the head of Center Creek, was also renovated and restocked with BCT. Habitat within these streams is generally in good shape. Angling pressure within these systems is light.

Clay Creek is a perennial stream downstream of Pine Lake. This small stream supports a population of southern leatherside. Southern leatherside are listed as a State of Utah Species of Concern due to habitat fragmentation and presence of non-native predators (UDWR 2006). Clay Creek has a naturally high sediment load. This condition has been further exacerbated by culvert failures and low water fords that have contributed large amounts of sediment. These effects have contributed to decreased southern leatherside population density and production.

This watershed does support two popular trout sport fisheries: Pine Lake and Pacer Lake. Angling pressure at Pine Lake is high, with rainbow trout and cutthroat trout being the target species. The fishery at Pacer Lake is primarily composed of brook trout, with some Arctic grayling also present.

Pine Creek and Forest Creek are perennial non-fish-bearing stream within the watershed. There is good aquatic habitat within and associated with both of these streams. It is possible that small unknown populations of fish or amphibians may exist within these streams or in associated nearby habitat.

Lower East Fork Sevier River Watershed (5th Field HUC 1603000205)

The Lower East Fork Sevier River Watershed is located in the Northeastern portion of the Powell Ranger District and Northwestern portion of the Escalante Ranger District. However, aquatic habitat is very limited within the watershed on the Powell Ranger District. The total

watershed acreage is approximately 159,891, of which approximately 89,747 acres are located on forest. On forest, there are approximately 19 miles of fish-bearing streams and 0 acres of fish-bearing lakes within the watershed.

Table 18. Lower East Fork Sevier River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Antimony Creek	160300020503	Rainbow trout	Good fish habitat within middle and lower reaches of the stream. Receives some angling pressure, particularly in lower reaches.

Within the watershed on the Forest, Antimony Creek is the only notable fish-bearing water body. Rainbow trout are abundant within the lower and middle reaches of Antimony Creek. Livestock grazing and the road system are impacting these reaches of the stream. Upper portions of Antimony Creek are severely degraded, primarily a result of livestock grazing, and do not support any fish. Within this upper reach, the riparian plant community is in exceedingly poor condition with very little recruitment of woody species, including willows. Additionally, stream banks are generally unstable and contribute high levels of sediment to the active channel. However, it is important to note that the upper reach may be naturally fishless due to downstream topography.

In the headwaters of the watershed there are numerous fishless lakes and ponds, most notably Pollywog Lake, Hay Lakes, and Lake Philo.

Headwaters Escalante River Watershed (5th Field HUC 1407000501)
The Headwaters Escalante River Watershed is located in the central portion of the Escalante Ranger District. The total watershed acreage is approximately 204,064, of which approximately 158,651 acres are located on Forest. On Forest, there are approximately 37.5 miles of fish-bearing streams and 81.8 acres of fish-bearing lakes within the watershed.

Table 19. Headwaters Escalante River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
North Creek	1407000501	Brook trout, cutthroat trout, rainbow trout	Good fish habitat. Road impacts from FR 30149 are evident.
Twitchell Creek	140700050103	Colorado River cutthroat trout (CRCT)	Good fish habitat. CRCT conservation population.
White Creek	140700050103	CRCT	Good fish habitat. CRCT conservation population.
Pine Creek	140700050105	CRCT	Good fish habitat. CRCT conservation population. Some angling pressure.
Water Canyon	140700050102	CRCT	Small stream with limited fisheries habitat. Naturally high sediment load.
North Creek Lakes	140700050103	CRCT, Brook Trout, Rainbow Trout	Popular sport fisheries. Area includes 10 lakes, 8 with non-motorized access only.
Dougherty Basin Reservoir	140700050103	CRCT	Located in North Creek Lakes area. Brood source for CRCT.

Water Body	6th Field HUC	Species Present	Comments
Posey Lake	140700050106	Rainbow trout, brook trout, Arctic grayling	Popular sport fishery. Area includes a Forest Service campground and day use area.
Purple Lake	140700050105	Brook trout	Popular sport fishery. Managed as a trophy water by UDWR. Road system is contributing sediment to the lake.
Southern Row Lake	140700050105	Brook trout, Arctic grayling	Popular sport fishery. Some impacts from livestock.

This watershed contains over 17 miles of occupied Colorado River cutthroat trout (CRCT) habitat within Water Canyon, Twitchell Creek, White Creek, and Pine Creek. These populations are managed as conservation populations of CRCT. Additionally these water bodies do receive a moderate amount of angling pressure, particularly Pine Creek. There are also four CRCT occupied lakes within the watershed: Long Willow Bottom Reservoir, Round Willow Bottom Reservoir, Tall Four Reservoir, and Dougherty Basin Reservoir. The two Willow Bottom reservoirs are managed as sport fisheries. Dougherty Basin Reservoir is managed as a brood lake for CRCT production. Tall Four Reservoir is connected to Dougherty Basin via a human-made canal system.

The North Creek Lakes are extremely popular sport fisheries located in the headwaters of North Creek. This complex of lakes is composed of Blue Lake, Yellow Lake, Flat Lake, Joe Lay Reservoir, Upper Barker Reservoir, Lower Barker Reservoir, Dougherty Basin Reservoir, Tall Four Reservoir, Long Willow Bottom Reservoir, and Round Willow Bottom Reservoir. These lakes provide angling opportunities for rainbow trout, brook trout, and cutthroat trout. Additionally, the area offers a unique opportunity to fish in a non-motorized setting as the lakes are connected to one another via a large non-motorized trail network.

Purple Lake and the southern Row Lake are popular sport fisheries located within the northeastern portion of the geographic area. Livestock grazing and the road system are adversely impacting the habitat within these lakes. Snowmelt is the primary source of inflow to both of these shallow lakes. Consequently, winter kill of fish is a periodic problem.

Amphibians, including boreal chorus frogs and tiger salamanders, are common within the Posey Lake area.

<u>Boulder Creek – Escalante River Watershed (5th Field HUC 1407000502)</u>
The Boulder Creek – Escalante River Watershed is primarily located in the eastern portion of the Escalante Ranger District. A small portion of the watershed is located on the Teasdale portion of the Fremont River Ranger District. The total watershed acreage is approximately 233,706, of which approximately 133,539 acres are located on Forest. On Forest, there are approximately 65.8 miles of fish-bearing streams and 249 acres of fish-bearing lakes within the watershed.

Table 20. Boulder Creek-Escalante River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Boulder Creek	1407000502	CRCT, brook trout, rainbow trout, brown trout, mottled sculpin	Remnant populations of CRCT in West Fork and East Fork of Boulder Creek. Good fish habitat throughout drainage.
Bear Creek	140700050209	Brook trout, rainbow trout	Good fish habitat. Some livestock and road impacts.
Deer Creek	140700050207	Brook trout	Good fish habitat. Complex network of water diversions and canals associated with stream.
Lake Creek	140700050202	Brook trout	Good fish habitat. Habitat is limited by high stream gradient in places.
South Slope Boulder Mountain Lakes	1407000502	Predominately brook trout	Popular sport fisheries. Some lakes produce trophy size brook trout.
Sand Creek	140700050203	Brown trout	Good fish habitat, located within the Box-Death Hollow Wilderness Area.

There are remnant populations of CRCT within the East Fork and West Fork of Boulder Creek. These populations were used to establish the brood source within Dougherty Basin Lake. Within the geographic area, CRCT occupy approximately 10 miles of habitat, some of which is sympatric with brook trout. Fish habitat within Boulder Creek is very good. The stream is high gradient with a boulder cobble substrate. Large plunge pools and step-pool complexes dominate the available habitat. This stream system is productive and produces above average fish biomass when compared to other areas in southern Utah (Platts and McHenry 1988, Brazier personal observation).

The many small lakes within the geographic area provide excellent sport fishing, primarily for brook trout. Boulder Mountain is known across the West for its exceptional brook trout lake fisheries. Some of the more popular lakes within the watershed are McGath Lake, Spectacle Lake, Horseshoe Lake, Kings Pasture Reservoir, Moosman Reservoir, and Deer Creek Lake. Many of these lakes are located on Boulder Top. There are virtually no perennial streams on the Boulder Top and, as a result, the lakes receive most of their inflow from snowmelt. These lakes tend to be shallow and can be susceptible to winter kill. This problem is exacerbated by sedimentation associated with the road system within the area. In the late 1990s, the Forest implemented a plan to close and rehabilitate many of the roads on Boulder Top. It is anticipated that this effort will preserve the quality of many of the lakes and their fisheries.

Sandy Creek – Fremont River Watershed (5th Field HUC 1407000304)

The Sandy Creek – Fremont River Watershed is located in the eastern portion of the Fremont River Ranger District (Teasdale Unit). The total watershed acreage is approximately 245,158, of which approximately 70,501 acres are located on Forest. On Forest, there are approximately 19.4 miles of fish-bearing streams and 156 acres of fish-bearing lakes within the watershed.

Table 21. Sandy Creek-Fremont River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Pleasant Creek	140700030401	Brook trout	Fair quality fish habitat. Livestock and developed recreation impacts.
Oak Creek	140700030406	Brook trout	Marginal quality fish habitat. Low density brook trout population near the Oak Creek campground.
Oak Creek Reservoir	140700030406	Brook trout	Popular sport fishery. Managed by UDWR as a trophy fishery.
Lower Bowns Reservoir	140700030401	Rainbow trout	Popular sport fishery. Motorized recreation impacts.

This geographic area is generally quite dry, thus the lack of fish-bearing water. Pleasant Creek does support a decent sized population of brook trout, but it is heavily impacted by livestock grazing, developed recreation, and motorized recreation. Oak Creek supports a small brook trout fishery. Aquatic habitat within Oak Creek is marginal with lots of fine sediment. Lower sections of Oak Creek, near Capitol Reef National Park, are in good shape but do not support any fish. Oak Creek Reservoir and Lower Bowns Reservoir are very popular sport fisheries. Oak Creek Reservoir is known for its large brook trout, while Lower Bowns Reservoir provides an opportunity to fish for stocked rainbow trout. Additionally, there are several smaller fish-bearing lakes within the headwaters of the watershed.

Deep Creek – Fremont River Watershed (5th Field HUC 1407000303)

The Deep Creek – Fremont River Watershed is located in the north-central portion of the Fremont River Ranger District (Teasdale Unit). The total watershed acreage is approximately 221,379, of which approximately 48,483 acres are located on Forest. On Forest, there are approximately 20.3 miles of fish-bearing streams and 177 acres of fish-bearing lakes within the watershed.

Table 22. Deep Creek-Fremont River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Carcass Creek	140700030303	Brook trout	Good quality fish habitat. Cold thermal regime.
Fish Creek	140700030302	Brook trout, mountain sucker	Small stream with marginal fish habitat. Stream is heavily impacted by livestock grazing and motorized recreation.
Donkey Creek	140700030305	Brook trout	Small stream with good quality habitat. Habitat is limited in areas due to livestock impacts and high gradient.
Birch Creek	140700030301	Brook trout	Small stream with good quality habitat. Very productive brook trout population.
North Slope Boulder Mountain Lakes	1407000303	Predominately brook trout, limited CRCT, and tiger trout	Extremely popular sport fisheries.

There are several small streams within the area that support wild populations of brook trout. These streams receive little angling pressure and in general are in good shape.

The many small lakes within the geographic area provide excellent sport fishing, primarily for brook trout. Boulder Mountain is known across the West for its exceptional brook trout lake fisheries. Some of the more popular lakes within the geographic area are Fish Creek Reservoir, Beaver Dam Reservoir, Blind Lake, Donkey Reservoir, and Coleman Reservoir. Several lakes within the area have been chemically treated to remove stunted brook trout populations. These lakes have generally been restocked with CRCT and tiger trout, whose population densities are easier to control than brook trout.

Good quality amphibian habitat is abundant along the North Slope of Boulder Mountain. Boreal toad is widely scattered across the area, and is generally associated with wet meadows, spring channels, and small lakes. Livestock grazing is adversely affecting habitat quality is some locations. Tiger salamander is also present in some of the lakes and ponds in the area.

Pine Creek – Fremont River Watershed (5th Field HUC 1407000302)
The Pine Creek – Fremont River Watershed in located in the northwest portion of the Fremont River Ranger District (Teasdale Unit). The total watershed acreage is approximately 224,675, of which approximately 73,038 acres are located on Forest. On Forest, there are approximately 10.7 miles of fish-bearing streams and 72 acres of fish-bearing lakes within the watershed.

Table 23. Pine Creek-Fremont River Watershed, Important Aquatic Biota Resources

Water Body	6th Field HUC	Species Present	Comments
Pine Creek	1407000302	CRCT	Fair fish habitat quality. Livestock grazing and road system are adversely affecting stream. CRCT conservation population.
Pine Creek Reservoir	140700030208	CRCT	Located in the headwaters of Pine Creek. Popular sport fishery.
Blue Lake	140700030207	Brook trout	Popular sport fishery.
North Row Lake	140700030207	Brook trout, rainbow trout, Arctic grayling	Popular sport fishery.

Pine Creek contains a conservation population of CRCT. This population was established in 2003 following chemical renovation of the stream and Pine Creek Reservoir. Portions of this stream are heavily impacted by livestock and the road system. In 2005, an interagency field tour to native cutthroat streams identified sediment problems within the stream that are likely impeding CRCT spawning (Duffield et al. 2005). Headwater areas of Pine Creek also provide excellent amphibian habitat, and are home to a breeding population of boreal toads.

Cumulative Effects Area

The cumulative effects area (CEA) for the aquatic biota resource includes all land within the Dixie National Forest boundary. Known aquatic biota population distribution and the limited connectivity (current and potential) of aquatic habitats on the Dixie National Forest with adjacent non-Forest Service lands support the relevance of this CEA.

II. Environmental Effects

Effects Common to All Alternatives

Roads, particularly those located in close proximity to riparian areas, pose a distinct threat to aquatic biota habitat quality and population structure (Gucinski et al. 2001, Furniss et al. 1991). Roads can route sediment into water bodies, fragment aquatic habitat (i.e., migration barriers), and provide a vector for introduction of aquatic nuisance species and hazardous materials (Trombulak and Frissell 2000). Additionally, roads provide access to and concentrate human and livestock use within riparian areas. This can lead to widespread degradation of stream banks, in-channel aquatic habitat, and riparian vegetation.

Under any of the alternatives, roads and motorized trails (routes) would be designated within watersheds that support fish populations and other aquatic biota. Some of these routes are located within riparian influence zones (RIZ), and thus can negatively impact both aquatic biota populations and habitat. For the purposes of this report, a RIZ is defined as any area falling within 300 feet of fish-bearing streams and high value lakes. Within this report, RIZ route density (the ratio of RIZ road miles/stream mile) will be used as the primary indicator of effects to aquatic biota.

General effects related to roads and motorized trails located within the RIZ are detailed in diagrams 1, 2, and 3. Information displayed in these diagrams is supported by Gucinski et al. 2001, Waters 1995, Furniss et al. 1991, Hausle and Coble 1976, and Cordone and Kelley 1961. It should be noted that none of the alternatives will increase road and motorized trail related impacts beyond what is occurring in the existing condition. Selection of any of the action alternatives would result in a decrease in detrimental effects to aquatic biota from roads and motorized trails due to the elimination of cross-country motorized travel and some road decommissioning.

On the Dixie National Forest a major effect to aquatic biota are system roads, non-system roads, and motorized trails, all of which generally run alongside streams and riparian zones and in canyon bottoms in areas where locations for routes are constrained, and often run near water even in unconstrained upper mountain headwaters and plateaus. The effects of motorized routes include increased stream channel confinement, reduced stream sinuosity, increased gradient, increased sedimentation, reduced riparian shading, and decreased amounts of large woody debris. Easy access also generally increases the degree of land management activities in an area such as grazing or timber harvest, and increases human activity such as recreation. All of these aspects can increase effects to aquatic habitat that in turn affect aquatic biota. Examples of potential effects are reduced carrying capacity, increased water temperature, degradation of water quality, introduction of non-native organisms, or aquatic nuisance species.

Diagram 1. Road and Motorized Trail Related Sediment Deposition Effects to Aquatic Biota

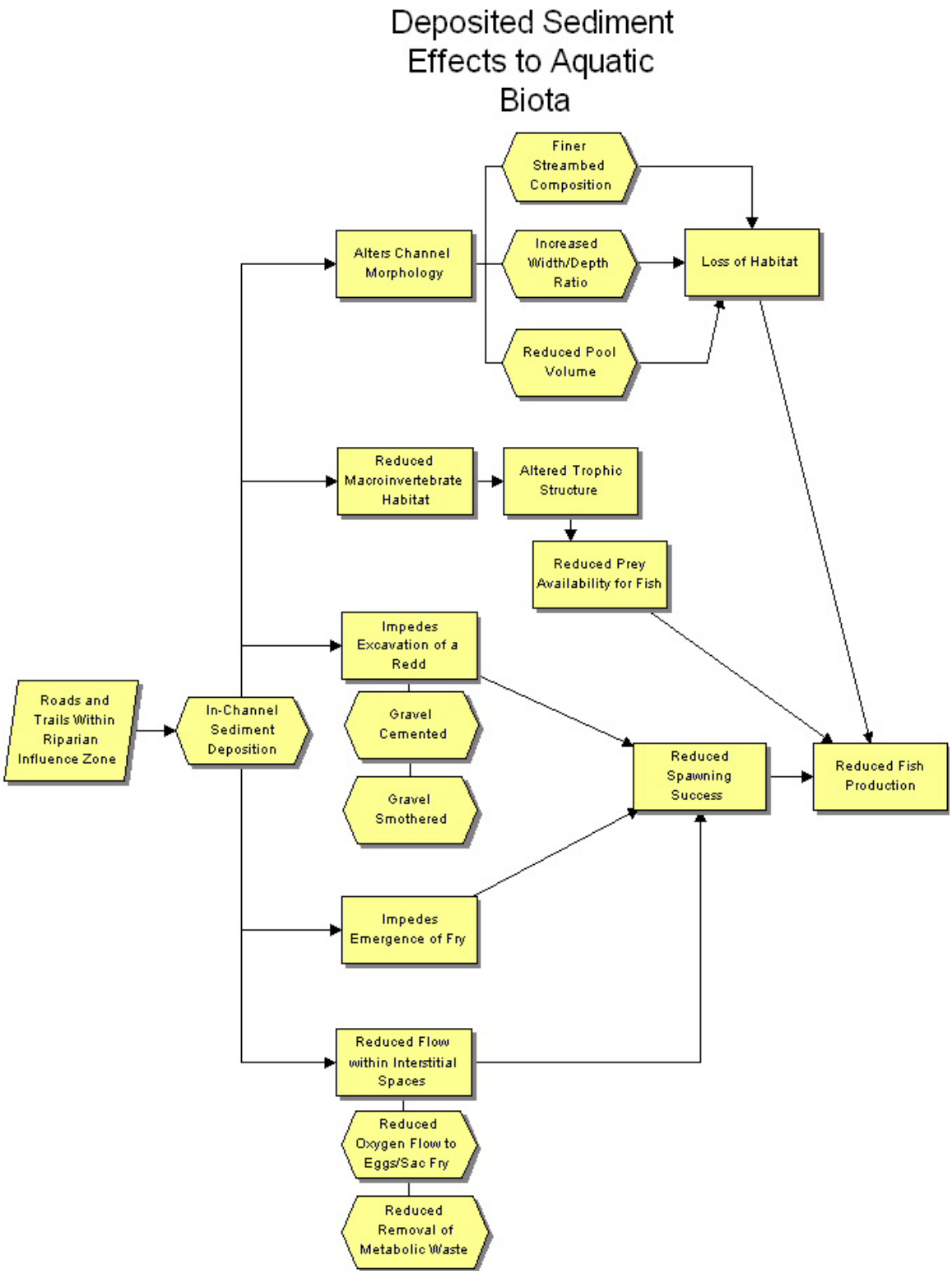


Diagram 2. Road and Motorized Trail Related Suspended Sediment Effects to Aquatic Biota

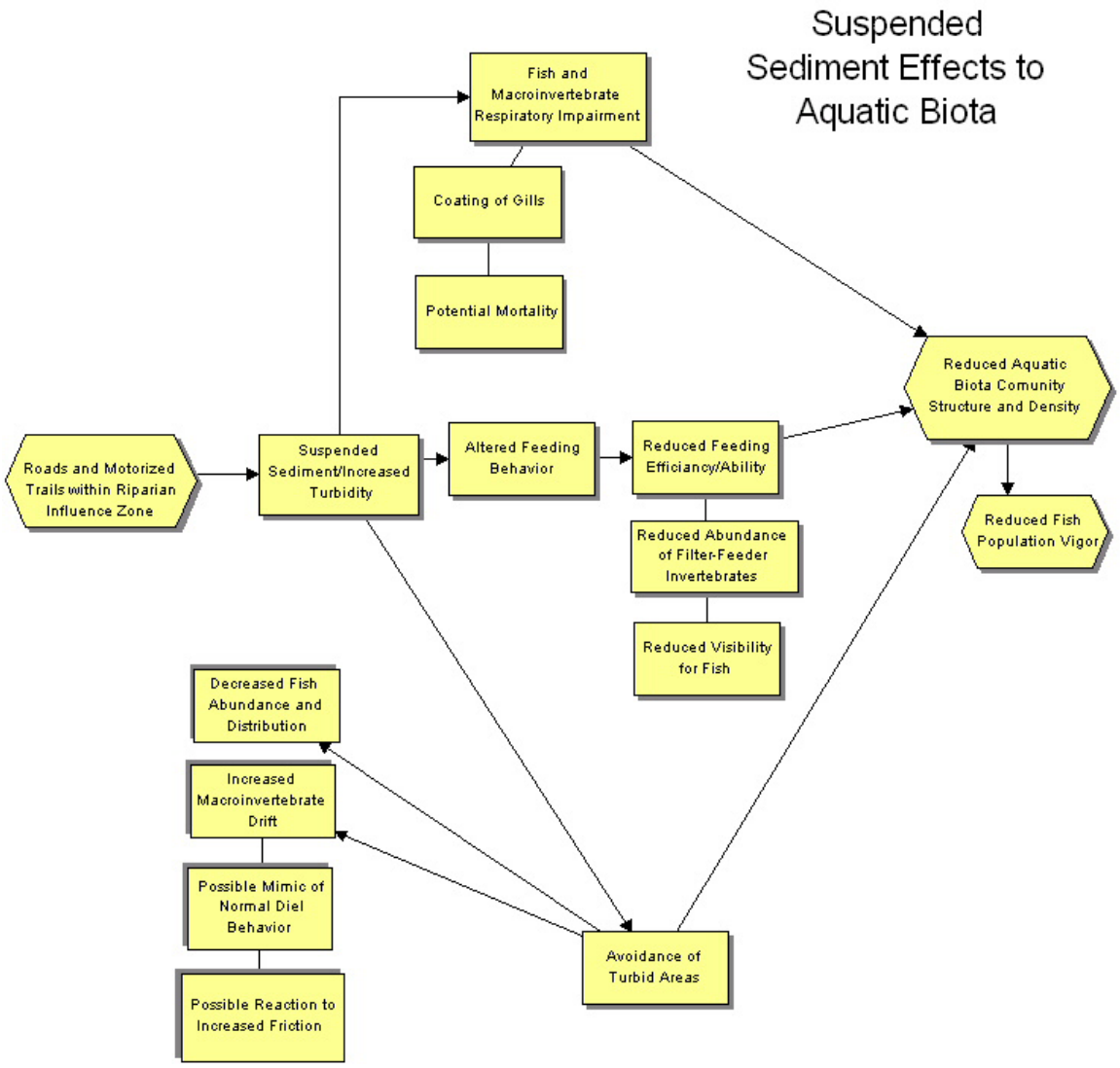
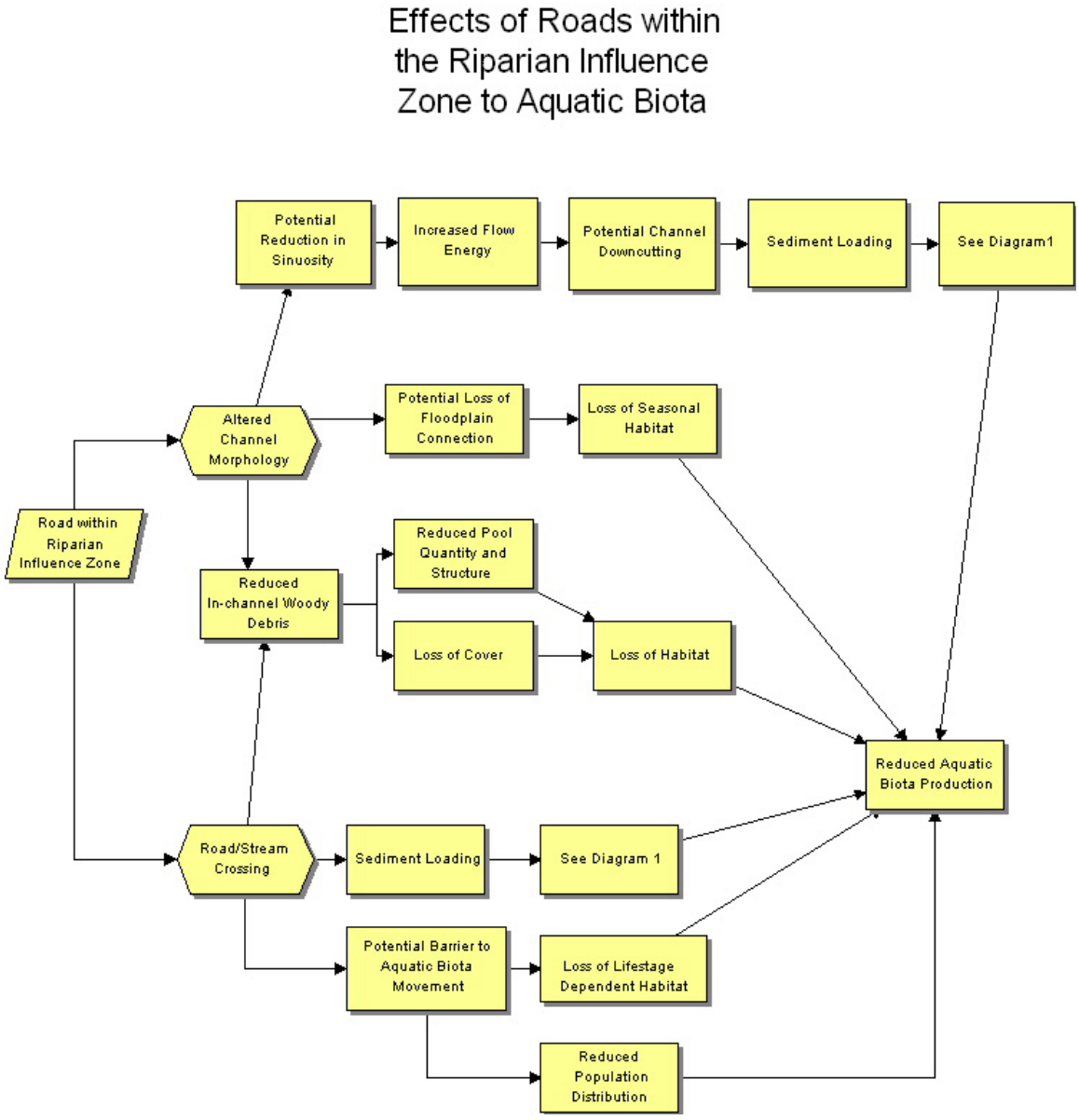


Diagram 3. Effects to Aquatic Biota from Roads and Motorized Trails Located Within the Riparian Influence Zone (RIZ)



Comparison of Alternatives

A summary of route density within the RIZ of streams and lakes is displayed in Table 24. Alternative B would result in the lowest route density within stream RIZs, while Alternative C would result in the lowest route density within lake RIZs. However, while there is some level of variance between the alternatives, effects to aquatic biota (when analyzed at the Forest scale) will be virtually identical regardless of which alternative is selected. However, it is important to realize that effects to specific water bodies or watersheds may vary across the alternatives.

Table 24. Comparison of RIZ Roads by Alternative, Fish-bearing Streams, and High Value Lakes

Alternative	Miles of Road Within Stream RIZ	Ratio of Rd/Stream (Miles)	Miles of Road Within Lake RIZ
A	174.89	0.366	40.11
B	144.29	0.302	29.58
C	150.14	0.314	29.44
D	159.30	0.334	34.81
E	177.79	0.372	40.41

Table 25 displays a summary of effects to aquatic biota habitat and populations by alternative. Data within this table were generated by comparing maps of the alternatives, field observations, and professional opinion. This table further supports the assertion that variation between the action alternatives would be difficult to detect in the long-term within aquatic biota habitat and populations. In general, the major benefit to aquatic biota from selection of any of the action alternatives would be the elimination of motorized cross-country travel.

Table 25. Summary of Aquatic Biota Effects by Alternative

5th HUC Watershed	Alternative				
	A	B	C	D	E
Upper Beaver Dam Wash 15010001001	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition
Moody Wash 1501000806	Potential for Increased Impacts	Improvement	Improvement	Slight Improvement	Slight Improvement
Shoal Creek 1603000613	Potential for Increased Impacts	Improvement	Improvement	Improvement	Slight Improvement
Escalante Valley - Pinto Creek 1603000614	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Upper Santa Clara River 1501000807	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Ash Creek 1501000804	Same as Current Condition	Improvement	Same as Current Condition	Same as Current Condition	Same as Current Condition
Gould Wash - Virgin River 1501000809	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Little Salt Lake 1603000602	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Fremont Wash 1603000601	Potential for Increased Impacts	Improvement	Improvement	Improvement	Slight Improvement
Bear Creek - Sevier River 1603000105	Potential for Increased Impacts	Improvement	Improvement	Slight Improvement	Slight Improvement
Panguitch Creek 1603000104	Potential for Increased Impacts	Improvement	Improvement	Slight Improvement	Slight Improvement
Mammoth Creek 1603000102	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition
Asay Creek 1603000101	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition
East Fork Virgin River 1501000802	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition	Same as Current Condition
Middle East Fork Sevier River 1603000204	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Upper East Fork Sevier River 1603000203	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Lower East Fork Sevier River 1603000205	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement

5th HUC Watershed	Alternative				
	A	B	C	D	E
Headwaters Escalante River 1407000501	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Boulder Creek - Escalante River 1407000502	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Sandy Creek - Fremont River 1407000304	Potential for Increased Impacts	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Deep Creek - Fremont River 1407000303	Potential for Increased Impacts	Improvement	Improvement	Slight Improvement	Slight Improvement
Pine Creek - Fremont River 1407000302	Potential for Increased Impacts	Improvement	Improvement	Slight Improvement	Slight Improvement

General description of terms:

- **Same as Current Condition** = No appreciable affect to aquatic biota due to continuation of current management.
- **Slight Improvement** = Improvement to aquatic biota populations or habitat largely tied to elimination of cross-country travel and not closure of any specific existing route(s) within the RIZ.
- **Improvement** = Improvement to aquatic biota populations or habitat correlated with combination of elimination of cross-country travel and closure of specific route(s) within the RIZ.
- **Potential for Increased Impacts** = Continuation of current management, including continuation of cross-country travel within RIZ.

Alternative A (No Action Alternative) - Effects

Under Alternative A, the current travel management system would remain in effect. Thus, a substantial portion of the Forest would remain open to cross-country travel, including approximately 14,823 acres within stream RIZs and approximately 2,843 acres within lake RIZs.

Alternative A would permit the development of increasing networks of user-created routes within areas open to cross-country travel. Depending on slope, terrain, and vegetation, the actual amount of these open travel areas that may receive motorized use varies. That is, in some sub-watersheds with gentle terrain and open vegetation, motorized vehicles (primarily OHVs) may be able to travel across a large percentage of the area. This can lead to higher rates of erosion across broad areas, but may also diffuse impacts.

In other sub-watersheds with steep terrain and dense vegetation, OHV use is often physically restricted to major ridgetops and drainage bottoms. Ridgetop use will generally be far enough away from streams to reduce sedimentation, but drainage bottom use can affect aquatic biota due to the direct proximity to streams and lakes, with damage including sedimentation, stream bank damage, and damage to vegetation. Additionally, these drainage bottoms are often important passageways for amphibians.

A summary of RIZ roads included within Alternative A is displayed in Table 26. There are also an additional approximate 17,666 acres of land within the RIZ of fish-bearing streams and high value lakes that would remain open to cross-country travel. This designation would permit further development of user-created routes within high value riparian areas, resulting in persistent and expanding (as new routes are created) degradation of aquatic habitats.

Table 26. Alternative A: Summary of Roads within RIZs by 5th HUC Watershed

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Upper Beaver Dam Wash 1501001001	4.80	0.22	0.05	0	0
Moody Wash 1501000806	6.96	1.7	0.24	0	0
Shoal Creek 1603000613	1.01	0.44	0.44	476	10.09
Escalante Valley - Pinto Creek 1603000614	17.82	8.51	0.48	0	0
Upper Santa Clara River 1501000807	20.26	5.85	0.29	13	1.10
Ash Creek 1501000804	18.80	2.23	0.12	0	0
Gould Wash - Virgin River 1501000809	10.88	4.63	0.43	0	0
Little Salt Lake 1603000602	10.85	8.92	0.82	38	0.77
Fremont Wash 1603000601	9.79	8.07	0.82	40	0.75
Bear Creek - Sevier River 1603000105	24.26	12.59	0.52	0	0

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Panguitch Creek 1603000104	40.45	14.56	0.36	1054	5.13
Mammoth Creek 1603000102	36.28	13.86	0.38	2	0.07
Asay Creek 1603000101	18.27	8.05	0.44	427	2.15
East Fork Virgin River 1501000802	5.88	5.77	0.98	0	0
Middle East Fork Sevier River 1603000204	41.99	14.97	0.36	110	1.74
Upper East Fork Sevier River 1603000203	41.81	17.97	0.43	179	3.54
Lower East Fork Sevier River 1603000205	16.14	5.04	0.31	149	2.99
Headwaters Escalante River 1407000501	37.44	16.77	0.45	543	3.54
Boulder Creek - Escalante River 1407000502	63.65	12.47	0.20	260	2.40
Sandy Creek - Fremont River 1407000304	19.41	4.97	0.26	156	1.55
Deep Creek - Fremont River 1407000303	20.33	5.35	0.26	182	1.77
Pine Creek - Fremont River 1407000302	10.58	1.95	0.18	22	2.52

Alternatives B, C, D, and E – Effects

The key benefit to aquatic biota and habitat under all these alternatives is the elimination of motorized cross-country travel on the Forest. This action should limit current and future expansion and creation of unauthorized routes, thus, limiting potential degradation of high value aquatic habitats.

Alternatives B, C, and D are relatively similar in terms of effects to aquatic biota and habitat. Selection and implementation of any of these three alternatives would decrease road density within the RIZ of fish-bearing streams and high value lakes as compared to the current condition. The variation in RIZ road mileage between these alternatives is spread out across the Forest and does not represent a significant difference within any one drainage.

Alternative E would designate more miles of motorized routes within RIZs than any other alternative, including the No Action Alternative. However, Alternative E would not include any areas open to motorized cross-country travel; thus, potential future degradation to aquatic biota habitats and populations would be reduced when compared to the No Action Alternative. Of the four action alternatives, Alternative E provides the least amount of benefit to aquatic biota resources on the Forest.

Road mileage within the RIZ of lakes is fairly low within all alternatives. Access to lakes on the Dixie National Forest is generally via a single route that dead ends at the lake in question. The

majority of these routes have been maintained within all alternatives as they serve specific destinations and provide necessary access for special uses or recreation.

There is a small amount of motorized trail construction included within Alternatives D and E. Alternatives D and E include a proposal to construct 1.26 miles of new motorized trail. All proposed new motorized trail construction will occur outside of the RIZs of fish-bearing streams and high value lakes. No effects to aquatic biota resources or habitat will occur as a result of this new trail construction in either alternative.

Summaries of RIZ road density for Alternatives B, C, D, and E is presented in Tables 27, 28, 29, and 30.

Table 27. Alternative B: Summary of Roads within RIZs by 5th HUC Watershed

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Upper Beaver Dam Wash 1501001001	4.80	0.22	0.05	0	0.00
Moody Wash 1501000806	6.96	0.16	0.02	0	0.00
Shoal Creek 1603000613	1.01	0.38	0.38	476	4.70
Escalante Valley - Pinto Creek 1603000614	17.82	7.20	0.40	0	0.00
Upper Santa Clara River 1501000807	20.26	4.23	0.21	13	0.65
Ash Creek 1501000804	18.80	0.00	0.00	0	0.00
Gould Wash - Virgin River 1501000809	10.88	4.35	0.40	0	0.00
Little Salt Lake 1603000602	10.85	8.91	0.82	38	0.77
Fremont Wash 1603000601	9.79	6.29	0.64	40	0.58
Bear Creek - Sevier River 1603000105	24.26	9.44	0.39	0	0.00
Panguitch Creek 1603000104	40.45	11.44	0.28	1054	4.85
Mammoth Creek 1603000102	36.28	12.97	0.39	2	0.00
Asay Creek 1603000101	18.27	8.05	0.44	427	2.15
East Fork Virgin River 1501000802	5.88	5.76	0.98	0	0.00
Middle East Fork Sevier River 1603000204	41.99	12.83	0.31	110	1.45
Upper East Fork Sevier River 1603000203	41.81	15.93	0.38	179	3.41
Lower East Fork Sevier River 1603000205	16.14	4.00	0.25	149	2.39
Headwaters Escalante River 1407000501	37.44	13.30	0.36	543	2.14
Boulder Creek - Escalante River 1407000502	63.65	11.08	0.17	260	2.40
Sandy Creek - Fremont River 1407000304	19.41	4.11	0.21	156	1.55
Deep Creek - Fremont River 1407000303	20.33	2.17	0.11	182	1.32
Pine Creek - Fremont River 1407000302	10.58	1.47	0.14	22	1.22

Table 28. Alternative C: Summary of Roads within RIZs by 5th HUC Watershed

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Upper Beaver Dam Wash 1501001001	4.80	0.22	0.05	0	0.00
Moody Wash 1501000806	6.96	0.24	0.03	0	0.00
Shoal Creek 1603000613	1.01	0.38	0.38	476	4.70
Escalante Valley - Pinto Creek 1603000614	17.82	7.20	0.40	0	0.00
Upper Santa Clara River 1501000807	20.26	4.35	0.21	13	0.65
Ash Creek 1501000804	18.80	2.23	0.12	0	0.00
Gould Wash - Virgin River 1501000809	10.88	4.31	0.40	0	0.00
Little Salt Lake 1603000602	10.85	9.04	0.83	38	0.77
Fremont Wash 1603000601	9.79	6.45	0.66	40	0.58
Bear Creek - Sevier River 1603000105	24.26	10.08	0.42	0	0.00
Panguitch Creek 1603000104	40.45	11.79	0.29	1054	4.14
Mammoth Creek 1603000102	36.28	13.00	0.36	2	0.00
Asay Creek 1603000101	18.27	8.05	0.44	427	2.15
East Fork Virgin River 1501000802	5.88	5.76	0.98	0	0.00
Middle East Fork Sevier River 1603000204	41.99	13.37	0.32	110	1.45
Upper East Fork Sevier River 1603000203	41.81	16.48	0.39	179	3.41
Lower East Fork Sevier River 1603000205	16.14	4.04	0.25	149	1.99
Headwaters Escalante River 1407000501	37.44	13.66	0.36	543	2.22
Boulder Creek - Escalante River 1407000502	63.65	11.67	0.18	260	2.40
Sandy Creek - Fremont River 1407000304	19.41	4.11	0.21	156	1.55
Deep Creek - Fremont River 1407000303	20.33	2.24	0.11	182	1.73
Pine Creek - Fremont River 1407000302	10.58	1.47	0.14	22	1.70

Table 29. Alternative D: Summary of Roads within RIZs by 5th HUC Watershed

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Upper Beaver Dam Wash 1501001001	4.80	0.22	0.05	0	0.00
Moody Wash 1501000806	6.96	1.55	0.22	0	0.00
Shoal Creek 1603000613	1.01	0.38	0.38	476	7.67
Escalante Valley - Pinto Creek 1603000614	17.82	7.75	0.43	0	0.00
Upper Santa Clara River 1501000807	20.26	4.67	0.23	13	0.94
Ash Creek 1501000804	18.80	2.23	0.12	0	0.00
Gould Wash - Virgin River 1501000809	10.88	4.73	0.43	0	0.00
Little Salt Lake 1603000602	10.85	9.05	0.83	38	0.77
Fremont Wash 1603000601	9.79	6.42	0.66	40	0.58
Bear Creek - Sevier River 1603000105	24.26	9.90	0.41	0	0.00
Panguitch Creek 1603000104	40.45	13.09	0.32	1054	4.89
Mammoth Creek 1603000102	36.28	1.58	0.37	2	0.07
Asay Creek 1603000101	18.27	8.05	0.44	427	2.15
East Fork Virgin River 1501000802	5.88	5.77	0.98	0	0.00
Middle East Fork Sevier River 1603000204	41.99	13.39	0.32	110	0.94
Upper East Fork Sevier River 1603000203	41.81	16.43	0.39	179	3.41
Lower East Fork Sevier River 1603000205	16.14	4.87	0.30	149	2.54
Headwaters Escalante River 1407000501	37.44	15.21	0.41	543	3.04
Boulder Creek - Escalante River 1407000502	63.65	12.00	0.19	260	2.40
Sandy Creek - Fremont River 1407000304	19.41	4.40	0.23	156	1.55
Deep Creek - Fremont River 1407000303	20.33	3.97	0.20	182	1.77
Pine Creek - Fremont River 1407000302	10.58	1.64	0.16	22	2.09

Table 30. Alternative E: Summary of Roads within RIZs by 5th HUC Watershed

5th HUC Watershed	Fish-bearing Streams			Lakes	
	Stream Miles	RIZ Road Miles	Ratio Rd/Stream	Lake Acres	RIZ Road Miles
Upper Beaver Dam Wash 1501001001	4.80	0.22	0.05	0	0.00
Moody Wash 1501000806	6.96	1.74	0.25	0	0.00
Shoal Creek 1603000613	1.01	0.44	0.44	476	10.12
Escalante Valley - Pinto Creek 1603000614	17.82	8.39	0.47	0	0.00
Upper Santa Clara River 1501000807	20.26	5.62	0.28	13	1.10
Ash Creek 1501000804	18.80	2.23	0.12	0	0.00
Gould Wash - Virgin River 1501000809	10.88	4.63	0.43	0	0.00
Little Salt Lake 1603000602	10.85	9.57	0.88	38	0.77
Fremont Wash 1603000601	9.79	8.07	0.82	40	0.75
Bear Creek - Sevier River 1603000105	24.26	12.46	0.51	0	0.00
Panguitch Creek 1603000104	40.45	15.03	0.37	1054	5.13
Mammoth Creek 1603000102	36.28	14.90	0.41	2	0.07
Asay Creek 1603000101	18.27	8.27	0.45	427	2.15
East Fork Virgin River 1501000802	5.88	5.76	0.98	0	0.00
Middle East Fork Sevier River 1603000204	41.99	16.22	0.39	110	1.74
Upper East Fork Sevier River 1603000203	41.81	17.97	0.43	179	3.54
Lower East Fork Sevier River 1603000205	16.14	5.08	0.31	149	2.99
Headwaters Escalante River 1407000501	37.44	16.90	0.45	543	3.54
Boulder Creek - Escalante River 1407000502	63.65	12.11	0.19	260	2.40
Sandy Creek - Fremont River 1407000304	19.41	4.98	0.26	156	1.55
Deep Creek - Fremont River 1407000303	20.33	5.33	0.26	182	1.77
Pine Creek - Fremont River 1407000302	10.58	2.09	0.20	22	2.79

Effects to Threatened, Endangered, and Sensitive Species

There are only two federally listed aquatic species: the Virgin River chub and woundfin, both listed as Endangered. These two fish species occur downstream of NFS lands within the Virgin River system. Implementation of any alternative being considered within this process would not affect fisheries habitat within the Virgin River mainstem where these species are known to occur.

The following species are listed on either the Intermountain Region's Sensitive Species List (USDA 2003) or on the State of Utah Sensitive Species List (UDWR 2006).

Bonneville Cutthroat Trout

Bonneville cutthroat trout (BCT) occupies streams and lakes on the Pine Valley, Cedar City, Powell, and Escalante Ranger Districts. Across the Forest, all action alternatives would provide similar or identical protection for BCT and its occupied habitat. However, Alternatives B and C could provide better protection for the species within the Threemile Creek watershed (6th HUC 160300010501). These two alternatives have reduced RIZ road densities within the upper Delong Creek area and along lower Threemile Creek when compared to Alternatives A, D, and E. Given the other current land uses (e.g., livestock grazing, dispersed recreation) within the watershed, however, it is unlikely that the reduced road densities within Alternatives B and C alone would result in significant increases in habitat quality or population structure.

Colorado River Cutthroat Trout

Colorado River cutthroat trout (CRCT) occupies streams and lakes on the Escalante Ranger District and on the Teasdale portion of the Fremont River Ranger District. All action alternatives would provide similar or identical protection for CRCT and its occupied habitat. There is some potential that proposed road closures within the West Branch Pine Creek drainage, which are included in Alternatives B and C, could help facilitate future work to biologically connect West Branch CRCT with mainstem Pine Creek and Right Fork Pine Creek CRCT through the elimination of culverts along roads 30729 and 30652.

Southern Leatherside (Formerly Leatherside Chub)

On the Dixie National Forest, southern leatherside distribution is limited to a few small drainages on the Cedar City and Escalante Ranger Districts. All action alternatives provide similar or identical protection for this species.

Virgin Spinedace

On the Dixie National Forest, Virgin spinedace distribution is limited to the Moody Wash drainage on the Pine Valley Ranger District. However, this species is somewhat widespread within the Virgin River headwaters downstream of the Pine Valley and Cedar City Ranger Districts. Road closures included within Alternatives B and C would reduce threats to Virgin

spinedace habitat within Moody Wash. Alternatives D and E would provide only limited benefits to Virgin spinedace when compared to the current condition (i.e., Alternative A, the No Action Alternative), primarily a result of eliminating motorized cross-country travel.

Arizona Toad

Arizona toad is known to occur in several drainages in the southwest portion of the Pine Valley Ranger District. Road closures included within Alternatives B and C would reduce threats to Arizona toad habitat within Moody Wash. Alternatives D and E would provide only limited benefits to Arizona toad when compared to the current condition (i.e., Alternative A, the No Action Alternative), primarily a result of eliminating motorized cross-country travel. In other occupied drainages, including the Pine Park area, all action alternatives would provide similar or identical protection for Arizona toad populations and habitat.

Boreal Toad

Boreal toad occupies habitat on the Paunsaugunt Plateau on the Powell Ranger District and on Boulder Mountain on the Teasdale portion of the Fremont River Ranger District. All known occupied habitat and populations on the Forest would be equally protected under all action alternatives. The Paunsaugunt Plateau is heavily roaded and will remain so regardless of which alternative is selected. Aside from roads, livestock grazing and chytrid fungus are currently limiting boreal toad habitat and populations in this area. Conversely, boreal toad occupied habitat on Boulder Mountain is sparsely roaded and will remain so regardless of which alternative is selected. On Boulder Mountain the primary threats to boreal toad habitat include livestock grazing, water impoundments, diversions, and conveyance structures.

III. Cumulative Effects

Utilities

Utility corridors are common features within the boundaries of the Dixie National Forest. In general, currently existing corridors are causing very limited impacts to the aquatic biota resource. These impacts are associated with utility corridor stream crossings and do not tend to be related to the motorized travel system. The greatest potential for detrimental effects to aquatic biota occurs during utility corridor construction. During these periods, ground disturbance is common and the potential for erosion and sediment deposition within aquatic habitats is high. Following construction, disturbed ground tends to recover quickly as vegetation and ground cover is reestablished. Selection and implementation of any of the alternatives is not expected to result in long-term cumulative impacts to the aquatic biota resource from utility corridor interactions.

Oil and Gas and Other Minerals

Oil, gas, and other mineral use on the Forest is currently fairly limited. The most common mineral use is from various gravel and cinder pits scattered across the Forest. Additionally,

there are a small number of gas wells on the Escalante Ranger District. Impacts to the aquatic biota resource from oil, gas, and other mineral activities are extremely limited due to the upland location of most of the gravel pits and gas wells. Selection and implementation of any of the alternatives is not expected to result in cumulative impacts to the aquatic biota resource from oil, gas, or other mineral activities.

Transportation

All routes that are being considered for designation within the alternatives of this project currently exist and are receiving some amount of use. The only exception to this is the small amount of new motorized trail construction being considered within Alternatives D and E (these routes are discussed on page 31). Because of this existing use, regardless of which alternative is selected, detrimental effects to aquatic biota habitat and populations from the motorized route network would either be reduced or maintained when compared to the current condition.

All action alternatives would result in the elimination of motorized, open cross-country travel. This action would reduce current and potential future interaction between cross-country travel and other Forest actions, thereby reducing the threat of detrimental effects to aquatic biota populations and habitat.

Alternative A, the No Action Alternative, has the highest potential to result in adverse cumulative impacts to aquatic resources. This is primarily related to the continuation of open cross-country travel on portions of the Forest, including sensitive riparian areas, stream corridors, and lake basins. This issue is further exacerbated due to the current travel system providing limited protection of aquatic resources (as described within this report) and the expected increase in motorized use of the Dixie National Forest. See the *Social and Economic Specialist Report* and the *Recreation and Scenery Specialist Report* for information on the anticipated increases in motorized use on the Forest.

All of the action alternatives would result in beneficial cumulative effects to aquatic biota in response to past and present implementation of travel management actions on the Forest. Table 31 lists present and recent past travel management decisions on the Forest. Some of these actions are included in signed decisions that have yet to be implemented on the ground. All of these projects either reduced total motorized route mileage within specific watersheds or reduced route encroachment on sensitive aquatic habitats. These actions have been initiated primarily to improve watershed function and aquatic and terrestrial habitat conditions.

Table 31. Previous and Pending Decisions With a Travel Management Component

Ranger District	Decision
Previous Decisions	
Pine Valley	South Fork Pinto Creek Road Relocation
Pine Valley	Water Canyon Riparian Restoration
Pine Valley	Upper Santa Clara River Vegetation and Fuels Project
Pine Valley	Pine Valley Recreation Facilities Rehabilitation Project
Pine Valley	Browse Area Travel Management Project
Cedar City	Duck Creek-Swains
Cedar City	Long Deer
Cedar City	Yankee Meadow Campground Project
Escalante	Black Forest, Velvet Lake, and Coyote Hollow Timber Sales
Escalante	Coyote Hollow

Ranger District	Decision
Escalante	Griffin Springs Travel Management
Escalante	Main Canyon Timber Sale
Escalante	Pacer
Escalante	Pretty Tree Bench
Escalante	South Creek
Escalante	Recap (Pacer)
Escalante	Roundy Timber Sale
Escalante	South Creek/Under Barney
Escalante	Antimony Creek Fisheries Enhancement
Fremont River (Teasdale portion)	Boulder Top
Fremont River (Teasdale portion)	Lower Bowns Recreation Complex
Fremont River (Teasdale portion)	Purple Lake
Pending Decisions	
Cedar City	Bear Valley Prairie Dog
Powell	Mount Dutton
Escalante	Pockets

Recreation

Dispersed camping within riparian areas is widespread across the Forest. OHV use and cross-country travel are common related activities that occur within and near popular dispersed camping areas. Selection of Alternative A would result in cumulative detrimental impacts associated with dispersed camping and OHV use within the RIZ of drainages within open cross-country travel areas. Additionally, routes included within all alternatives that encroach upon RIZs would present the potential for adverse cumulative effects associated with dispersed camping. These effects may include increased sediment influx into water bodies from bank damage and user-created crossings, reduced riparian plant composition and structure, and increased risk of aquatic nuisance species transfer and introduction. Each of these effects has the potential to reduce aquatic biota habitat condition and population structure.

Vegetation Treatments

Various vegetation treatments are included within the past, present, and foreseeable future actions on the Dixie National Forest. Road construction, maintenance, closure, and obliteration are common components to many of these projects. Many of the existing roads on the Forest were originally created during implementation of past timber sales. Recent past vegetation treatment projects often resulted in a reduction in motorized route mileage through the closure and obliteration of unneeded or poorly designed routes. Selection of any of the action alternatives would result in beneficial cumulative effects to the aquatic biota resource through the reduction of total motorized route mileage and open motorized cross-country areas. These beneficial effects would be most evident within Alternatives B, C, and D.

Land Exchanges and Easements

Existing road easements on the Forest are included within the motorized route network that has been analyzed as part of this process. There are no foreseeable future land exchanges or easements that would result in cumulative effects to the aquatic biota resource in conjunction

with this project. Current easements and recent past land exchanges are not appreciably affecting the quality of the aquatic biota resource on the Forest.

Special Use Permits

The Forest issues many special use permits for various activities, including outfitting and guiding and special events. The effects to the aquatic biota resource from these activities are highly variable, but tend to be innocuous and site specific. Since selection and implementation of any of the action alternatives would result in beneficial effects to the aquatic biota resource, no detrimental cumulative effects to the aquatic biota resource in conjunction with the various special uses is expected or likely.

Grazing

Livestock grazing is common and widespread on the Dixie National Forest. In general, allotments are grazed from late spring through early fall. This activity can result in harmful effects to the aquatic biota resource. On the Dixie National Forest, livestock grazing is a primary causative factor of the poor condition of many aquatic systems. Since selection and implementation of any of the action alternatives would result in beneficial effects to the aquatic biota resource, no detrimental cumulative effects to the aquatic biota resource in conjunction with livestock grazing is expected or likely.

IV. Conclusions and Summary Statements

Regardless of the alternative selected, forest-wide response (i.e., improvement or degradation) within aquatic biota populations and habitats is likely to be slight. Additionally, the magnitude of these responses is expected to fall within the normal variation and would be difficult to tie directly to this project. However, certain elements contained within the action alternatives of this project have the capability of improving the aquatic biota resource at specific locations.

Selection of any of the action alternatives would result in slight beneficial effects to aquatic biota populations and habitat on the Forest. This is primarily a response to the elimination of cross-country travel. Additionally, Alternatives B, C, and D would reduce total motorized route mileage across the Forest and within certain watersheds. However, these effects are not likely to result in marked improvement in fish biomass production or a wholesale improvement in aquatic habitats on the Forest.

Selection of Alternative A would result in a continuation of current deleterious effects to aquatic biota populations and habitat associated with the motorized travel system. The primary causative factor behind these effects is the continuation of cross-country travel and the persistence of specific routes within RIZs and key watersheds.

V. Compliance with Other Laws and Regulations

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. The analysis also identifies methods used and references scientific sources relied on.

The conclusions stated within this report are based on the scientific analysis that utilized a thorough review of relevant scientific information, a consideration of responsible opposing views, and site-specific data collected using regionally accepted protocols. It is acknowledged that there may be incomplete or unavailable information, scientific uncertainty, and risk associated with the analysis included in this report.

The best available science is a composite of several key elements. The elements of the science used are:

- **Site-specific data and history.** Aquatic habitats across the Forest have been surveyed and known aquatic biota populations have generally been monitored within the recent past (i.e., within the past 10 years). Known fish populations on the Forest are generally monitored using electroshocking equipment in streams and gill nets in lakes. Aquatic macroinvertebrate communities are generally monitored using a surber sampler and laboratory analysis conducted at an independent facility. Known amphibian populations and potential habitat are generally surveyed using a standard visual encounter protocol. Relevant site-specific aquatic biota data collected prior to this project proposal was utilized during this analysis.
- **Scientific literature.** Literature reviewed and cited as part of this analysis is clearly identified within the body of the report and is listed within the References section of this report and the Motorized Travel Plan Environmental Impact Statement.
- **Professional knowledge, judgment, and experience.** The primary specialist who conducted the aquatic biota resource analysis was Steve Brazier, Dixie National Forest Fisheries Biologist. Professional knowledge of the project area and cumulative effects area and professional judgment of how to integrate relevant science with local conditions have been incorporated into this analysis.

Clean Water Act

The Clean Water Act requires each state to implement its own water quality standards. The State of Utah's Water Quality Antidegradation Policy requires maintenance of water quality to protect existing instream Beneficial Uses on streams designated as Category 1 High Quality Waters. All surface waters geographically located within the outer boundaries of the Dixie National Forest, whether on private or public lands, are designated as High Quality Waters (Category 1) (Utah Administrative Code 2008). This means they will be maintained at existing high quality. New point sources will not be allowed and non-point sources will be controlled to the extent feasible through implementation of Best Management Practices or regulatory programs (ibid). The State of Utah and the Forest Service have agreed through a 1993 Memorandum of Understanding to use Forest Service Plan Standards and Guidelines and the Forest Service Handbook 2509.22 Soil and Water Conservation Practices as the Best

Management Practices. This use of Soil and Water Conservation Practices meets the water quality protection elements of the Utah Nonpoint Source Management Plan.

The Beneficial Uses and High Quality of water in the streams draining the analysis area would be maintained to the extent feasible during and following project implementation through the proper implementation of Best Management Practices (the Soil and Water Conservation Practices) as described within the project-specific design features.

Endangered Species Act

The Endangered Species Act of 1973 requires that actions of federal agencies do not jeopardize or adversely modify critical habitat of federally listed species. No critical habitat for any listed aquatic species would be impacted with implementation of any of the alternatives.

Executive Order 11990 of May 24, 1977

This executive order requires the Forest Service to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In compliance with this order, Forest Service direction requires that an analysis be completed to determine whether adverse impacts would result.

Wetland areas are included within the project area boundary in all alternatives; however, none of the alternatives would result in an increase in impacts within wetland and riparian areas. Alternative A, the No Action Alternative, would result in a continuation of the current motorized travel management strategy. All action alternatives would result in a decrease of impacts within wetland and riparian areas, primarily through the elimination of open cross-country travel on the Forest. Thus, all alternatives ultimately comply with the intent of Executive Order 11990.

Executive Order 11988 of May 24, 1977

This order requires the Forest Service to provide leadership and to take action to (1) minimize adverse impacts associated with occupancy and modification of floodplains and reduce risks of flood loss, (2) minimize impacts of floods on human safety, health, and welfare, and (3) restore and preserve the natural and beneficial values served by flood plains. In compliance with this order, the Forest Service requires an analysis be completed to determine the significance of proposed actions in terms of impacts to flood plains.

Floodplain areas are included within the project area boundary in all alternatives; however, none of the alternatives would result in an increase in impacts within floodplain areas. Alternative A, the No Action Alternative, would result in a continuation of the current motorized travel management strategy across the Forest. All action alternatives would result in a decrease of impacts within floodplain areas, primarily through the elimination of open cross-country travel on the Forest. Thus, all alternatives ultimately comply with the intent of Executive Order 11988.

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VII. Appendix A: Fish Population Monitoring Data, 2007-2007

The tables included within this appendix represent the known self-sustaining fish population distribution within Dixie National Forest streams. This data is based upon fish population surveys conducted by Forest personnel and UDWR personnel. Additionally, there are over 100 fish-bearing lakes on the Forest. These lacustrine fish populations are monitored exclusively by the UDWR, primarily using gill nets. This gill netting data is on file at the UDWR, Southern Region Office, Cedar City, Utah.

Table A-1. Fish Population Monitoring Data – Pine Valley Ranger District

5th HUC Watershed	Stream	Years Surveyed	Species Present
1501000804	Leap Creek	2002	BCT
1501000804	Mill Creek	2002	BCT
1501000804	Harmon Creek	2002	BCT
1501000804	South Ash Creek	2002	BCT
1501000806	Moody Wash	2007 (visual)	VSD, DS, SPD
1501000807	Reservoir Canyon	2002	BCT
1501000807	Water Canyon	2001	BCT
1501000807	Santa Clara River	2003, 2004, 2006	BNT, BKT, RBT
1501000807	Lloyd Creek	2003	-
1501000807	Forsyth Creek	2003, 2004	RBT
1501000809	Leeds Creek	2002	BCT
1501000809	Horse Creek	2002	BCT
1501000809	Spirit Creek	2002	BCT
1501000809	Pig Creek	2002	BCT
1501001001	Pine Park Canyon	2003 (visual)	RBT, DS
1603000613	Rock Creek	2006 (visual)	RBT
1603000613	Grassy Creek	-	RBT
1603000614	Pinto Creek	2006	RBT
1603000614	South Fork Pinto Creek	2005	RBT, SPD

Species Key: BCT = Bonneville Cutthroat Trout, BNT = Brown Trout, BKT = Brook Trout, RBT = Rainbow Trout, CT = Cutthroat Trout, VSD = Virgin Spinedace, DS = Desert Sucker, SPD = Speckled Dace, MS = Mountain Sucker, RS = Redside Shiner, MTS = Mottled Sculpin, LS = Southern Leatherside.

The data presented in Table A-1 represents known self-sustaining fish populations on the Pine Valley Ranger District. There are a limited number of additional streams on the District that do

provide permanent or seasonal aquatic habitat with very marginal fish habitat qualities. Fish species presence within Moody Wash, Pine Park Canyon, and Rock Creek was verified visually. Consequently, no recent quantitative fish population data exists for these streams. Species presence within Grassy Creek is assumed, based upon species presence within Lower Enterprise Reservoir.

Table A-2. Fish Population Monitoring Data – Cedar City Ranger District

5th HUC Watershed	Stream	Years Surveyed	Species Present
1501000802	Stout Canyon	2003, 2004	BNT
1501000802	Dairy Canyon	2007	BNT
1603000101	Duck Creek	-	RBT, BKT, BNT
1603000101	Swains Creek	2003	BKT, CT, MTS, MS, LS?
1603000101	Asay Creek	-	?
1603000101	West Fork Asay Creek	-	?
1603000102	Castle Creek	2004	BKT
1603000102	Lowder Creek	2006	BKT
1603000102	Mammoth Creek	-	BKT, RBT, BNT
1603000104	Ipson Creek	-	RBT
1603000104	Clear Creek	-	RBT, BCT
1603000104	Bunker Creek	2004	BKT
1603000104	Deer Creek	2003	BKT
1603000104	Blue Spring Creek	-	BKT
1603000104	Panguitch Creek	-	BCT
1603000104	Butler Creek	2006	BNT, RBT
1603000104	Caddy Creek	2006	?
1603000105	Threemile Creek	2001	BCT
1603000105	Delong Creek	2001	BCT
1603000105	Indian Hollow	2001	BCT
1603000105	Sandy Creek	2002	BCT
1603000105	Bear Creek	2006	BNT, RS, SPD, MS
1603000601	Cottonwood Creek	2006	-
1603000601	Little Creek	2003	-
1603000601	Red Creek	-	RBT
1603000602	Bowery Creek	2006	-
1603000602	Center Creek	2006	RBT

Species Key: BCT = Bonneville Cutthroat Trout, BNT = Brown Trout, BKT = Brook Trout, RBT = Rainbow Trout, CT = Cutthroat Trout, VSD = Virgin Spinedace, DS = Desert Sucker, SPD = Speckled Dace, MS = Mountain Sucker, RS = Redside Shiner, MTS = Mottled Sculpin, LS = Southern Leatherside

The data presented in Table A-2 represents known self-sustaining fish populations on the Cedar City Ranger District. There are a limited number of additional streams on the District that do provide permanent or seasonal aquatic habitat with very marginal fish habitat qualities. Species presence within the Panguitch Lake basin streams (i.e., Blue Spring Creek, Ipson Creek, Clear Creek, Panguitch Creek) was primarily derived from visual observation during the Panguitch Lake rotenone treatment in spring 2006, and from post treatment stocking actions. Species presence within Asay and West Fork Asay creeks is unknown, due to very limited habitat on forest. It is assumed that the fishery is dominated by brown trout, which is common within the upper mainstem of the Sevier River.

Table A-3. Fish Population Monitoring Data – Powell Ranger District

5th HUC Watershed	Stream	Years Surveyed	Species Present
1603000105	Left Fork Sanford Creek	2002	BCT (currently fishless)
1603000203	East Fork Sevier River	2004	BNT, BKT, CT, RBT, SPD, MS, RS
1603000203	Kanab Creek	2004	BNT, BKT, CT, MS
1603000203	Podunk Creek	2004	BKT
1603000203	Crawford Creek	-	-
1603000203	Sieler Creek	-	-
1603000203	Robinson Canyon	-	BKT, CT
1603000203	Blubber Creek	2004	BKT
1603000203	East Creek	-	BKT
1603000203	Blue Fly Creek	2003	BKT, SPD
1603000204	Cottonwood Creek	2002 (spot shock)	-
1603000204	Deer Creek	2002 (spot shock)	-
1603000204	Deep Creek	2007 (spot shock)	BCT

Species Key: BCT = Bonneville Cutthroat Trout, BNT = Brown Trout, BKT = Brook Trout, RBT = Rainbow Trout, CT = Cutthroat Trout, VSD = Virgin Spinedace, DS = Desert Sucker, SPD = Speckled Dace, MS = Mountain Sucker, RS = Redside Shiner, MTS = Mottled Sculpin, LS = Southern Leatherside

The data presented in Table A-3 represents known self-sustaining fish populations on the Powell Ranger District. There are a limited number of additional streams on the District that do provide permanent or seasonal aquatic habitat with very marginal fish habitat qualities. Fish distribution within the East Fork Sevier River headwaters is widespread; however, some tributary streams provide only seasonal or very limited fish habitat, and thus do not support self-sustaining populations of fish. Non-native salmonid populations within Cottonwood Creek, Deer Creek, and Left Fork Sanford Creek were extirpated following the Sanford Fire of 2002. Self-sustaining populations have yet to be reestablished within these drainages. Cottonwood Creek and Deer Creek are scheduled to be restocked with Bonneville cutthroat trout.

Table A-4. Fish Population Monitoring Data – Escalante Ranger District

5th HUC Watershed	Stream	Years Surveyed	Species Present
1407000501	Water Canyon	2006	CRCT
1407000501	North Creek	2006	BKT, CRCT, RBT
1407000501	White Creek		CRCT
1407000501	Twitchell Creek		CRCT
1407000501	Dougherty Canal		CRCT
1407000501	Pine Creek		CRCT, BNT
1407000501	West Branch Pine Creek		CRCT
1407000502	Sand Creek	-	BNT
1407000502	Lake Creek	2007	BKT
1407000502	Bear Creek	2003	BKT, RBT

5th HUC Watershed	Stream	Years Surveyed	Species Present
1407000502	Boulder Creek	2007	CRCT, BKT, RBT, BNT
1407000502	West Fork Boulder Creek	2006	CRCT
1407000502	East Fork Boulder Creek	2006	CRCT, BKT, RBT, BNT
1407000502	Deer Creek	-	BKT
1407000502	West Fork Deer Creek	2007	BKT
1407000502	East Fork Deer Creek	2007	BKT
1603000204	Clay Creek	2006	BKT, LS
1603000204	Horse Creek	2006	BKT
1603000204	Ranch Creek		BCT
1603000204	Center Creek		BCT
1603000205	Antimony Creek	2003, 2006	RBT

Species Key: BCT = Bonneville Cutthroat Trout, BNT = Brown Trout, BKT = Brook Trout, RBT = Rainbow Trout, CT = Cutthroat Trout, VSD = Virgin Spinedace, DS = Desert Sucker, SPD = Speckled Dace, MS = Mountain Sucker, RS = Redside Shiner, MTS = Mottled Sculpin, LS = Southern Leatherside

The data presented in Table A-4 represents known self-sustaining fish populations on the Escalante Ranger District. There are a limited number of additional streams on the District that do provide permanent or seasonal aquatic habitat with very marginal fish habitat qualities. Fish species presence within native cutthroat trout streams is largely based upon UDWR electroshocking surveys that have occurred periodically within the last five years.

Table A-5. Fish Population Monitoring Data – Fremont River Ranger District

5th HUC Watershed	Stream	Years Surveyed	Species Present
1407000302	Pine Creek		CRCT
1407000303	Birch Creek	2006	BKT
1407000303	Boulder Creek	2006	BKT
1407000303	Bullberry Creek		CRCT
1407000303	Fish Creek	2004	BKT, MS
1407000303	Spring Creek		BKT
1407000303	Carcass Creek	2004	BKT
1407000303	Donkey Creek	2006	BKT
1407000304	Pleasant Creek	2003	BKT
1407000304	Wildcat Creek	-	BKT?
1407000304	Oak Creek	2003	BKT

Species Key: BCT = Bonneville Cutthroat Trout, BNT = Brown Trout, BKT = Brook Trout, RBT = Rainbow Trout, CT = Cutthroat Trout, VSD = Virgin Spinedace, DS = Desert Sucker, SPD = Speckled Dace, MS = Mountain Sucker, RS = Redside Shiner, MTS = Mottled Sculpin, LS = Southern Leatherside

The data presented in Table A-5 represents known self-sustaining fish populations on the Fremont River Ranger District. There are a limited number of additional streams on the District that do provide permanent or seasonal aquatic habitat with very marginal fish habitat qualities. CRCT were reestablished within Pine Creek in 2004 following a series of rotenone treatments that eliminated non-native salmonids within the drainage. CRCT presence within Bullberry

Creek is assumed based upon presence of this species within headwater lakes (i.e., Bullberry Lakes) that were stocked following rotenone treatments that occurred in 2003 and 2004. Species presence within Spring Creek and Wildcat Creek is assumed based upon species presence within downstream hydrologically connected streams.

VIII. Appendix B: Aquatic Macroinvertebrate Monitoring Data, 2001-2007

The tables included within this appendix represent all aquatic macroinvertebrate data that has been collected on the Dixie National Forest since 2001. The Dixie National Forest Land and Resource Management Plan (1986) lists aquatic macroinvertebrates as a Management Indicator Species (MIS) when "fish population data is not available for a particular water body." Since 2001, this data has been collected locally, primarily to support the NEPA processes, establish baseline data, and to assess habitat recovery following wildfires.

Table B-1. Aquatic Macroinvertebrate Monitoring Data – Pine Valley Ranger District

5th HUC Watershed	Stream	Years Surveyed	BCI
1501000807	Santa Clara River	2002, 2007	68, *
1501000804	Harmon Creek	2003, 2006	49, 69
1501000804	Mill Creek	2003, 2004, 2005	51, 64, 58
1501000804	South Ash Creek	2003, 2004	48, 55
1501000804	Leap Creek	2003, 2006	49, 56
1501000807	Water Canyon	2005	73

BCI = Biotic Condition Index, * = Currently at lab awaiting processing

Harmon Creek, Mill Creek, South Ash Creek, and Leap Creek were severely affected by the Sequoia Fire in 2002. Macroinvertebrate communities and aquatic habitats within these streams are still recovering from the post-fire effects.

Table B-2. Aquatic Macroinvertebrate Monitoring Data – Cedar City Ranger District

5th HUC Watershed	Stream	Years Surveyed	BCI
1603000104	Butler Creek	2002	85
1603000102	Castle Creek	2002	81
1603000602	Center Creek	2002	93
1603000102	Mammoth Creek	2002	72
1603000102	Mammoth Spring	2002	65
1603000602	Bowery Creek	2003	82
1603000105	Threemile Creek	2003	81
1603000104	Bunker Creek	2004	84
1603000104	Deer Creek	2004	68
1603000101	Duck Creek	2004	56
1603000101	Swains Creek	2004	96
1603000105	Delong Creek	2007	*

BCI = Biotic Condition Index, * = Currently at lab awaiting processing

Table B-3. Aquatic Macroinvertebrate Monitoring Data – Powell Ranger District

5th HUC Watershed	Stream	Years Surveyed	BCI
1603000204	Deep Creek (lower)	2002,2003,2004,2005,2006	52, 49, 53, 49, 51
1603000204	Deep Creek (upper)	2003,2004,2005,2006	49, 55, 51, 52
1603000204	Deer Creek	2002,2003,2004,2005,2006	53, 57, 55, 49, 57
1603000204	Cottonwood Creek	2003,2004,2005,2006	54, 55, 52, 55
1603000204	Pine Creek	2006	67
1603000204	Forest Creek	2006	70
16030002043	West Fork Hunt Creek	2002,2003	49, 50
1603000203	East Fork Sevier	2007	*
1603000203	Kanab Creek	2004	77

BCI = Biotic Condition Index, * = Currently at lab awaiting processing

Deep Creek, Deer Creek, Cottonwood Creek, and West Fork Hunt Creek were severely affected by the Sanford Fire in 2002. Macroinvertebrate communities and aquatic habitats within these streams are still recovering from the post-fire effects.

Table B-4. Aquatic Macroinvertebrate Monitoring Data – Escalante Ranger District

5th HUC Watershed	Stream	Years Surveyed	BCI
1407000501	Pine Creek	2001, 2007	72, *
1407000501	Twitchell Creek	2001, 2007	77, *
1407000501	White Creek	2007	*
1407000502	Bear Creek	2002	72
1407000502	West Fork Boulder Creek	2003	67
1407000502	Lake Creek	2007	*
1603000205	Antimony Creek	2002, 2005	74, 74
1603000204	Center Creek	2002, 2007	73, *
1603000204	Ranch Creek	2002, 2007	94, *

BCI = Biotic Condition Index, * = Currently at lab awaiting processing

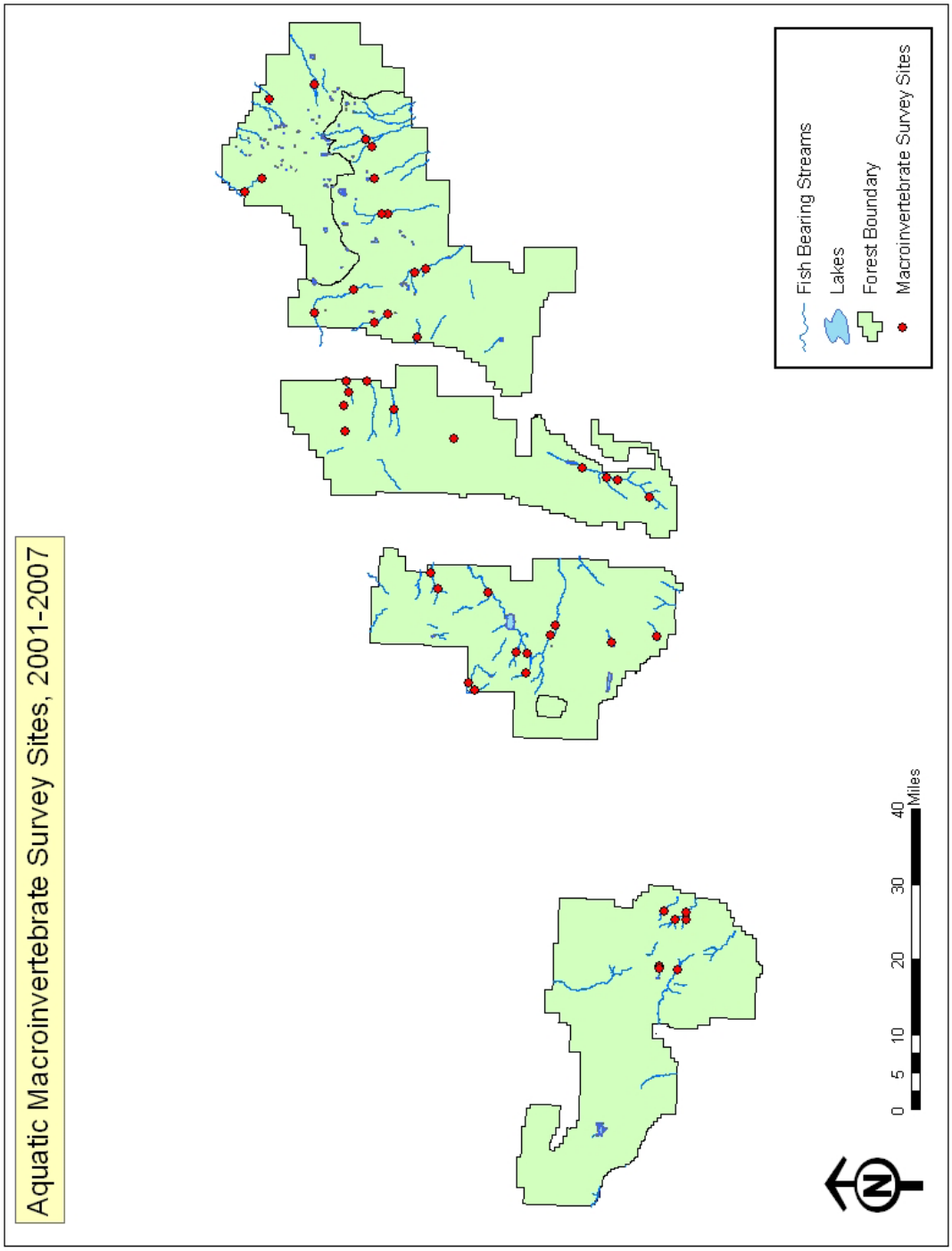
Table B-5. Aquatic Macroinvertebrate Monitoring Data – Fremont River Ranger District

5th HUC Watershed	Stream	Years Surveyed	BCI
1407000302	Pine Creek	2002, 2007	74, *
1407000303	Pleasant Creek	2002	78
1407000304	Carcass Creek	2003	86

BCI = Biotic Condition Index, * = Currently at lab awaiting processing

IX. Appendix C: Maps

Map C-1. Aquatic Macroinvertebrate Survey Sites, 2001-2007



Map C-2. Fish Population Survey Sites, 1994-2007