3.0 THE AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the existing physical, biological, social, and economic environment, which may be affected by the Proposed Action and the alternatives. These existing conditions are described according to two broad categories. The physical and biological environment includes natural factors such as air quality, water resources, wildlife and fisheries, and visual resources. The human environment includes human-influenced factors such as heritage resources, recreation, and socio-economics.

3.1.1 STUDY AREA

The Study Area for the analysis contained in this SDEIS varies according to the resource being analyzed. Generally speaking, the analysis performed for the physical and biological environment was conducted within a common Study Area that is 2,574 acres in size.[1] This Study Area includes the current SUP area, those NFS lands proposed for SUP area expansion, and the private lands within and adjacent to the Bridger Bowl. The scope of the Study Area is increased for specific resources in order to address direct, indirect, and cumulative effects (e.g., wide ranging wildlife species, transportation impacts, and air quality impacts).

[1] Area totals may not agree precisely with the Study Area size of 2,574 acres due to rounding.

3.2 GEOLOGY AND SOIL RESOURCES

3.2.1 GEOLOGY

The Bridger Bowl Study Area for the soils analysis encompasses 2,574 acres and is located in the Bridger Mountain Range. The Study Area is dominated by east facing, steep to moderately steep slopes, which originated from the uplift of the Livingston Group and Fort Union formation. The Fort Union formation, which is underlain by the Livingston Group, is composed of sandstone and a conglomerate of alternating siltstone and mudstone. Uplift of the Bridger Range exposed sedimentary rocks from the early Paleozoic through the late Cretaceous periods. These moderately steep to steep slopes are a thick series of fractured and terraced sandstone, tuff, mudstone, and shale.

Soils in this area develop primarily from landslide debris, which area derived from inter-bedded shale, weathered sandstone, and weathered limestone bedrock. Landslide debris soils are moderately fine textured, with few to many rock fragments. Soils developed from weathered sandstone and shale are moderately fine to medium textured. Limestone weathering within the Study Area creates shallow soils with coarse to moderately coarse texture.

3.2.2 SOILS

The soils in the Bridger Range vary with regard to slope, soil texture, amount of rock fragments, depth, and parent material. Three soil formation areas are distinct within the 2,574 acre Study Area and are defined by Upland Slopes, Ridges, and Toe of Slope.

Soils in the Upland Slope group are the most common group in the Study Area; they are derived from sedimentary rocks and occur in the terraced uplands, ranging from high to lower elevations. These soils occur in strongly sloping to steep areas, ranging from midslopes to foothills. The dominant soil texture in this group is moderately-fine or fine and is commonly classified as clay loam, silty clay loam, or clay.

Soils that comprise the Ridge group are typically shallow soils that are derived from sandstone parent material. These soils contain a high percentage of rock fragments and are typically well drained sandy loam and highly erodible.

Soils found in the Toe of Slope group are usually very deep with buried horizons containing varying amounts of rock. These soils are typically well drained and form over shale and sandstone parent material. These soils have primarily developed from alluvial outwash and the accumulation of landslide debris derived from inter-bedded sandstone, shale, and weathered limestone. Soils that form from slide debris vary in texture from moderately fine to coarse.

The soil types identified below in Table 3.2-1 are known to occur within the Study Area based on Forest Service soils mapping contained in a Geographic Information System (GIS) database. The soil attributes recorded in the GIS database include percent slope, elevation, erosion hazard, texture, and parent material. A numbered code was used by the Forest Service to label and discuss soil properties. No soils data is available for the approximately 138 acres of private land east of the Bridger Bowl parking lot because this area was not mapped by the Forest Service.

Table 3.2-1
Existing Soil Types within the Bridger Bowl Study Area

Soil Type	Area (acres)
25-3A – Medium texture	30.6
71-1D - Fine texture	769.9
84-2B - Moderately fine texture	1.4
86-3B - Moderately fine texture	262.5
87-1A - Moderately coarse texture	508.9
87-1B - Moderately coarse texture	2.8
87-2D - Moderately fine texture	255.1
87-2E - Moderately fine texture	54.3
91-2B - Moderately fine texture	422.9
93-1A - Coarse texture, bedrock	127.7
Unclassified	137.9
Total	**2574.0**

Source: Forest Service

Soil Types

- 87-1A occurs on 40 percent plus slopes at elevations ranging from 7,800-8,800 feet. It is highly erodible with a moderately coarse texture originating from overthrust limestone with some sedimentary rock parent material.

- 93-1A occurs on 20-40 percent slopes at elevations ranging from 7,000-9,800 feet. It is highly erodible with a coarse to very coarse texture. The parent material is colluvium rock/talus with undifferentiated material

- 71-1D occurs on 0-20 percent slopes at elevations ranging from 7,000-8,000 feet. It is a moderately erodible soil with fine texture originating from mass wasting deposits of weathered soft sedimentary rocks.

- 87-2D occurs on 40 percent plus slopes at elevations ranging from 6,500-8,000 feet. It is a moderately erodible soil with moderately fine texture. The parent material is a mixture of folded and faulted sedimentary rocks including sandstone shale and limestone.

- 87-2E occurs on 40 percent plus slopes at elevations ranging between 8,000-8,800 feet. It is a moderately erodible soil with moderately fine texture. The parent material is a mixture of folded and faulted sedimentary rocks including sandstone shale and limestone

- 91-2B occurs on 10-20 percent slopes at elevations ranging from 7,800-8,500 feet. It has a low erodibility and a moderately fine texture. The parent material is soft sedimentary rock.

- 86-3B occurs on 10-20 percent slopes at elevations ranging from 6,300-7,800 feet. It has moderately fine texture, derived from folded and faulted volcanic and sedimentary rocks that are comprised primarily of inter-bedded sandstone and shale.

- 84-2B occurs on 10-20 percent slopes at elevations ranging from 6400-7000 feet. It has moderately fine texture, derived from folded and faulted volcanic and sedimentary rocks that are comprised primarily of inter-bedded sandstone and shale.

- 87-1B occurs on 40 percent plus slopes at elevations ranging from 5,800-7,800 feet. It is a moderately erodible soil with moderately coarse texture. The parent material is limestone with some soft sedimentary rocks.

- 25-3A occurs on 0-20 percent slopes at elevations ranging from 8,500-9,500 feet. It is a moderately erodible soil, with medium texture, and is derived from volcanic rock.

3.2.3 EROSION HAZARD

Primary management considerations for the soils in the 2,574 Study Area include the potential for erosion on steep slopes and erosion related to the existing road network. In addition, the short growing season associated with these soils can affect the timing and success of revegetation plans and erosion control (USDA, Soil Conservation Service, 1992).

Erosion from Mountain Slopes

The Forest Service GIS database also includes information regarding the erosion hazard potential of the soils in the Study Area. The determination of the erosion hazard potential of surface soils assumes that all vegetative cover, including the surface organic horizons, is removed, and the soil is bare (USDA, 1995a). The erosion hazard potential also reflects the influences of climate, slope gradient, soil physical characteristics, and bedrock composition. The soils within the Study Area are presented by erosion hazard potential in Table 3.2-2 and the distribution of these areas is displayed graphically in Figure 3-1. Erosion hazard within the Study Area ranges from low at toe slopes and valley bottoms, to high on ridges and steep mid- and upper-mountain slopes. While most management activities in mountainous landscapes generate some increased risk of soil erosion, actual erosion depends on the degree of impact of a management action and the effectiveness of erosion control and site stabilization.

Figure 3-1: Existing Soil Erosion Potential

Table 3.2-2
Existing Soil Types by Erosion Hazard within the Bridger Bowl Study Area

Erosion Hazard	Area (acres)	Percent of Total
High	639.4	25
Medium	1,109.9	43
Low	686.8	27
Unclassified	137.9	5
Total	**2,574.1**	**100**

Actual surface erosion under natural conditions within the Study Area is common but not extensive. Observed natural surface erosion areas include: soils with minimal development of an organic horizon and sparse ground flora; secondary erosion of scarps and exposed banks in debris avalanche tracks and inner gorge slumps; and raindrop splash on sub alpine soils under herbaceous cover disturbed by freeze-thaw action. The latter is indicative of the sensitivity of soils in sub alpine areas to disturbance under management. Soil erosion from mountain slopes and roads is analyzed in more detail in Section 3.2.4.

Erosion from Roads

Many different road characteristics determine the volume of sediment generated and delivered to streams. Some of these include: total length of road, road density, geology of the area, form and steepness of slopes, location, road type, surface material, number of stream crossings, type of drainage structures, and maintenance. These characteristics were incorporated into the R1R4 sediment model described below to determine the sediment yield derived from roads.

3.2.4 SEDIMENT YIELD

The R1R4 model (Cline et al., 1981) was used to estimate existing and potential sediment yields to waterbodies in the four major watersheds within and adjacent to the Bridger Bowl Study Area. The watersheds included in the Watershed Model Analysis Area are the South Fork of Brackett Creek (SF Brackett Creek), the Upper Bridger Creek, the Maynard Creek, and the Slushman Creek Watersheds. The Watershed Model Analysis Area includes the Bridger Bowl Study Area and the private and NFS lands downstream of the Bridger Bowl Study Area in the lower portions of the watersheds analyzed. The approximate size of the Watershed Model Analysis Area is 6,160 acres. Sediment yield coefficients have been modified to reflect conditions and actual measured sediment yields on the GNF. Sediment yields estimated by the model factor in the distribution of land types and associated basic erosion hazard rates in each soil type assuming average annual precipitation. Estimated natural sediment yield (sediment yield in absence of human activities) and existing sediment yields for each watershed are outlined in Table 3.2-3. The existing sediment yield reflects the impacts from existing development activities from the ski area and other private land owners and the Forest Service. The analysis results presented in Table 3.2-3 account for Best Management Practices (BMPs) that are currently used by Bridger Bowl for ski area maintenance activities to minimize erosion and sedimentation and to protect water quality.

Table 3.2-3
Existing Sediment Yield to watersheds within the Bridger Bowl Study Area

Watershed	Natural Sediment Yield (tons/year)	Existing Sediment Yield (tons/year)	Percent Above Natural Conditions
SF Brackett Creek	83.0	89.8	8.2 %
Upper Bridger Creek	121.0	161.2	33.2 %
Maynard Creek	36.0	63.7	76.9 %
Slushman Creek	79.0	100.0	26.6 %

Source: Forest Service, 2004

The sediment yield to Upper Bridger Creek and Slushman Creek have been increased due to road building and timber harvest in the lower part of each drainage on NFS land and other privately owned land, these increases are 33 percent and 27 percent respectively. Maynard Creek, which flows through existing Bridger Bowl base area and adjacent private lands, has had a substantial increase (77 percent) in sediment yields due to historic building, road, and ski trail construction. The SF Brackett Creek watershed has the smallest increase (8 percent) in sediment yields as compared to the other three watersheds due to the limited amount of road building and development in the upper portion of the watershed.

3.2.5 SOIL PRODUCTIVITY

Forest Service policy identified in Forest Service Manual (FSM) 2550 for management on NFS lands requires the implementation of specific Soil Quality Standards (SQS) to ensure the maintenance of ecosystem processes and to avoid the permanent impairment of land productivity (USFS, 1998). Although these standards and guidelines do not apply to developed recreation sites, soil productivity within the Study Area is considered in this analysis because of the dispersed nature of ski area management and the concerns for watershed resource management in these areas. Activities such as soil grading and construction of impervious surfaces typically cause direct impacts to soil productivity, which reduces or eliminates the soil's capacity to support plant or animal life. Based on field investigations, aerial photo interpretation, and GIS analysis, the productivity of approximately 62.0 acres of soil has been permanently impacted by the historic construction of roads, parking lots, and buildings within the Study Area for the development of the ski area, residential homes, and other private land developments (see Table 3.2-4).

Table 3.2-4
Existing Impacts to Soil Resources within the Bridger Bowl Study Area

Parameter	Existing Conditions
Permanent Impacts from Roads[a] (acres)	40.3
Permanent Impacts from Other Impervious Surfaces (acres)	21.7
Total Permanent Soil Impacts (acres)	**62.0**
Percent of Study Area with Permanent Soil Impacts	**2.4**

[a] The term "roads" includes all Forest Service, Bridger Bowl, and other private roads in the Study Area.

Graded areas that are revegetated are considered to have experienced temporary soil productivity impacts because the productivity of the soil would normally return over a short period of time (i.e., 5 to 10 years). Temporary impacts from previously graded areas that have been revegetated where not calculated in this analysis because identification of these areas from air photo interpretation was not possible. Ski trails and other cleared areas that consist of herbaceous and shrub vegetative cover have the potential for detrimental effects, especially on erosion prone soils. This is because they generally result in a reduced or absent duff layer common in adjacent forests, and they may result in the loss of organic matter from surface soil horizons. Most areas in a modified vegetative condition (e.g., ski trails) support good coverage of grasses, forbs, and shrubs, which create conditions that introduce organic matter to the soil and reduce soil erosion, thus retaining some level of soil productivity.

3.3 WATER RESOURCES

Located approximately 15 miles northeast of Bozeman, Bridger Bowl is located in the Bridger Mountain Range. The Bridger Mountain Range is drained by the Shields River to the north, which flows into the Yellowstone River. The Bridger range is drained to the south by the Gallatin River, which flows into the Missouri River. The four sub-watersheds that occur within the 2,574 acre Bridger Bowl Study Area include SF Brackett Creek, Upper Bridger Creek, Maynard Creek, and Slushman Creek. Average annual precipitation varies from about 27 inches at the mouth of Maynard Creek to about 50 inches at the crest of the Bridger Range. According to information published by NOAA in 1973, rainfall intensity is mapped at lower elevations within the Study Area at 1.2 inches for a 2 year-6 hour event and 2 inches for a 25 year-6 hour event. Higher elevations have estimated rainfall intensity of 1.3 inches for a 2 year-6 hour event and 2.2 inches for a 25 year-6 hour event. Average annual snowfall varies from about 100 inches to 400 inches in the Study Area. Approximately 60 to 70 percent of the total annual precipitation occurs as snow.

3.3.1 STREAMS

The streams within the Bridger Bowl Study Area were identified by Forest Service GIS mapping and additional air photo interpretation. The stream network within the Bridger Bowl Study Area consists primarily of mainstem reaches and tributaries of Maynard Creek, the headwaters of Upper Bridger Creek northeast of Maynard Creek, and Slushman Creek at the southern portion of the Study Area (see Figure 3-2). Maynard Creek and Slushman Creeks are tributaries to Upper Bridger Creek, which flows south through Bridger Canyon to the confluence with the East Fork of the Gallatin River approximately one mile north of Bozeman. The headwaters of SF Brackett Creek is located near Bradley Meadows in the northwest portion of the Study Area. SF Brackett Creek flows north from the Study Area to the confluence with the Middle Fork and North Fork of Brackett Creek, before flowing into the Shields River approximately two miles north of the Study Area.

There are two water impoundments within the Study Area, one of these is located on Bridger Bowl private lands and is used for snowmaking operations. This impoundment is located just north of the base area between the parking lots and the Bridger Pines subdivision. The second impoundment is located just north of Bridger Pines on private land that is not owned by Bridger Bowl, Inc.

Figure 3-2: Existing Watershed Resources

Information about roads, including road density and road crossings of streams, is important to make an assessment of watershed conditions. It can be used as a general measure of the watershed's overall condition and can also determine the potential risk of cumulative effects to the watershed. Table 3.3-1 shows that the Bridger Bowl Study Area contains 15.9 total miles of Forest Service, Bridger Bowl, and other private roads, which results in an overall road density of 4.0 mi/mi^2. Of this road total, 8.6 miles of roads are on NFS lands. According to GIS analysis of the stream network in the Study Area, there are 29 road crossings of streams by Forest Service, Bridger Bowl, and other private roads. Approximately 17 of these stream crossings are for Forest Service roads and mountain service roads that are used or maintained by Bridger Bowl. The remaining stream crossings are from other Forest Service and Private Roads (e.g., Bridger Pines, Private logging roads, etc.). See Section 3.2.4 for more information regarding erosion from roads within Bridger Bowl Study Area.

Table 3.3-1
Bridger Bowl Study Area Stream Information

Parameter	Study Area
Stream Length	
Perennial (miles)	2.5
Intermittent (miles)	11.2
Total Stream Length	**13.7**
Drainage Density (miles/miles^2)	3.4
Total Road Length[a] (miles)	15.9
Roads on NFS lands (miles)	8.6
Road Density (miles/miles^2)	4.0
Road Crossings of Streams	29

[a]Total roads include those on NFS lands, Bridger Bowl private lands, and other private lands.

The streams within the Study Area were surveyed for channel stability using methods established by Pfankuch (1975), where a higher score equals lower stability. Less than 38 is considered "excellent" stability, 39 to 76 is considered "good" stability, 77 to 114 is considered "fair" stability, and over 115 is considered "poor" stability. The streams draining the Bridger Bowl Study Area were also classified using geomorphic definitions as described in the Rosgen Stream Classification system (Rosgen, 1994).

SF Brackett Creek initiates with several seeps and springs into intermittent channels, finally becoming a perennial stream in the western portion of Section 18 in T1N; R7E. SF Brackett Creek at this location is an A3/A4 channel type which is characterized by a steep gradient (greater than 4 percent), cobble/gravel substrate, highly confined, with low sinuosity (less than 1.3). Channel stability in this reach is rated as 70 or "good." SF Brackett Creek changes to a B4 channel type near the Forest boundary and is characterized by a moderate gradient (1.5 to 4 percent), with gravel substrate, and moderate sinuosity (greater than 1.2). Channel stability in this reach is rated as 72 or "good."

Maynard Creek south of the Pierre's Knob lower terminal is a stable A2/A3 channel type, boulder/cobble dominated with a channel stability rating of 54 or "good." At the main road crossing of Maynard Creek near the base area, the stream reach is a A3 channel type but channel stability has been degraded to 97 or "fair" due primarily to accelerated sediment deposition from ski area developments (roads, ski trails, channel disturbances) and minor slumps. This lower reach of Maynard Creek shows some evidence of stream channel scour and bank cutting.

The portion of Slushman Creek within the Bridger Bowl Study Area is a very stable A2 channel type (steep boulder dominated channel) with a channel stability rating of 45 or "good."

The stream channel condition in Upper Bridger Creek was not analyzed for this EIS because it located primarily in private land and would not be significantly impacted by any of the proposed Action Alternatives.

3.3.2 WETLANDS

The wetlands within the Bridger Bowl Study Area were identified from field mapping done by Forest Service hydrologists and through air photo interpretation. Wetlands in the Study Area provide water quality protection via sediment filtration, habitat for aquatic and terrestrial life, flood storage, groundwater recharge and discharge, sources of primary production, recreation, and aesthetics. As shown in Table 3.3-2, there are 41 wetlands within the Bridger Bowl Study Area that collectively cover approximately 45.0 acres. Because most of the Study Area is well drained with limited areas of groundwater emergence, the wetlands found within the Study Area are primarily stream-fed palustrine scrub shrub and emergent wetlands that have unconsolidated bottom and rock bottom classes, as shown in Figure 3-2 (Cowardin, 1979).

Some small and localized seeps and spring wetlands occur at discharge points from unconsolidated Quaternary deposits that are described in the groundwater part of this section. These wetlands are small groundwater fed palustrine scrub shrub wetlands and are mainly found north of the parking lots and along Upper Bridger Creek. Below Bradley Meadows in SF Brackett Creek, springs, seeps, and a high water table produce localized areas of palustrine scrub shrub wetlands and palustrine emergent wetlands surrounded by alder thickets. The plant communities within the shrub scrub wetlands are typically dominated by mountain alder (*Alnus incana*), white spirea (*Spiraca berulifolia*), and Northern black current (*Ribes* spp.). The emergent wetlands found in the northwest portion of the Study Area have plant communities dominated by Western coneflower (*Rudbekia occidentalis*), valerian (*Valeriana dioica*), larkspur (*Delphinium spp*.), and arrowleaf balsamroot (*Balsamhoriza sagittata*). False hellebores (*Veratrum* spp.) are often found in more moist portions of these wetlands, which are typically adjacent to streams.

Table 3.3-2
Summary of Existing Wetlands in the Bridger Bowl Study Area

Wetland Type	Number of Wetlands	Total Area (acres)
Palustrine Emergent	3	3.2
Palustrine Scrub Shrub	38	41.8
Total	**41**	**45.0**

3.3.3 WATER QUANTITY

Surface Water

Average annual water yield rates range from 0.71 acre-feet of water per acre of land area at approximately 6,000 feet elevation to 2.2 acre-feet of water per acre of land area at approximately 8,700 feet elevation within the Study Area. Average annual water yield by the entire drainages is estimated in Table 3.3-3. Annual hydrographs are sharply influenced by snowmelt with most of the runoff occurring as snowmelt during May and June with low flows occurring in February (Williams, 1967).

Table 3.3-3
Projected Annual Water Yield for the Watershed Model Analysis Area

Parameter	SF Brackett	Upper Bridger	Maynard	Slushman
Watershed Area (mi^2)	2.4	2.3	2.2	2.7
Existing Water Yield (acre ft./yr)	1,410	1,329	1,295	1,590
Percent Above Natural	0.07	0.3	0.7	0.6

Annual water yield in Maynard Creek, Upper Bridger Creek, and Slushman Creek are elevated above natural levels because the existing watershed developments (e.g., roads, parking lots, ski trails) are more efficient at conveying overland flow to the stream system than under natural conditions. Existing watershed development by Bridger Bowl, the Forest Service, and other private developments such as roads, clearcuts, ski trails, buildings, and parking lots reduce transpiration by vegetation and infiltration into the soil. Developments in these watersheds have increased current water yield to an estimated 0.7 percent in Maynard Creek, 0.6 percent increase in Slushman Creek, and 0.3 percent in Upper Bridger Creek. Peak snowmelt runoff discharge in Maynard Creek is likely greater than the model predicts since the existing watershed developments are more efficient at conveying overland flow to the stream system. The limited amount of development in SF Brackett Creek is reflected in the model where the annual water yield is only 0.07 percent above natural conditions.

The water source for snowmaking at Bridger Bowl is the impoundment in the base area. Approximately 27 acres of ski trails currently have snowmaking coverage that is provided by this impoundment. The maximum water volume withdrawn from Maynard Creek for snowmaking in any one year is an additional 20 acre-feet above the 2,240 acre-feet of water yield (annual average). The water volume used for snowmaking was based on the size of the detention pond, since the size of the pond did not change when the snowmaking area was expanded in 2003, the water volume modeled for snowmaking would remain unchanged. Assuming that 80 percent of the Maynard Creek water yield occurs as snowmelt runoff, and that none of the snowmaking water would evaporate, the water yield increase of Maynard Creek would be 0.9 percent, which is too low to be measurably affected by streamflow, channel scour, or sediment yield.

Groundwater

Whittingham (1996) reports that two types of aquifers occur in the Maynard Creek drainage including fractured bedrock and unconsolidated Quaternary deposits including rock glacial till, undifferentiated till, outwash, and buried channels. Bedrock fractures are limited and bedrock aquifers yield only a minor portion of groundwater discharge to Maynard Creek. The surficial Quaternary deposits are the primary discharging aquifers in Maynard Creek, mainly at lower slope locations. Groundwater discharge is limited, however, and most of the Maynard Creek drainage discharge results from direct surface water runoff. The Whittingham study focused on the Maynard Creek system, but it is assumed that groundwater characteristics in Slushman, Upper Bridger, and SF Brackett Creeks are very similar due to the similarities in geology, topography, and geomorphology between all four of these watersheds.

At Bridger Bowl, groundwater is utilized for potable water use. The base area facilities, including the Jim Bridger Lodge, the ski patrol building, and the new Day lodge utilize one well. The water supply system consists of a well and pump, chlorination system, and a 3,400-gallon holding tank. Water consumption at Bridger Bowl is approximately three gallons per person per day. The well produces at 34 gallons per minute (gpm) and is capable of supplying up to 22,440 gallons per day following standard hours of operation, which can accommodate approximately 6,400 people per day. The Deer Park Chalet has its own well with a sustained yield of 20 gpm. The water supply system for the Deer Park Chalet also has a 3,900 gallon storage tank and two pressure tanks. All nearby residential developments have their own wells and wastewater treatment systems.

3.3.4 WATER QUALITY

All of the streams in the Study Area have been designated by the Montana Department of Environmental Quality (MDEQ) as B-1 Classification (MDEQ, 1994). The B-1 Classification is designed to protect a variety of beneficial uses including drinking (after treatment), recreation, growth and propagation of salmonid fisheries, and agricultural and industrial water supply.

None of the streams in the Study Area are classified as water quality limited segments by the MDEQ 2002 303(d) list or listed as segments in need of total maximum daily load (TMDL) development by the MDEQ (MDEQ, www.deq.state.mt.us/wqinfo/303_d/303d_information.asp, March 24, 2004). Maynard and Slushman Creeks are tributaries to Upper Bridger Creek, which has beneficial water uses such as irrigation purposes and downstream fisheries. Upper Bridger Creek is tributary to the East Fork of the Gallatin River, which is also not listed as a water quality limited segment (MDEQ, www.deq.state.mt.us/wqinfo/303_d/303d_information.asp, March 24, 2004). The water quality of the East Fork of the Gallatin River has not been assessed for beneficial uses such as agriculture, aquatic life support, cold water fisheries (trout), drinking water supply, industrial uses, or primary recreational contact. The East Fork of the Gallatin River, including Bridger Creek and tributaries must be re-assessed by MDEQ by 2007 for water quality impairment. The actual assessment will likely occur in 2005 and at that time it is possible that the East Fork of the Gallatin River may be added to the 303(d) list of impaired waterways (Story, 2003). The SF Brackett Creek is a tributary to the Shields River, which is on the 303(d) list of impaired waterways (www.deq.state.mt.us/wqinfo/303_d/303d_information.asp on March 24, 2004). The Shields River is listed for partial impacts to aquatic life and cold water

fisheries due to erosion, dewatering problems, flow alterations, and riparian degradation from mainly agricultural sources.

Sediment guidelines have been developed by the GNF based on fisheries being the primary beneficial use of forest streams. The R1R4 model (Cline, 1981) was used to estimate existing and potential sediment yields of the watersheds within the Watershed Model Analysis Area. This analysis is discussed in Section 3.2.4 – Sediment Yield. Estimated baseline (natural) sediment yield to waterbodies and existing sediment yields for each watershed are shown in Table 3.2-3.

SF Brackett Creek is classified as a Class A stream in the GNF due to the presence of Yellowstone Cutthroat Trout in the lower reaches of its drainage. According to GNF guidelines, to protect Class A streams, sediment increases should not exceed 30 percent above natural rates. The estimated annual sediment yields in SF Brackett Creek under existing conditions is 89.8 tons per year (see Table 3.2-3), which is 8.2 percent above natural conditions (Story, 2003). Therefore, the existing water quality of SF Brackett Creek is within GNF standards for Class A streams.

Maynard, Upper Bridger, and Slushman Creeks are considered Class D streams in the GNF since there is no documented presence of fish in these drainages. The main emphasis in Class D streams is to maintain geomorphic integrity without excessive downstream sediment discharge. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates (Story, 2003). The sediment yield to Upper Bridger Creek and Slushman Creek have been increased above natural rates (33 – 27 percent) due to road building and timber harvest in the lower part of each drainage on NFS land and other privately owned land. Maynard Creek, which flows entirely through existing Bridger Bowl base area, has had a substantial increase (77 percent) in sediment yields above natural rates due to historic building, road, and ski trail construction. The sediment yield in Maynard Creek is expected to be decrease over time as historic base area disturbances continue to recover hydrologically. The estimated sediment yields to these three streams for existing conditions do not exceed the GNF standard of "100 percent above natural conditions" for Class D streams (Story, 2003).

The Forest Service approved the use of herbicide at Bridger Bowl to control areas infested with noxious weeds. Herbicide is not used for ski area wide vegetation management and the manufacturers instructions are followed to ensure adequate usage and distances from waterbodies. In addition, Bridger Bowl currently uses a chemical called Snowmax™, which is mixed with water to improve snowmaking operations. Snowmax™ raises the freezing temperature of the water and works as a "ice-nucleating seed" that ice crystals can attach to. Snowmax™ is EPA approved and there have been many studies indicating that Snowmax™ has minimal effects to humans, animals, or the water quality of groundwater or streams (Colorado State, 1998). The potential of oil and grease pollution from stormwater runoff from the parking lots is minimized through appropriate erosion control BMPs. No water quality data for oil and grease presence in streams within the Study Area was available for this analysis.

The Deer Park Chalet has its own re-circulating sand filter treatment system, which was built in 1996 to accommodate approximately half of anticipated visitation at the time. In August 2001, Bridger Bowl received permission from the MDEQ to construct a re-circulating sand filter

wastewater treatment system with a capacity to serve approximately 5,400 skiers per day. Both wastewater treatment systems were given a "nondegradation determination" by the MDEQ by showing that they met Montana's nondegradation policy and rules (75-5-303, MCA and ARM 16.20.701). The wastewater treatment systems are septic systems that re-circulate effluent through sand filters, and then discharge effluent to the ground via a pressure closed subsurface drainfield. This wastewater treatment system could be expanded in the future to meet a larger skier capacity.

The water use as measured by Bridger Bowl from 1983 to 1999 averages approximately 3.5 gallons per skier visit. In 2002, waterless urinals were installed in the Jim Bridger Lodge as a water conservation measure. As a result, water use, as measured at the base area treatment system for the 2002/03 season, water use has been reduced to three gallons per skier visit. Recent water sampling (conducted in May 2002) resulted in measured Nitrate/Nitrite levels of 0.71 mg/L (Montana Microbiological Services, June 2002). The Federal water quality standards for nitrate and nitrite are 10 and 1 mg/L, respectively (EPA, 1986). This system also has a 3,900-gallon storage reservoir and two pressure tanks to service the facility. This well was also tested for nitrate and nitrite in 2002; analysis showed in measured Nitrate/Nitrite levels of 0.71 mg/L (Montana Microbiological Services, June 2002).

3.4 VEGETATION

A vegetation analysis was conducted within the 2,574 acre Bridger Bowl Study Area. As described in the introduction to this chapter, the Study Area including the existing SUP area, the proposed SUP expansion areas, and private lands within and adjacent to the ski area. A number of distinct plant community types are present in the Study Area ranging in elevation from 6,200 feet to 8,500 feet. The current distribution of plant community types within the Study Area reflects the elevation and moisture gradient variance within the Bridger Mountains, as well as the cumulative effect of land-use activities and natural disturbances. There are seven plant community types within the Study Area including spruce/sub alpine fir, Douglas-fir, lodgepole pine, mixed conifer, quaking aspen, shrubs, and herbaceous (see Table 3.4-1). Non-vegetated land cover types comprise the remaining portions of the Study Area and they include, open water, rock and talus, and developed cover. Developed cover is defined for this analysis as all impervious surfaces (e.g., roads, parking lots, and buildings). Plant community cover types were delineated based on aerial photograph interpretation, GIS analysis, land surveys, and site visits. The total approximate area of each cover type within the Study Area is shown in Table 3.4-1.

Table 3.4-1
Existing Plant Community within the Bridger Bowl Study Area

Plant Community Type	Area (acres)
Old growth	
Douglas Fir	22.0
Lodgepole pine	50.3
Spruce/sub alpine Fir	110.6
Total Old growth	**182.9**
Mature	
Douglas Fir	290.4
Lodgepole pine	27.7
Spruce/sub alpine Fir	116.7
Mixed conifer	168.2
Total Mature	**603.0**
Immature	
Douglas Fir	23.3
Lodgepole pine	77.7
Spruce/sub alpine Fir	39.1
Mixed conifer	29.2
Quaking Aspen	15.3
Total Immature	**184.6**
Total Forest Cover	**970.5**
Non-forest cover	
Shrub	20.8
Herbaceous	1,072.5
Rock and Talus	449.4
Total Non-forest	**1,542.7**
Total Vegetation Cover	**2,513.2**[a]

[a]Total vegetation cover does not equal the Study Area size of 2,574 because there are approximately 63.6 acres of open water and developed land that are not vegetated in this area.

Figure 3-3: Existing Vegetation Communities

3.4.1 PLANT COMMUNITY TYPES

The spruce (*Picea Spp.*) and sub alpine fir (*Abies lasiocarpa*) plant community type is a moist, sheltered upland community (USDA, GTR-INT-34, 1977), most common on north and northeast slopes between 6,200 and 8,500 feet elevation within the Study Area. Three distinct age classes of spruce/sub alpine fir vegetation cover types have been identified; old growth, mature, and immature. Engelmann Spruce, lodgepole pine (*Pinus contorta*), and limber pine (*Pinus flexis*) occur as a codominant component with spruce/sub alpine fir in the closed canopy overstory. The understory is a mix of shrubs and perennial herbs composed of grouse whortleberry (*Vaccinium scoparium*), blue huckleberry *(Vaccinium globulare)*, Western meadowrue (*Thalictrum occidentale*), elk sedge (*Carex geyeri*), and scattered virgin's bower *(Clematis pseudoalpina*). Typically found on steep slopes, these shrub and herbaceous vegetation communities vary within the three spruce/sub alpine fir age classes.

The Douglas fir (*Pseudotsuga menziesii*) plant community type is found within the current permit area on southeast and eastern aspects at mid-low elevations. On the eastern aspect slopes, the Douglas fir plant community type was limited to a small area that is moisture limited and dominated by grass in the understory. As with the spruce/sub alpine fir plant community type, three age classes of Douglas fir were identified; old growth, mature, and immature. Scattered lodgepole, limber pine, and spruce/sub alpine fir were found within the canopy and subcanopy of this plant community. The shrub community composition is similar to the spruce/sub alpine fir shrub community but included snowberry (*Symphoricarpos albus*) and pinegrass (*Calamagrostis rubescens*). The herbaceous vegetation is generally sparse under the closed canopy stands dominated by Douglas fir.

The lodgepole pine (*Pinus contorta*) plant community type is less common throughout the Study Area. Three distinct age classes of lodgepole pine vegetation cover types have been identified; oldgrowth, mature, and immature. These pine dominated plant communities contain scattered spruce/sub alpine fir, englemann spruce, and Douglas fir. The understory is a mix of shrubs and perennial herbs composed of grouse whortleberry, blue huckleberry, Western meadowrue, and elk sedge.

The mixed conifer plant community type is scattered throughout the Study Area at varying elevations and is made up of mature and immature stands. These forest communities are composed of lodgepole pine, Douglas fir and spruce/sub alpine fir. The understory is primarily mixed shrubs of snowberry, grouse whortleberry, and a thin herbaceous layer of pinegrass.

The quaking aspen (*Populus tremuloides*) plant community type occupies lower elevations and occurs along mountain streams. This mature plant community type occurs primarily at the base of the Bridger Mountains near deep and moist soils. The subcanopy and shrub layer is mixed with western serviceberry (*Amelenchier alnifolia*), mountain snowberry (*Symphoriocarpos oreophilus*) and a number of *Ribes* species are associated with the quaking aspen plant community type.

The shrub plant community type occurs in isolated patches near seeps and moist soils. These plant communities are dominated by mountain alder (*Alnus incana*), white spirea (*Spiraca berulifolia*), snowberry, and *Ribes* species.

The herbaceous plant community type occurs at the mid-elevation portions of the Study Area where there is no evidence of trees at any life stage. The herbaceous areas are dominated by forbs including a mix of Western coneflower (*Rudbekia occidentalis*), valerian (*Valeriana dioica*), sticky geranium (*Geranium viscosissimum*), larkspur (*Delphinium spp*.), and arrowleaf balsamroot (*Balsamhoriza sagittata*). In moist portions of these meadows (often adjacent to streams), false hellebores (*Veratrum* spp.) often dominate.

The rock and talus cover type is characterized by unstable soils and rock with krumholtz (stunted) spruce/sub alpine fir, scattered white bark pine, and limber pine. Engelmann spruce is less common, but it is present in the scattered clumps of krumholtz trees. The shrub and herbaceous component is sparse with low growing common juniper (*Juniperus communis*), forbs, and grasses. This habitat type is the result of harsh climactic conditions, rock slides, and a very short growing season.

The 1.6 acres open water cover type is characterized as water impoundments, reservoirs, or natural lakes. Since this cover type is not a vegetation community, it is not included in Table 3.4-1.

The 62.0 acres developed cover type includes all paved, graveled, and dirt roads, including parking lots, and structures. Since this cover type is not a vegetation community, it is not included in Table 3.4-1.

3.4.2 THREATENED AND ENDANGERED PLANT SPECIES

One federally listed species, Ute Ladies' Tresses (*Spiranthes diluvialis*), and one proposed for listing species, Oregon Checker-mallow (*Sidalsea oregana*), are known or suspected to occur in the Bridger Mountains, Gallatin County, and on the GNF. The two species are listed by the USDI-Fish and Wildlife Service (USFWS) and the Montana Natural Heritage Program (NHP). The following table and discussion addresses the federally listed species including their status, habitat requirements, and possible occurrence in the Bridger Bowl Study Area.

Table 3.4-2
USFWS Threatened and Endangered Plant Species for Gallatin County

Species	Elevation (ft)	Habitat	Status
Ute Ladies' Tresses (*Spiranthes diluvialis*)	4,050-5,080	wetlands/open valleys	Threatened
Oregon Checker-mallow (*Sidalsea oregana*)	3,026-6,840	valley grasslands	Proposed Listing

Source: USFWS, Montana NHP

Ute Ladies' Tresses (*Spiranthes diluvialis*)

Ute Ladies' Tresses is a perennial orchid usually with one stem that is 8-20 inches tall and arising from tuberously thickened roots. Its narrow leaves are 0.5 inch wide, can reach 11 inches long, are longest at their base, and persist during flowering. The inflorescence consists of few to many white or ivory flowers clustered in a spike of 3-rank spirals at the top of the stem. The

sepals and petals are ascending or perpendicular to the stem. Ute Ladies' Tresses flowers in August-early September.

Oregon Checker-mallow (*Sidalsea oregana*)

Oregon Checker-mallow is an herbaceous perennial with erect stems that are one to six inches tall and arise from a branched rootcrown that surmounts a taproot. The basal leaves have long petioles and round blades that are deeply palmately divided into five to nine nearly linear lobes. The alternate stem leaves become smaller with few lobes upward. The lower stems and leaves are sparsely covered with star-shaped hairs. Short-stalked flowers are borne in a terminal spike. Each pink flower has a 5-lobed, hairy calyx that is four to nine mm long and five separate, oblong, shallowly bilobed petals that are 15-20 mm long. The fruit, which is two to three mm long, is a flattened-globose capsule with many sections, giving it the appearance of a peeled orange. Oregon Checker-mallow flowers in the end of June-mid-August and fruits in late August.

On August 30, 1997 a sensitive plant survey was conducted in the Bridger Bowl Study Area (McCarthy, 1997). Although suitable habitat for Oregon Checker-mallow was present, no federally listed or proposed for listing plant species were observed or recorded in the survey report. As described in the mitigation table, pre-project surveys will be conducted for these species prior to any project implementation.

3.4.3 SENSITIVE PLANT SPECIES

Currently twenty sensitive plant species are reported, or suspected to occur in the Bridger Mountains, Gallatin County, or on the GNF. These species habitat ranges from wet to dry and from low elevation to above tree line. The following table and discussion addresses the seventeen sensitive plant species which were listed prior to the 1997 sensitive plant survey, and the three sensitive plant species listed thereafter. All species, their habitat, and their elevation occurrence are listed in Table 3.4-3.

Table 3.4-3
Sensitive Plant Species with Potential for Occurrence in the Bridger Mountains

Species	Surveyed	Elevation (ft)	Habitat
Musk-root (Adoxa moschatellina)	Yes	4,000-6,000	cool moist/rock slides
Short-styled columbine (Aquilegia brevistyla)	Yes	5,000-6,200	open woods/stream banks
Large-leafed Balsamroot (Balsamorhiza macrophylla)	Yes	7,400-7,920	sagebrush/grassland
Pale Sedge (Carex livida)	Yes	2,910-6,030	wet organic soils/fens
Slender Indian Paintbrush (Castilleja gracillima)	Yes	5,160-7,000	wet meadows
Small Yellow Lady's-slipper (Cypripedium parviflorum)	Yes	2,520-6,200	damp mossy woods/fens
*English sundew (Drosera anglica)	No	3,100-9,000	wet organic soils/fens
*Beaked spikerush (Eleocharis rostellata)	No	2,700-6,100	alkaline wet soils/fens
Giant helleborine (Epipactis gigantea)	Yes	2,900-6,200	Stream banks/fens/seeps
*Slender cottongrass (Eriophorum gracile)	No	3,080-7,600	wet organic soils/fens
Hiker's gentian (Gentianopsis simplex)	Yes	4,460-8,400	fens/meadows/seeps
Northern rattlesnake plantain (Goodyera repens)	Yes	4,400-6,800	north facing/mossy slope
Discoid goldenweed (Haplopappus macrocarpa, macrocarpa)	Yes	6,840-8,900	rock slides/krummholz
Austin's knotweed (Polygonum Douglasii var. austiniae)	Yes	4,320-8,520	open gravelly shale
Jove's Buttercup (Ranunculus jovis)	Yes	6,700-9,500	sagebrush/grassland
Barratt's willow (Salix barrattiana)	Yes	6,240-10,000	cold moist soil
Wolf's willow (*Salix wolfii* var. *wolfii*)	Yes	7,500-10,000	cold moist soil
Shoshonea (*Shoshonea pulvinata*)	No	6,440-7,800	limestone outcrops
Small-flowered pennycress (*Thlaspi parviflorum*)	No	6,500-1,000	grasslands/alpine turf
Alpine meadowrue (*Thalictrum alpinum*)	Yes	4,855-8,280	moist alkaline meadows
California false-hellebore (*Veratrum californicum*)	Yes	6,160-7,360	wet meadows/stream banks

*Indicates 1999 listing
Source: Forest Service, USFWS, & Montana NHP

On August 30, 1997 a sensitive plant survey was conducted in the Bridger Bowl Study Area. Although suitable habitat for many of the species was present, none of the sensitive plant species were observed within the Bridger Bowl Study Area during the survey (McCarthy, 1997). Two species, Shoshonea and Small-flowered pennycress, were not surveyed for during the 1997 survey.

In 1999 three new sensitive plant species were listed in Bridger Mountain Range, Gallatin County, or the GNF area. These species are denoted by an asterisk (*) in the above table. All three species are unique to wet organic soils and fens occurring at elevations found within the Study Area. However, no bogs or fens where identified during the wetland survey, so these species are not likely to be present in the Study Area.

The whitebark pine (*Pinus albiculis*) and Timothy (*Phleum pretense)* have not been identified as a Species of Concern or federally listed species by the USFWS, Forest Service, or the MNHP. Therefore, they were not included in the Sensitive Plant Species analysis.

3.4.4 FRAGMENTATION AND OLD GROWTH

The Bridger Mountains are an isolated range separated from contiguous mountain habitat by surrounding agricultural and rural land. The composition and distribution of vegetation communities in the Bridger Mountains has been influenced over time by human activities such as timber harvest, domestic livestock grazing, fire suppression, developed and dispersed recreation, development and use of transportation systems, and residential development. As part of the Forest planning process, the Forest Service is conducting systematic landscape-scale analyses by geographic area; typically at the scale of a mountain range. Such an analysis at the landscape scale has yet to be completed for the Bridger Mountain Range.

An analysis of the east side of the Bridger Range and many surrounding reference compartments and mountain ranges was performed to analyze potential changes in fragmentation and old growth as a result of the Proposed Action (Novak, 2003). The analysis area for the fragmentation study included Timber Compartments 504 and 515, which encompasses approximately 18,294 acres of land on the GNF. The study used the FRAGSTATS model, which is a spatial pattern analysis program for quantifying landscape structure (McGarigal and Marks, 1995), and assumed that 80 acres of contiguous mature forest is a minimum required for many interior forest animal species (Harger, 1978) and fragmented forest is the result of human and natural disturbances. Based on this study, the following conclusions were reached based on current conditions: 1) the Fragmentation Analysis Area (FAA) of compartment 504 has the lowest percent of interior forest habitat of any of the four areas analyzed; 2) the largest forest patch identified in the FAA was smaller than all of the other large patches identified in the four reference areas; and 3) the FAA has an intermediate number of interior forest patches (Novak, 2003). Based on the above information, it is reasonable to conclude that presently the FAA is one of the most fragmented forested areas on the Gallatin National Forest (GNF) (Novak, 2003). This is due to past activities from timber harvest, road building, and residential development throughout the compartments and conditions common to high elevation ridge soils.

Observations within the smaller scale, 2,574 acre Bridger Bowl Study Area follow similar trends to those observed in the FAA. Forest clearing for ski trails and other private developments such as residential homes and private timber harvest has fragmented native forest communities and possibly influenced changes in biodiversity. While much of the forest communities in the upper elevations (above 7,500 feet) of the Study Area are naturally sparse and patchy due to the harsh environment, forest clearing in the lower elevation portions of the Study Area has resulted in the permanent modification of forested habitat. Approximately 426.4 acres of the Study Area has been modified for ski runs and associated roads, buildings, and parking lots. A large proportion of the existing SUP area below 7,500 feet is in what is considered a fragmented state due to the forest clearing and development by Bridger Bowl and other private parties. The lower elevation portions of the north and south expansion areas are currently undisturbed and are not fragmented, while the portions of the expansion areas above 7,500 feet are naturally fragmented.

According to the GNF Plan, the Forest will strive to maintain at least 10 percent of the forest land within a timber compartment as old growth forest. The Bridger Bowl Study Area includes small portions of timber compartments 504 and 515 (see Figure 3-4). Therefore, timber compartments 504 and 515 were studied using GIS software to determine the current extent of old growth forest within each compartment. The forest compartments analyzed total approximately 18,336 acres and extend well outside the 2,574 acre Study Area. Representative compartments in the Gallatin Range and Crazy Mountain Range were used as a reference and control for fragmentation comparison. Currently, the east side of the Bridger Range is one of the most fragmented forest areas in the GNF (Novak, 2003). As displayed in Table 3.4-4, there is approximately 413 acres of old growth forest within the 5,897 acres of forest land within in compartment 504. The percent of old growth forest as compared to the forest land in compartment 504 is approximately 7.0 percent, which is below the Forest Plan Standard of 10 percent (USDA, 1987). Compartment 515 contains approximately 1,051 acres of old growth forest, which is approximately 11.6 percent of the forested area of the compartment and therefore, compartment 515 is above the standard of 10 percent.

Table 3.4-4
Existing Old Growth Forest in Timber Compartments 504 and 515

Parameter	Acres	Percent
Old Growth Forest in Compartment 504	413	7.00
Old Growth Forest in Compartment 515	1,051	11.60

Source: Forest Service

Figure 3-4: Existing Forest Age Classes

3.5 WILDLIFE

3.5.1 INTRODUCTION

The Forest Plan has two specific goals that are directly related to wildlife:

- Provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big game animals.

- Provide sufficient habitat for recovered populations of threatened and endangered species (i.e., grizzly bear, bald eagle, Canada lynx, and gray wolf).

Other GNF wildlife objectives include:

Wildlife

Management of wildlife habitat would emphasize forage and cover needs on big game winter range. Vegetative manipulation projects may include prescribed burns or timber harvest. Non-game and small game needs would be enhanced by providing for vegetative diversity and protecting special habitat components. The Forest would apply grizzly bear guidelines developed from the Interagency Grizzly Bear Guidelines of 1986 and the "Grizzly Bear Recovery Plan" of 1982, which are included in the current Forest Plan. Management of the Forest would provide for the recovery of the bald eagle and peregrine falcon.

Sensitive and Indicator Species

Habitat that is essential for species identified in the Sensitive Species list developed for the northern region would be managed to maintain these species. These species include trumpeter swan, flammulated owl, wolverine, western big-eared bat, harlequin duck, northern goshawk, peregrine falcon, boreal toad, northern leopard frog, and black-backed woodpecker. Indicator species, which have been identified as species groups, whose habitat is most likely to be affected by Forest management activities, would be monitored to determine population change. These species include grizzly bear, bald eagle, elk, pine marten, and northern goshawk.

Biodiversity

Biodiversity (or biological diversity) is a term defined by the Office of Technology and Assessment as "the variety and variability among living organisms and the ecological complexes in which they occur" (Hann, 1990). Multiple laws mandate agency attention to the concept of biodiversity. The National Forest Management Act (NFMA 1976) 36 CFR 219.26 states that "Forest planning shall provide for diversity of plant and animal communities… consistent with the overall multiple-use objectives of the planning area." The Endangered Species Act (ESA 1973) requires the conservation of threatened and endangered species so as to maintain biodiversity. The National Environmental Policy Act (NEPA 1976) Title I, Sec. 101 (b) (4) relates the need to "maintain, wherever possible, an environment which supports diversity". Biodiversity is a complex concept that covers a broad spectrum of spatial and temporal scales. At the fine end of the spatial scale, biodiversity can be assessed at the molecular and genetic

level while at the other end of the scale biodiversity may be considered at the landscape or even global level.

Biodiversity may be influenced over time by natural ecological processes as well as human land use activities. Natural ecological processes, as well as human land manipulation, can have varying consequences to local wildlife populations. Some habitat changes are temporary, such as those produced by fire, wind, insects, and disease, while others are permanent, such as some changes caused by human development. Temporary habitat changes may impact biodiversity in the affected area, but such effects are typically short-lived and do not likely influence biodiversity at the larger scale. Cumulative impacts of temporary habitat changes are more likely to have significant impacts on biodiversity at the landscape level. Permanent habitat alterations are more likely to impact faunal diversity, both at the local scale with individual events, as well as cumulatively over space and time.

The Bridger Mountains are an isolated range separated from contiguous mountain habitat by surrounding agricultural and rural land. Vegetative structure and faunal occupation of the Bridger Mountains has been influenced over time by human activities such as timber harvest, domestic livestock grazing, fire suppression, developed and dispersed recreation, development and use of transportation systems, and residential development. As part of the Forest planning process, the Forest Service is conducting systematic landscape-scale analyses by geographic area; typically a mountain range. Such an analysis has yet to be completed for the Bridger Mountain Range.

In spite of relatively high levels of human development in the Bridger Range, suitable habitat is still present for the entire suite of native fauna expected to occur in this range prior to European settlement. However, because of the relatively small size, and high level of human development in the Bridgers, this mountain range may no longer provide the large, undisturbed blocks of habitat required by some species. Notably absent from the Bridgers today are species such as the grizzly bear, bighorn sheep, gray wolf, and possibly lynx. Some of the species that no longer occur in the Bridgers were eliminated from large portions of their historic range and are now protected under the ESA. Recovery efforts have increased population levels of some of these species, and they are currently expanding their range so that we might again see species such as the gray wolf and peregrine falcon occupying suitable habitat in the Bridger Mountains. Although some of the large, charismatic species listed above no longer occur in the Bridgers, many large, wide-ranging animals still make regular use of the habitat available in this area. Such species include black bear, mountain lion, wolverine, coyote, bobcat, moose, elk, mule deer, and white-tailed deer.

The Study Area contains a very similar suite of faunal species as that present throughout the Bridger Range. Seasonal weather patterns affect the distribution of wildlife across the landscape. For example, mule deer are present in the existing SUP area during the spring, summer, and fall months, but move onto winter range on the west side of the mountains during the ski area operating season. Likewise, black bears are not found in the SUP area during the ski season, as they are winter hibernators. Some animals however, are likely displaced from the SUP area, or their use patterns are altered, by human activity; both during the ski season as well as during the spring, summer and fall months when dispersed recreation and ski area maintenance activities occur. For example, moose, which are year-round residents in the Bridgers, are rarely seen in the

SUP area during the ski day, but their tracks and scat reveal that they come into the Study Area during off-hours.

Habitat alterations have also likely influenced changes in biodiversity within the SUP area. Clearing and thinning trees to create ski runs has resulted in the permanent modification of forested habitat. The existing SUP area is approximately 1,122 acres of NFS lands. Of this area, approximately 444.2 acres have been modified for ski runs, roads, buildings, and trails. This type of habitat modification may preclude use of the area by species that might otherwise occupy the habitat if it were in a naturally forested condition. Removal of hazardous snags, down logs and lower tree limbs to provide for skier safety also results in habitat modification that could reduce the carrying capacity within the SUP area to support species such as cavity nesters and small mammals that require these habitat components. Snow compaction modifies winter habitat for several species. For example, groomed and heavily skied runs preclude access to subnivean habitat for species such as grouse, pine marten, weasels, mice and voles. Snow compaction can also influence biodiversity by changing the competitive relationship between species. For instance, snow compaction is thought to minimize the competitive advantage of deep snow adapted species such as lynx and wolverine, in favor of more generalist carnivores like coyote, mountain lion, and bobcat.

Methodology

A list of Threatened, Endangered, and Sensitive wildlife species likely to be present in the Study Area was obtained from the GNF biologist, the Bozeman Ranger District, Montana Department of Fish, Wildlife, and Parks (MDFWP), the USFWS, and the Montana NHP. Field surveys were conducted in August of 1996. Habitat type, vegetative cover, and key habitat features were mapped, and habitat of key species was documented.

The wildlife species included in this evaluation have been identified as warranting discussion for one of the following reasons: the species or its habitat is known or is likely to occur in the Study Area; the species or its habitat may be affected by the proposed expansion, the species or its habitat must be addressed as directed by law or policy, i.e., threatened, endangered, and sensitive species, or it is designated as a Management Indicator Species (MIS) by the Forest Service.

In accordance with Section 7(c) of the Endangered Species Act (ESA), a list of Threatened and Endangered species has been requested from the USFWS for the Study Area. Federally listed species that may be present in or near the Study Area include the threatened Canada lynx, threatened bald eagle, and the gray wolf, which has been reintroduced into the Yellowstone ecosystem as a nonessential experimental population. The grizzly bear is a threatened species, but the Study Area is well outside the grizzly bear recovery zone, and there have been no verified sightings in the Bridger Mountain Range for many years.

A determination of the effects from the 2002 Bridger Bowl Master Development Plan Update to grizzly bear, Canada lynx, bald eagle, and gray wolf is presented in the *Biological Assessment for Bridger Bowl Ski Area Master Development Plan* (BA). Since that time, the vegetation and habitat mapping in the Bridger Bowl Study Area has been updated for the EIS, and the scope of the Proposed Action has been reduced slightly as compared to the 2002 Master Plan. A

description of the recent changes to the Master Plan and the current scope of the Proposed Action are contained in Section 2.3.

The Forest Service has identified Management Indicator Species (MIS) in order to maintain adequate habitat to sustain viable populations of all native and desirable non-native fish and wildlife species on the GNF. The condition of these species can be used as a barometer to assess the impacts of management actions on a particular area. Specific management goals, objectives, and guidelines have been developed for each MIS. The Forest Plan lists five MIS that require monitoring as an evaluation of Forest Service actions on wildlife habitat. Of these species, grizzly bear and bald eagle are discussed under the section: Threatened, Endangered, and Proposed Wildlife Species. In addition, elk, goshawk (a R1 sensitive species), and pine marten will be discussed.

A complete list of species included in this analysis, their status, primary habitat association, and probability of occurring in the Study Area, is found in Table 3.5-1. Some species have more than one associated status, which is indicated in the Table.

Table 3.5-1
Species Potentially Occurring in the Study Area

Species Name	Status	Habitat Association	Probability of Occurrence
Threatened and Endangered Species			
Canada lynx *(Lynx canadensis)*	T	Typically associated with spruce, subalpine fir, and lodgepole pine forests (Koehler, 1989). Early successional habitat is necessary for foraging and mature forests are necessary for dens (Ruediger et al., 2000).	Not currently known to occur within the Study Area though suitable habitat exists within the northern and southern expansion areas.
Grizzly bear *(Ursus arctos horribilis)*	T, MIS	Vast areas of wilderness; a variety of habitats including meadows, wet areas, open slopes with huckleberries (USFWS, 1993)	Grizzly bear use of the Study Area is unlikely. There is no verified evidence of grizzly bear use in the Bridger Mountains in recent decades. Not expected to occur within the Study Area.
Bald eagle *(Haliaeetus leucocephalus)*	T, MIS	Almost always found near large bodies of water where primary prey items of fish and waterfowl can be found (Johnsgard, 1990).	Eagles are most commonly observed in the Study Area during their fall migration. The Study Area does not provide suitable nesting or foraging habitat.

Species Name	Status	Habitat Association	Probability of Occurrence
Species Proposed for Listing			
Gray wolf *(Canis lupus)*	Non-essential, experimental species treated as P	Key habitat includes big game winter range (Jones et al., 1983). Wilderness; isolation from human disturbance for denning (Paradiso, Nowak, 1982).	Gray wolf was re-introduced into Yellowstone NP (approximately 90 miles south of the Study Area) as a nonessential experimental population. There have been no verified wolf sightings in the Bridger Mtns (Fontaine, Pers. Comm., 1996).
Forest Service Sensitive Species			
Trumpeter swan *(Cygnus buccinator)*	FSS	Associated with large bodies of water such as major rivers and lakes.	No suitable habitat occurs within the Study Area
Harlequin duck *(Histrionicus histrionicus)*	FSS	Associated with large, clear swiftly flowing mountain streams (Bellrose, 1980).	No suitable habitat occurs within the Study Area
Peregrine falcon *(Falco peregrinus)*	FSS	Major habitat requirements include tall cliffs and a body of water where primary prey items of shorebirds and waterfowl can be found (Johnsgard, 1990).	Peregrine falcons are seen during fall migration along Bridger Ridge and in the Gallatin Valley during spring migration. There are no known resident breeding pairs in the Bridger Mountains.
Flammulated owl *(Otus flammeolus)*	FSS	Habitat ranges from mature ponderosa pine forest to mixed ponderosa pine/Douglas fir forest. Closely associated with extensive stands of old growth (Dobkins, 1994)	There has been one observation of a Flammulated owl on the west side of the Bridger Mountains (approximately 12 miles from the Study Area) (Jurist, Pers. Comm.). Potentially suitable habitat does not occur within the Study Area.
Black-backed woodpecker *(Picoides arcticus)*	FSS	Associated with coniferous forests, usually spruce and fir, and is especially tied to two to five year old burned areas (Dobkins 1994; Short, 1982).	No suitable habitat occurs within the Study Area.
Wolverine *(Gulo gulo)*	FSS	Montane forest types of Douglass fir, lodgepole pine, spruce, and subalpine fir (Copeland, 1996). High elevation rock habitat are used as denning habitat in winter.	Known to occur within the Study Area; no documentation of reproductive denning sites.
Northern goshawk *(Accipiter gentiles)*	FSS, MIS	Associated with dense mature forests with high canopy cover and multilayered canopy. Small, open areas are used for foraging (Johnsgard, 1990).	Potentially suitable habitat exists within the Study Area. May occur within the Study Area.

Species Name	Status	Habitat Association	Probability of Occurrence
Western big-eared bat *(Corynorhinus townsendii)*	FSS	Mesic habitats of coniferous or deciduous forests (Kunz and Martin, 1982). Hibernacula and maternity roosts located in caves, summer roosting in tree cavities and loose bark (Torquemada and Cherry, 1985). Foraging occurs primarily over wet meadows and other areas of water along forest edges.	Suitable foraging and summer roosting habitat present within the Study Area. May occur within the Study Area.
Northern Leopard frog *(Rana pipiens)*	FSS	The habitat of the adult frog is the narrow zone between water and grassland. Eggs and tadpoles require clear, clean, freshwater streams.	Suitable habitat occurs within the Study Area. Presence unlikely due to high elevation.
Boreal toad *(Bufo boreas boreas)*	FSS, C	Restricted to suitable breeding habitat in spruce-fir forests and alpine meadows. Breeding habitat includes lakes, marshes, ponds, and bogs with sunny exposures and quiet, shallow water.	Suitable habitat exists within the proposed Study Area. May occur within the Study Area.
Management Indicator Species			
Pine marten *(Martes americana)*	MIS	Associated with mesic forest types of subalpine fir, spruce, and lodgepole pine.	Known to occur within the Study Area.
Big Game Species			
Elk *(Cervus elaphus)*	BG, MIS	Combination of coniferous forest and open habitats; densely forested areas during calving and fall rut. Seclusion from human disturbance important for calving (Thomas, Toweill, 1982).	Known to occur within the Study Area during spring, summer, and fall. Migrate to the west side of the Bangtail Range and the west side of the Bridger Mountains during winter.
Mule deer *(Odocoileus hemionus)*	BG	High elevation, diverse, mesic habitats with high quality forage.	Known to occur within the Study Area during the spring, summer, and fall months.
White-tailed deer	BG	Associated with lower elevation riparian habitat, and coniferous forests.	Uncommon within the Study Area, but are known to occur along Bridger Creek.
Moose *(Alces alces)*	BG	Dense, subalpine fir and associated shrubby riparian areas.	Known to occur within the Study Area year-round.
Mountain goat *(Oreamnos americanus)*	BG	Closely associated with steep, rocky cliffs, pinnacles, ledges, and talus slopes.	Known to occur within the Study Area.
Black bear *(Ursus americanus)*	BG	Utilizes a wide variety of habitats including coniferous and deciduous forest, forest edges, meadows, wetlands, and subalpine parkland (Johnson and Cassidy, 1997).	Known to occur within the Study Area.

Species Name	Status	Habitat Association	Probability of Occurrence
Mountain lion *(Felis concolor)*	BG	Utilize a wide variety of habitats, disperse great distances, and large home ranges. Typically den in concealed, sheltered locations.	Known to occur within the Study Area
Blue grouse *(Dendragapus obscurus)*	BG	Found at lower elevations in semi-open habitats during summer but migrate to higher elevations in winter, feeding primarily on pine needles.	Known to occur within the Study Area.
Ruffed grouse *(Bonasa umbellus)*	BG	Closely associated with aspen stands, feeding almost exclusively on aspen buds during winter.	Known to occur within the Study Area.
Other Species of Interest			
Boreal owl *(Aegolius funereus)*	**	Habitat ranges from mature mixed deciduous and conifer forest to pure mature conifer stands (Hayward et al., 1987; Holt, 1987). Nesting habitat includes multi-layer canopy, a high density of large trees, and an open understory (Hayward, 1983).	Potentially suitable habitat occurs within the Study Area. May occur within the Study Area. Surveys conducted in the Pine/Slushman drainages in 1992 did not detect any owls.

T = Threatened, P = Proposed, FSS = Forest Service Sensitive, MIS = Management Indicator Species, C = Candidate Species for Federal Listing; ** recently removed from the r1 sensitive species list

3.5.2 THREATENED, ENDANGERED, AND PROPOSED WILDLIFE SPECIES

Threatened Species

Canada lynx (Lynx canadensis)

Lynx are typically associated with spruce, subalpine fir, and lodgepole pine forests in the mountains of the west (Koehler, 1989). They are well adapted to cold winters and deep snows of northern latitudes in western Montana above 4,000 feet elevation (Koehler et al., 1979). Unlike other carnivores whose diet may be quite varied, lynx prey almost exclusively on snowshoe hares (*Lepus americanus*) (Koehler, 1989). Forest conditions that favor snowshoe hare abundance will benefit lynx. Koehler (1989) found the highest snowshoe hare densities in 10-20 year old stands of lodgepole pine, which is where lynx concentrate their hunting efforts. In these stands, the lodgepole was < 1 inch DBH and stem density was approximately 15,840 per acre, providing forage, escape and thermal cover for the snowshoe hares. There are approximately 77.7 acres of immature lodgepole pine forest within the Study Area. Although lynx are specialized for hunting hares, alternate food sources including tree squirrels, voles, mice and grouse are also important (USDA, 1994b).

Lynx require a mosaic of forest conditions, including early successional habitat for hunting and mature forests for dens. Den sites are typified by lodgepole pine, spruce, and subalpine fir forests older than 200 years with northerly aspects and a high density of down-fall logs (Koehler, 1989). These mature stands for dens were as small as 1-5 acres in size with stringers of connected travel corridors that provide security cover for adults and kittens. There are

approximately 288.7 acres of mature and old growth forest available within the northern and southern expansion areas. The existing SUP area contains approximately 497.2 acres of mature and old growth forest interspersed with naturally open spaces as well as cleared ski trails. Due to the almost continuous ski area activity within the existing SUP area, due to nighttime trail grooming, early morning avalanche control, and daytime operations, the existing SUP area was not considered to contain suitable denning habitat for this project (USDA, 2003).

Physical adaptations, such as large paw size give the lynx a competitive advantage in deep snow conditions over other predators such as bobcats and coyotes. Winter recreation activities that result in snow packing, including grooming of ski trails, could reduce the competitive advantage lynx have over the more generalist predators (USDA, 1994b). There is no documented occurrence of lynx in the Bridger Mountains, Bridger Canyon, or in the Bangtails in databases maintained by MDFWP, Forest Service, or Montana NHP. There have been scattered accounts of lynx to the east of the Study Area in the Crazy Mountains (Fouse, Pers. Comm., 1996) and south in the Gallatin and Madison mountain ranges. The most recent harvest of a lynx in the vicinity of the Study Area occurred in 1994 approximately 15-20 miles south and across a major highway (I-90) from the Study Area (Fager, Pers Comm, 1996). Monitoring efforts have been implemented in the Bridger Range in an attempt to detect the presence of lynx (Wild Things Unlimited, 2003). Since suitable lynx habitat exists in the Bridgers, including the proposed northern and southern expansion areas, this analysis assumes that lynx may be present in the Study Area at some time.

South Bridger Lynx Analysis Unit

The Lynx Analysis Unit (LAU) affected by the Bridger Bowl proposal is the South Bridger LAU (SB LAU), which covers an area approximately 17,750 acres (roughly 28 mi^2) in size, and contains approximately 12,159 acres of lynx habitat. Studies of lynx habitat in the southern part of the range indicate that at least 10 mi^2 (approximately 6,400 acres) of lynx habitat should be present within a LAU to provide sufficient habitat for lynx survival and reproduction (Ruediger et al. 2000:7-4). The SB LAU is sufficiently large to cover the average home range size of a female lynx and contains adequate habitat to support lynx on a year-round basis.

LAU boundaries do not change with individual projects; they remain constant unless biological or ecological information becomes available to suggest better delineation. The SB LAU contains lynx habitat in the southeast portion of the Bridger Range, plus a small amount of lynx habitat in the adjacent Bangtail Mountains. Figure 3-5 displays the SB LAU boundary in relation to the Study Area.

Lynx habitat in an unsuitable condition includes those areas that have experienced some form of disturbance, either natural or man-caused, that severely reduced or eliminated forest cover. Unsuitable lynx habitat in the SB LAU has resulted primarily from past timber harvest for wood production and ski area development. Harvest methods that have produced unsuitable lynx habitat conditions include clearcuts, seed tree cuts, shelter wood and commercial thinning, where 90 percent or more of the forest cover has been removed.

There has been no landscape scale assessment completed for the Bridger Range, so federal actions must limit disturbance so that no more than 30 percent of lynx habitat in the LAU is in an

unsuitable condition. At a small ski area like Bridger Bowl, skiers make use of all the available terrain, often skiing through trees that might otherwise provide suitable lynx habitat. Outside of the ski area, lynx habitat was deemed unsuitable only when all or most of the forest cover had been removed. Considering all lynx habitat in the SB LAU (public and private ownership), there is currently about 2,447 acres, or 20 percent in unsuitable condition.

Figure 3-5: Lynx Analysis Unit Boundary in Relation to the SDEIS Study Area Boundary

Grizzly bear (Ursus arctos horribilis)

Grizzly Bears are a wide-ranging and opportunistic species that once occurred in and near riparian woodland and open prairie (Jones et al., 1983). Grizzly bears utilize a wide variety of habitats, depending on the season. During spring, following den emergence, grizzly bears are most likely to be present at lower elevations and follow green vegetation into higher elevations as the season's progress. Their present habitat is in mostly forested mountains with areas sparsely populated by humans.

Bridger Bowl is located approximately 35 air miles north of the grizzly bear recovery zone for the Greater Yellowstone Ecosystem (GYE). The Bridger Range contains security cover and other natural features necessary for wildlife travel corridors, and provides a logical north-south connection between ecosystems. However, grizzly bears have never been known to use the Bridgers as a connecting route between ecosystems. There is no verified evidence of grizzly bear use in the Bridger Mountains in recent decades.

Within the Bridger Bowl SUP area, human use varies seasonally and daily. Seasons of greatest recreation use are winter and summer and the majority of activity takes place during the day. Grizzly bears could potentially utilize the SUP area as part of a larger home range. They may also travel through the area between patches of potentially suitable habitat. However, habitat suitability for grizzly bears is greatly reduced by the existing level of human use within the SUP and surrounding area. Given the distance of the nearest grizzly bear recovery zone and this reduced habitat suitability, regular use of the SUP area by grizzly bear is considered unlikely. For these reasons, the USFS has determined not to analyze grizzly bear for the proposed project (USDA 2003).

Bald eagle (Haliaeetus leucocephalus)

Bald eagle breeding habitat requirements include open areas near a river or large lake with an adequate supply of moderate sized to large fish (Johnsgard, 1990). Nesting sites are usually in the fork of a large tree within one mile of water, which is somewhat protected from disturbance during the nesting period. Bald eagles will also eat rabbits, waterfowl, and carrion. Winter habitat is dependent upon weather conditions and a source of open water, as well as the availability of carrion.

Eagles are frequently observed in the winter and early spring along the east Gallatin River, located eleven miles west on the other side of the Bridger Mountains and along Flathead Creek eleven miles to the northeast (Brelsford). Bald eagles are most commonly observed in the Study Area during their fall migration. The Study Area does not provide suitable nesting or foraging habitat for bald eagles. The USFS has determined that the Proposed Action would have no effect on bald eagles (USDA 2003).

Proposed Species (Nonessential Experimental Population)

Gray wolf (Canis lupus)

In 1995, the gray wolf was reintroduced into Yellowstone National Park (approximately 90 miles south of the Study Area) as a nonessential experimental population. Under Section 10(j) of the

Endangered Species Act Amendments of 1982 (16 U.S.C. 1531-1540), the Secretary can designate reintroduced populations established outside the species current range but within its historical range as "experimental." Reintroduction of the experimental population must be separate geographically from non-experimental populations of the same species, and further the conservation of the species. An experimental population designated as "nonessential" is considered to be nonessential to the continued existence of the species. Nonessential experimental populations outside of the National Wildlife Refuge System or National Park System are treated as though they are a species proposed for listing.

Historically, gray wolves occupied a variety of habitat types, suggesting a broad array of habitat tolerances. Key components of suitable habitat for gray wolves include a year-round large ungulate and alternative prey base, space with minimal human encroachment and contact, and suitable denning and rendezvous sites (USFWS, 1987) Key habitat for the gray wolf includes big game winter range in which prey can be found in high densities (Jones et al., 1983). The Study Area is not a wintering area for most big game due to deep snow. There have been no gray wolf observations within the Bridger Mountains for several decades (Fontaine). The USFS has determined that the Proposed Action would have no effect on gray wolves (USDA 2003).

3.5.3 FOREST SERVICE SENSITIVE WILDLIFE SPECIES

The following species are listed as sensitive for the GNF:

Trumpeter swan (Cygnus buccinator)

The trumpeter swan is associated with large water bodies such as major rivers and lakes. There is no suitable habitat for trumpeter swans in the Study Area; as a result, this species is not analyzed in detail in this document.

Harlequin duck (Histrionicus histrionicus)

Harlequin ducks are associated with large, clear, swiftly flowing mountain streams (Bellrose, 1980). There is no suitable habitat for harlequin ducks in the Study Area; as a result, this species is not analyzed in detail in this document.

Peregrine falcon (Falco peregrinus)

In August of 1999, the peregrine falcon was de-listed by the USFWS and is no longer considered an endangered species (63 FR 45446-45463). Forest Service policy requires that species removed from the federal list of threatened and endangered species be included on the Forest Service sensitive species list for at least five years following de-listing.

The most common habitat characteristic for the peregrine falcon is the presence of tall cliffs (>50 meters) (Johnsgard, 1990). The other major habitat requirements include a source of water, which is almost always close to the nest site, and a localized and adequate source of small to medium sized birds. Prey species include shorebirds and waterfowl; however, doves, pigeons, grouse and passerines are also included.

Portions of the Bridger Mountain Range represent potential nesting habitat and is designated as such in the Forest Plan. Peregrine falcons are seen during fall migration along Bridger ridge and in the Gallatin Valley during spring migration (Flath, Pers. Comm., 1996). However, there are no known resident breeders in the Bridger Mountains. The USFWS and the MDFWP indicated no particular concerns for peregrine falcons relative to the project as proposed (Vandehey, Pers. Comm., 1996; Flath, Pers. Comm., 1996).

Flammulated owl (Otus flammeolus)

Flammulated owl habitat ranges from mature ponderosa pine forest to mixed ponderosa pine/Douglas fir forest and perhaps other montane coniferous forests, to a lesser extent, below 6,000 feet (Johnsgard, 1988). These owls nest in woodpecker excavated (sometime natural) cavities in pine, larch, fir, and occasionally aspen (Dobkins, 1994). They feed exclusively on invertebrates: insects, scorpions, spiders, and centipedes, only rarely taking small mammals or birds. Flammulated owls are closely associated with extensive stands of old growth (Dobkins, 1994). This species has disappeared from portions of its previous breeding range where such habitats have been highly fragmented. These owls avoid cutover areas and forests younger than 100 years old (Reynolds and Linkhart, 1987). Flammulated owls nest from mid-May through early August (USDA, 1994a).

There has been one observation of a flammulated owl on the west side of the Bridger Mountains, approximately 12 miles from the Study Area (Jurist). Field surveys in 1992 did not reveal potential flammulated owl habitat within the Study Area due to elevation and the highly fragmented Douglas-fir forest.

Black-backed woodpecker (Picoides arcticus)

The black-backed woodpecker is associated with coniferous forest, usually spruce and fir, and is especially tied to 2 to 5 year old burned areas (Dobkins 1994, Short 1982). A three-year breeding bird survey was conducted south of Bridger Bowl in the Pine/Slushman drainages, and no black-backed woodpeckers were observed (Moore, 1996). During field surveys conducted in August of 1996, numerous northern flickers, and a three-toed woodpecker were sighted, but no black-backed woodpeckers were detected. The Bostwick Canyon fire burned over 1,200 acres in 1991, just over the ridge from Bridger Bowl. No surveys for black-backed woodpeckers have been conducted in this burn; however, due to the age of the burn, it would not be expected to find black-backed woodpeckers using the area to any considerable degree. Large, recent fires in the vicinity of Bridger Bowl would provide suitable habitat for the black-backed woodpecker which could result in occasional visits to the Study Area.

Wolverine (Gulo gulo)

Little is known about specific habitat relationships for wolverines in western North America, but they are considered forest carnivores associated with relatively large tracts of undisturbed, often remote, coniferous forest habitat (Banci, 1994). Wolverines are wide-ranging animals. In Montana, average home range size varies from 100 km^2 (about 38 $miles^2$) for females with young, to 422 km^2 (about 163 $miles^2$) for adult males (Hornocker and Hash, 1981). Home range sizes are likely attributed to wide-ranging foraging bouts for both sexes, and the much larger

home range size of males is primarily a function of wandering in search of females during the summer breeding season. These large home range sizes coupled with low reproductive rates result in naturally low densities of wolverines within occupied habitat (Conard, 1999).

Although they are physiologically carnivores, wolverines have a wide variety of food items in their diet. The wolverine's foraging strategy is that of a habitat generalist. In the snow-free months, wolverines are opportunistic omnivores, taking advantage of the availability of food sources such as berries, small mammals, and insects (Banci, 1994).

In winter, wolverines rely heavily on scavenging carrion from large mammal carcasses (Banci, 1994). Elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) are present within the Study Area during the summer and fall, while moose (*Alces alces*) and mountain goat (*Oreamnos americanus*) are present year-round. Natural factors such as old age, disease, accidents, and predation by large carnivores, as well as mortality from hunting by humans, can produce ungulate carcasses for wolverines to utilize over winter. Wolverines might also feed on small mammals such as snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), marmot (*Marmota flaviventris*), pica (*Ochotona princeps*) and porcupine (*Erithizon dorsatum*). Since wolverines are primarily opportunistic habitat generalists when it comes to feeding, foraging habitat is not considered to be a limiting factor in the Bridger Mountain Range.

Pregnant females select natal dens, where kits are born in mid-winter. The majority of known natal den sites involve areas of deep snow accumulation, where snow tunnels are often part of the infrastructure (Pulliainen, 1968; Magoun, 1985; Roskaft, 1990; Copeland 1996). Den sites have also been reported in hollow logs, tree cavities, abandoned beaver lodges, under down logs, beneath the root wads of fallen trees, among boulders, on rock ledges, in old bear dens, and in log jam debris. Den sites located in forested habitat have typically been associated with spruce (*Picea* spp.) types (Banci, 1994). Natal dens may be abandoned for a number of reasons including snow melt, infestation by parasites, to avoid detection by predators, or to avoid disturbance from human intrusions (Copeland, 1996). Females disturbed at a den site will move their kits, often to less suitable, or even apparently unsuitable, sites (Pulliainen, 1968).

Suitable denning habitat is available on both sides of the Bridger Range, although the east side produces heavier snow loading, which may be preferable for tunneling associated with den sites. Talus slopes and cirque basins seem to provide key denning habitat components for wolverines (Copeland, 1996), and the upper slopes in the Bridger Mountains provide these habitat features. The Bradley Meadows area appears to provide higher quality denning habitat than the Slushman drainage, due to greater availability of mature to over-mature forest habitat, northerly aspects that provide snow conditions more conducive to tunneling, and vegetative and topographic conditions that provide greater protection from wind and freeze/thaw events. There are a total of 435 acres of existing denning habitat for wolverine (including talus, mature, and old growth subalpine fir and spruce forest) available within the Study Area. Currently, approximately 159 acres of this habitat is being indirectly affected by ski area operations, leaving approximately 276 acres of habitat in an undisturbed condition.

Wolverines are known to occur in the Bridger Mountain Range (Dixon, Pers. Comm., 1998) and have been detected (by tracks, sightings and photos) on a fairly consistent basis in the Study Area, most notably within the proposed SUP expansion areas (Wild Things Unlimited, 2003).

The Bridger Range is a relatively small, isolated mountain range. Considering the limited land base and the large home range size of wolverines, there may be only a few individual wolverines occupying habitat in the Bridger Range at any one time. However, wolverines in the Bridger Range are considered part of a larger population that includes most of southwest Montana (Giddings) and part of a genetically identifiable subpopulation that includes the Gallatin Mountain Range to the south (Cigelski, 2002). Wolverines have large home ranges, and it is believed that exchange does occur between populations in the Bridgers and the Big Belt Mountains to the north (Giddings)

Wolverine Analysis Area

For the purpose of a larger scale analysis, a Wolverine Analysis Area was delineated around the Study Area (see Figure 3-6). The Wolverine Analysis Area includes timber compartments 504 and 515 plus portions of compartment 503 (sub-compartments 04, 05, 06 and 07). This area was chosen because it is of sufficient size (34,418 acres) to contain the average home range of a female wolverine with young and contains all activities associated with the Proposed Action. The Wolverine Analysis Area spans both sides of the Bridger Range, with about half the acreage located on the east side where better denning habitat occurs, and the other half on the west side, where big game winter range could provide winter/denning season food sources in the form of ungulate carcasses. Based on GIS analysis, approximately 8 percent (2,588 acres) of the Wolverine Analysis Area contains suitable denning habitat for wolverines. The Study Area currently contains a total of approximately 435 acres of denning habitat which is 16.8% of the denning habitat available in the Wolverine Analysis Area. Within the Study Area, 159 acres are indirectly affected by ski area operations (grooming, skiing, avalanche control) leaving approximately 276 acres of suitable undisturbed denning habitat within the Study Area (see Table 3.5-2)

Figure 3-6: Wolverine Analysis Area in Relation to the SDEIS Study Area Boundary

Northern goshawk (Accipiter gentilis)

In addition to being designated as an MIS in the Forest Plan, the northern goshawk was added to the R1 Sensitive Species List in 1999. These birds are associated with dense mature forests with 80-88 percent canopy closure and a multilayered canopy (Johnsgard, 1990). Small, open areas are used for foraging. Goshawk feed on birds and mammals of moderate to large species, primarily grouse, snowshoe hare, cottontail rabbits and squirrels. Nesting sites are usually near a source of water on moderate slopes with a northerly aspect. Suitable nesting habitat can be found in Douglas fir, spruce-fir and lodgepole cover types, however, in the northern Rockies nests were located in Douglas fir forests and lodgepole pine stands more often than any other tree species (Montana Partners in Flight 2004). The Study Area contains approximately 801.2 acres of mature and old growth forest though not all of it is suitable nesting habitat due to the small size of some forest patches (see Figure 3-4) and variable canopy cover. The northern expansion area contains approximately 193.5 acres of contiguous mature and old growth spruce-fir and lodgepole pine forest and the southern expansion area contains approximately 95.2 acres of mature and old growth mixed conifer and Douglas fir forests.

Goshawks have a large home range and appear to be sensitive to fragmentation (Flath, Pers. Comm., 1996). They are known to nest in the Bridger and Bangtail Mountains. During an August 1996 survey, there were several unverified sightings of a large gray hawk. Red-tailed hawks and golden eagles were also observed. Field surveys were conducted after the nestling period, but it is unknown if goshawks are nesting in the Study Area. There is a goshawk nest site within approximately one mile of the Slushman drainage. This nest was known to be active between 1984 and 1988. The site was surveyed in 1992 and found to be inactive; it has not been actively monitored since 1992 (Dixon, Pers. Comm., 1998). Surveys conducted for goshawk in the summer of 2000 did not locate any individuals within the Study Area (USFS 2000); however, suitable habitat exists within the dense, mature forests in the Study Area and goshawks may occur in the area.

Western big-eared bat (Corynorhinus townsendi)

The western big-eared bat is typically found in mesic habitats of either coniferous or deciduous forests, and it may have some affinity to riparian areas (Kunz and Martin, 1982). In Montana, these bats generally inhabit caves for hibernacula and maternity roosts. This species is non-migratory and exhibits a high degree of site fidelity, returning year after year to the same maternity roost. The greatest threat to western big-eared bat populations is destruction or alterations of maternal and hibernacula roosting sites (Torquemada and Cherry, 1995). Feeding sites primarily occur over wet meadows and other areas of water along forest edges. Summer roosting sites can also be in tree cavities or behind loose bark. There are no known caves in the Study Area. Western big-eared bats could occur in the area; however, no surveys have been conducted in the Bridger Mountains. The Bradley Meadows area may provide foraging habitat for this species, as it consists of mesic coniferous forest with multiple seep areas and contains the upper reaches of SF Brackett Creek.

Northern leopard frog (*Rana pipiens*)

During ongoing analysis for the Proposed Action in March of 1999, the northern leopard frog was added to the Region 1 sensitive species list. The northern leopard frog is found across the prairie regions of the eastern two-thirds of Montana east of the Continental Divide. It was formerly present in intermountain valleys west of the Continental Divide, especially in the Flathead and lower Clark Fork river drainages, but in recent years has been documented at two western sites (Montana Fish, Wildlife and Parks website - A 03/24/04). This frog has been documented at elevations up to 6,700 feet. Habitats utilized by the northern leopard frog in Montana include low elevation and valley bottom ponds, spillway ponds, beaver ponds, stock reservoirs, lakes, creeks, pools in intermittent streams, warm water springs, potholes, and marshes. There is no evidence that this species has ever occupied high elevation wetlands in Montana sites (Montana Fish, Wildlife and Parks website - A 03/24/04).

The northern leopard frog is known to have a wide distribution and is documented within the Madison/Missouri River drainage. There is suitable habitat around the wetlands and seeps in the northern expansion area, and this species has recently been documented within the Study Area (B. Shepherd, Montana Fish, Wildlife, and Parks, Pers. Comm.). It is possible that the occasional individual may occur within the Study Area however this is expected to be unlikely due to the high elevation (above 6500 feet) of the available suitable habitat.

Boreal toad (Bufo boreas boreas)

During the ongoing analysis for the Proposed Action in March of 1999, the boreal toad was added to the Region 1 sensitive species list. In addition, the USFWS added the boreal toad to its list of candidate species in October of 1999 (64 FR 57533-57547). This species is known to exist within western Montana and Yellowstone National Park and specimens have been collected at elevations up to 9220 feet (Montana Fish, Wildlife, and Parks website - B 03/24/04).

Boreal toads are known to occupy a diverse range of habitat types, from wetlands and aquatic environments during breeding season to sagebrush meadows and forested areas later in the year. Occurrences at high elevation ponds and fens at or near treeline have been reported (Montana Fish, Wildlife and Parks website - B 03/24/04). It is known that the boreal toad migrates between aquatic breeding and terrestrial non-breeding habitats. Movement patterns are highly variable, with some individuals remaining in the same location for several days, then moving 50 meters or more on several consecutive nights (Montana Fish, Wildlife and Parks website - B 03/24/04). Despite the availability of suitable habitat there is no documented presence of boreal toads within the Study Area (State of Montana, NHP Data Base, 1999). Forest cover has been noted in aspen, Douglas-fir, lodgepole pine, Engelmann spruce, and subalpine fir forests (Montana Fish, Wildlife and Parks website - B 03/24/04).

Generally, boreal toads are active during the day and night; juveniles are mostly diurnal while adults tend to be nocturnal except in spring. The active period typically begins in April or May and extends to September or October, depending on elevation and latitude (Montana Fish, Wildlife and Parks website - B 03/24/04). In Montana, records extend from late April to early October (Montana Fish, Wildlife and Parks website - B 03/24/04).

Suit able habitat for boreal toad exists in the wetlands, springs, and seeps within the Study Area and although there have not been any documented sightings the boreal toad is likely to occur within the Study Area.

3.5.4 MANAGEMENT INDICATOR SPECIES

Pine marten (Martes americana)

Marten are a management indicator of old growth-dependent species in mesic forest types. They are associated with subalpine fir, spruce and lodgepole pine habitats. Martens are active predators of many small forest mammals including squirrels and snowshoe hares but primarily mice and voles (Jones et al., 1983). Marten have been observed using alpine areas and utilize forest openings if there is sufficient down wood to provide cover (Csuti et al 2001). The Study Area contains a total of 785.9 acres of suitable mature and old growth pine marten habitat, and the species is known to occur there (Dixon, Pers. Comm., 1998).

Migratory birds

Migratory birds are those species that regularly breed in continental North America and winter in a variety of other locations, typically in Central and South America and the Caribbean. Widespread declines in populations of many migrants have intensified interest in avian conservation and resulted in policy direction to evaluate the impact of proposed activities on the nesting habitats of these species.

Migratory birds occur in a wide variety of habitat types including immature, mature, and old-growth forests. However, in the relatively arid western United States, densities of migratory birds are highest in riparian areas, with coniferous forests being the second-most used habitat by this assemblage of species (Saab and Rich, 1997).

Migratory bird species are protected from harm under the Migratory Bird Treaty Act (16 USC 703-711). A January 2001 Executive Order requires federal agencies to ensure that environmental analyses of federal actions evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

3.5.5 GAME BIRDS AND MAMMALS

The species listed in Table 3.5-3 occur in the Study Area during at least a portion of the year. The following sections provide detailed information regarding the presence of individuals and their habitat within the Study Area.

Table 3.5-3
Big Game and Upland Game Birds Occurrence in the Study Area

Species	Comments
Mule deer	Observed during the spring, summer, and fall months
White-tailed deer	Observed during the Summer months
Elk	Observed during the spring, summer, and fall months
Moose	Observed year-round
Mountain goat	Observed along Bridger ridge only
Mountain lion	Distribution changes according to prey species distribution
Black bear	Observed during summer months
Blue and Ruffed grouse	Observed year-round

Source: Forest Service

Elk (Cervus elaphus)

Elk is a species that occurs throughout the Bozeman Ranger District. They are a heavily hunted big game species and demand extensive management attention. Elk are primarily found in coniferous habitats throughout the year. They generally use high elevation open parks during the summer months and densely forested areas during calving, the fall rut, and hunting season. Foraging habitat typically includes open canopy forest, herbaceous and shrub meadows where grasses, sedges, forbs, and browse can be easily accessed. In the winter, elk use lower elevation and semi-open southern exposure habitats (Maxwell). Elk cow/calf groups and a single bull were observed in the Study Area during an August 1996 survey. A spring was noted near tree line in the Study Area that was heavily used by ungulates. Elk calving occurs within the Study Area between approximately May 15 and July 15 (Pac, Pers. Comm. 1996).

The Bridger Bowl SUP area provides important spring, summer, and fall range for elk (Pac, Pers. Comm., 1996). The Study Area does not provide for winter elk habitat due to deep snow accumulation. Elk have been observed in the winter on the westside of the Bangtail Range and the west side of the Bridger Mountains. There is no known exchange between the Bridger and Bangtails elk herds. Although elk numbers in the Bangtails have been on an increasing trend, elk that summer in the Bangtails generally winter at lower elevations on the east side of the Bangtails. Some elk that summer in the Bridgers are known to winter in the Battle Ridge area, but do not move all the way into the Bangtails (Lemke).

Mule deer (Odocoileus hemionus)

Mule deer are a featured management species in the Bridger Mountain Range and extensive research has been conducted over the last 30 years (Pac et al., 1991). The Bridger Bowl SUP area provides important spring, summer, and fall range for mule deer (Pac, Pers. Comm., 1996). Mule deer occur in the Study Area during the late spring and summer months and are known to calve within the Study Area between May 15 and July 15 (Pac, Pers. Comm. 1996). The population moves out of the area during October and November, dispersing to two distinct

wintering areas: one at the southern end of the Bridger Mountains and the other on the eastside of the Bangtail Mountains along Brackett Creek. Distribution of mule deer during spring, summer, and autumn centers on areas characteristic of high precipitation zones. These areas are high in elevation, and have diverse-mesic habitats with high quality forage (Pac et al., 1991). The Study Area provides good habitat and mule deer use was prominent during field surveys.

White-tailed deer (Odocoileus virginians)

White-tailed deer were not observed and are not common in the Study Area, but they do occur along Bridger Creek. These deer tend to use lower elevation riparian habitat, but their populations are expanding and white-tailed deer are now seen along first order streams in predominately coniferous habitats (Pac, Pers. Comm., 1996).

Moose (Alces alces)

Moose occur in the Study Area as noted during August 1996 field surveys. They generally winter as individuals or in small social groups. Key habitat for moose is dense subalpine-fir and associated shrubby riparian areas, which is prevalent in the Study Area (Pac, Pers. Comm., 1996). Due to the lush nature of the vegetation in the area, the Study Area provides high quality year-round habitat for moose (Pac, Pers. Comm., 1996).

Mountain goat (Oreamnos americanus)

Mountain goats use the full extent of Bridger ridge. They were introduced between 1969 and 1970, and they maintain a population of around 60-100 goats. The high-elevation, rocky terrain associated with the ridge of the Bridger Range provides year-round habitat for mountain goats. A small segment of the population (10-20 animals) traditionally winters south of the ski area on the east face of Saddle Peak. The majority of the population winters north of the ski area in the vicinity of Flathead Pass (Pac, Pers. Comm., 1996). Goat tracks have occasionally been seen along the ridge within the existing ski area boundary and also within the proposed expansion areas to the north and south during the late ski season (March-April) (Dixon, Pers. Comm., 1998).

Black bear (Ursus americanus)

Black bear occur in the Study Area as noted during the August 1996 field survey. Black bear are generally associated with coniferous habitats, feeding on grasses and forbs in the summer months and berries and pine nuts in the fall. Bears hibernate on steep north facing slopes around 7,000 feet elevation from November to April (Pac, Pers. Comm., 1996).

Mountain lion (Felis concolor)

Mountain lion occur throughout the Bridger and Bangtail Mountain ranges. Their primary prey source is elk and mule deer. There has been a significant increase in mountain lion numbers, primarily due to the attitude shift in predator control that has occurred in recent years (Pac, Pers. Comm., 1996). Mountain lion seasonal distribution is somewhat determined by prey species. Lions are likely to be present in the Study Area during the summer months; tracks indicate at

least occasional use of the area just north of the proposed expansion into Bradley Meadows in winter (Dixon, Pers. Comm., 1998).

Blue and Ruffed grouse (Dendragapus obscurus) (Bonasa umbellus)

Both species were observed during the field surveys. Ruffed grouse are closely tied to aspen stands and rely heavily on aspen buds as a winter food source. There are approximately 15.3 acres of aspen available within the Study Area located entirely around the lower elevation base area. Blue grouse are found at lower elevations in semi-open habitats during the summer months, but migrate to higher elevations in the winter. Winter food primarily consists of conifer needles. Skiers often encounter blue grouse along the ridge and upper portions of the ski area (Bridger Bowl Avalanche Patrol, 2003).

3.5.6 OTHER SPECIAL INTEREST SPECIES

The Bridger Range acts as a funnel for migrating raptors, as westerly winds create updrafts along the north-south spine of the mountains. The birds utilize these "thermals" to soar, which helps them conserve energy during the trip south. This major migration route serves the largest known concentration of migrating golden eagles in the lower 48 states. As many as seventeen different raptor species have been observed along this route, directly above Bridger Bowl, including bald eagles, peregrine falcons, northern harriers, sharp-shinned hawks, Cooper's hawks, red-tailed hawks, and American kestrels (HawkWatch International, 1991-1997).

Boreal owl (Aegolius funereus)

The boreal owl was originally included in the 1999 DEIS as a Forest Service Sensitive species. Based on multi-year survey results, the boreal owl was removed from the Northern Region Sensitive Species list in March 1999.

Boreal owl habitat ranges from mature mixed deciduous and conifer forest to pure mature conifer stands (Hayward et al., 1987, Holt, 1987). Characteristic nesting and calling sites include multiple canopy layers, a high density of large trees (>15" dbh), and an open understory (Hayward, 1983). Palmer (1986) found that ground cover was mostly composed of *Vaccinium* and *Arnica* species, which also supports the owl's primary food source – red-backed voles (*Clethrionomys gapperi*). Boreal owls are cavity dependent, typically using old woodpecker holes, especially those of the northern flicker (*Colaptes auratus*). The typical overstory of boreal owl habitat is made up of mixed coniferous forest with a subalpine fir understory, and it generally contains 8 to 40 snags per acre, ranging from 12-20 inches in diameter.

On the GNF, boreal owls have been recorded in lodgepole pine, lodgepole/Douglas fir, and subalpine fir dominated stands, above 6,000 feet elevation. Surveys were conducted in the Pine/Slushman drainages in 1992, but no boreal owls were detected (Brelsford, 1992).

The forested component of the Bradley Meadows area appears to provide suitable boreal owl habitat, but no surveys have been conducted in this area, so their presence north of Bridger Bowl is unknown.

3.6 FISHERIES

The Forest Plan identifies one general goal statement associated with fish habitat management; "to maintain and enhance fish habitat to provide for an increased fish population." The Forest Plan has several objectives that address fisheries resources. Fish habitat should be managed by application of best management practices (BMPs), and management standards have been set to mitigate impacts occurring to the fishery resource from land use activities. Special considerations would be given to high quality water leaving the Forest to provide for the downstream "Blue Ribbon" trout streams; therefore, management of timber within riparian zones would be designed to maintain or improve fish habitat.

The Forest Plan further refines this direction by providing Implementation Guidelines, which identify specific management requirements for various stream classes. Streams are classified in the GNF as Class D streams if no fish species are present. The main emphasis in Class D streams is to maintain geomorphic integrity without excessive downstream sediment discharge. According to GNF guidelines, to protect Class D streams, sediment increases should not exceed 100 percent above natural rates (Story, 2003).

Streams are classified in the GNF as Class A streams if sensitive fish species are present. According to GNF guidelines, to protect Class A streams, sediment increases should not exceed 30 percent above natural rates (Story, 2003). Additional guidance for the management of streams with populations of westslope cutthroat trout and Yellowstone cutthroat trout is contained in the Land-use Strategy for Implementation of the 1999 Memorandum of Understanding and Conservation Agreement for westslope cutthroat trout in Montana (1999 MOU). The pertinent portion of the 1999 MOU is as follows:

> *The Memorandum of Understanding and Conservation Agreement (MOUCA) for westslope cutthroat trout in Montana includes as objectives 1) protecting all pure westslope cutthroat trout populations; and, 2) ensuring the long-term persistence of westslope cutthroat within their native range. The Land-Use Strategy for Implementation of the 1999 Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (Strategy) for the MOUCA, adopted by the Forest Service (FS) and Bureau of Land Management in 2002, further defines how the MOUCA will be implemented by federal land management agencies. For new activities, the Strategy stipulates that the FS will 1) provide watersheds supporting conservation populations of westslope cutthroat trout with the level of protection necessary to ensure their long-term persistence; 2) defer any new federal land management action if it cannot be modified to prevent unacceptable aquatic/riparian habitat degradation; and 3) maintain westslope cutthroat trout habitat at 90% of optimum habitat conditions. When this 90% of optimum condition criteria is not met, only activities resulting in habitat improvement are to be considered. The Strategy also states that FS Biological Evaluations (FSM 2670) prepared for new activities should, in most cases, conclude that there will be a beneficial effect or no effect to the westslope cutthroat trout population or its habitat. This strategy was adopted by the GNF for both Yellowstone and westslope cutthroat trout.*

The GNF uses sediment modeling to determine consistency with this guidance, where sediment delivery to streams shall not exceed 30 percent over natural levels in order to ensure that aquatic habitat capability is not degraded beyond 90 percent of optimum conditions.

3.6.1 THREATENED AND ENDANGERED FISH SPECIES

According to Forest Service field surveys and Forest Service and USFWS computer databases, there are no threatened or endangered fish species in the Study Area (Barndt, Pers. Comm., November 17, 2003).

3.6.2 FOREST SERVICE SENSITIVE AND MANAGEMENT INDICATOR FISH SPECIES

Fisheries Habitat

SF Brackett Creek is a second order tributary to the main stem of Brackett Creek, which is a tributary to the Shields River. The upper end of the South Fork Brackett Creek is an intermittent stream in its upper reaches. The upper portion of SF Brackett Creek drainage contains a high density of springs and seeps creating many small, wet, and heavily vegetated boggy areas. These areas provide a high degree of sediment filtration capability to the drainage. A spring located about 200 yards upstream of FS Road 631 in T1N-R7E-Section 18 provides sufficient volume to create perennial flows. This inherently stable A3/A4 channel type is heavily vegetated with alder and perennial vegetation. This high gradient riffle dominated channel at the upper end of SF Brackett Creek does not possess the needed pool habitats and channel development to support a resident fish population. Fish presence begins lower in the drainage in T1N-R7E-Section 8 where the channel converts to a lower gradient B4 channel type near the GNF boundary. A beaver dam complex in the lower portion of SF Brackett Creek provides high quality pool habitats needed for overwintering fish.

Maynard Creek is a second order tributary to Bridger Creek, which is a tributary to the East Gallatin River. Lower Maynard Creek in T1N-R7E-Section 19 shows evidence of past high levels of accelerated sediment delivery. Heavily embedded substrates and high levels of deposited sediment and clay exist in backwater areas. No documentation of fish species presence exists for Maynard Creek. A small reservoir on Maynard Creek has been periodically stocked with rainbow trout. Poor channel development and steep gradients limit fish inhabitation of this stream upstream of the reservoir, which serves as a sediment trap for the drainage; extensive sediment deposition was noted downstream of the outlet of the reservoir.

The South Fork of Slushman Creek was also inspected. The upstream end of this very small (<1 cfs), steep A2/A3 channel type stream is heavily vegetated with willow trees and contains a high component of boulder and large cobble making the stream channel very stable. In addition, there is no documented presence of fish in Slushman Creek.

Both Maynard and Slushman Creeks are tributaries to Upper Bridger Creek. No sensitive fish species are documented present in Bridger Creek as of 2000 (GNF, District Files, 2000). Westslope cutthroat trout and fluvial arctic grayling were historically present in the upper Missouri River basin, which could have included Bridger Creek; however, 5,200 Big Hole River Arctic Grayling were stocked in the West Gallatin River during 1992, and about 10,000 were stocked in 1993 (FAGW, 1993). A few of these tagged grayling have been accounted for in the

East Gallatin River. Brown, rainbow, and brook trout are also known to be present in Bridger Creek.

SF Brackett Creek is classified as a Class A stream in the GNF due to the presence of Yellowstone Cutthroat Trout in the lower reaches of its drainage. The estimated annual sediment yields in SF Brackett Creek under existing conditions is 89.8 tons per year (see Table 3.2-3), which is 8.2 percent above natural conditions (Story, 2003). The existing water quality of SF Brackett Creek is within GNF "30 percent above natural conditions" standard for Class A streams. Based on inspections of fish habitat and riparian area conditions, along with current sediment delivery rate estimates, SF Brackett Creek currently provides habitat at a level greater than the 90 percent capability requirement in the 1999 MOU with the Bureau of Land Management.

Maynard, Upper Bridger, and Slushman Creeks are considered Class D streams in the GNF since there is no documented presence of fish in these drainages. The sediment yield to Upper Bridger Creek and Slushman Creek have been increased above natural rates (33 – 27 percent) due to road building and timber harvest in the lower part of each drainage on NFS land and other privately owned land. Maynard Creek, which flows entirely through existing Bridger Bowl base area, has had a substantial increase (77 percent) in sediment yields above natural rates due to historic building, road, and ski trail construction. The sediment yield in Maynard Creek is expected to be decrease over time as historic base area disturbances continue to recover hydrologically. The estimated sediment yields to these three streams for existing conditions do not exceed the GNF standard of "100 percent above natural conditions" for Class D streams (Story, 2003).

Yellowstone cutthroat trout (Oncorhynchus clarki bouvieri)

Yellowstone cutthroat trout are indigenous to the Yellowstone River and its tributaries. Due to cross breeding with rainbow trout, few pure populations remain, and these populations are restricted to small headwater streams. The Forest Service electro-fished the lower portion of SF Brackett Creek in 2000, and has found a population of Yellowstone cut throat trout (see Table 3.6-1) (GNF, District Files, 2000). SF Brackett Creek begins in T1N-R6E-Section 13, the Bradley Meadows area of the Study Area. There are four isolated populations of Yellowstone cutthroat trout in the northern portion of the Bridger Mountains that are highly vulnerable to cumulative effects of development along these tributaries.

Only 36 genetically pure stream dwelling populations of Yellowstone cutthroat trout are known to exist within the state of Montana encompassing less than 10 percent of their historic range. Causes for decline throughout their historic range include introduction of exotic species, reduction of habitat quality, and population fragmentation. The Brackett Creek population of Yellowstone cutthroat trout is typical of most cutthroat populations within the Shields River drainage, in that it is reproductively isolated from other pure populations by the mainstem fish species assemblage of hybridized cutthroat and rainbow trout.

Table 3.6-1
Sensitive Fish Presence and Habitat

Sensitive Fish Species	Species Status	Suitable Habitat	Species Present
Arctic grayling	Forest Service Sensitive, ESA Candidate	No	No
Westslope cutthroat trout	Forest Service Sensitive	Yes	No
Yellowstone cutthroat trout	Forest Service Sensitive	Yes	Yes

Source: Forest Service

Westslope cutthroat trout (Oncorhynchus clarki lewisi)

Bridger Creek is a tributary to the Gallatin River within the historic range for westslope cutthroat trout, however no pure populations have been found (see Table 3.6-1). Pure cutthroat populations have been defined as less than 10 percent hybridization with other trout species, mainly rainbow. Westslope cutthroat trout historically inhabited the upper Missouri River drainage. The current distribution of genetically pure westslope cutthroat trout in the state of Montana is estimated to be less than 2.5 percent of their historic range. Only three genetically pure and several hybridized populations of westslope cutthroat trout are known to be present on the GNF within the Gallatin and Madison River drainages.

Arctic grayling (Thymallus arcticus)

Fluvial Arctic grayling historically inhabited the upper Missouri River drainage. There is no documented presence of Arctic grayling in the Bridger Creek drainage (see Table 3.6-1). An attempt has been made to reintroduce fluvial Arctic grayling into the Gallatin River over the past several years. The success of this effort is not known at this time. The Arctic grayling was recently listed as a candidate for federal listing by the USFWS (67 FR 40657-40679).

3.7 ROADLESS

The Forest Plan has established forest-wide multiple use goals, objectives, and management area requirements, as well as management area prescriptions. The analysis of roadless lands documented in Appendix C of the FEIS for the Forest Plan describes each roadless area, the resources and values considered, the range of alternative land uses studied, and the effects of management under each alternative. As a result of the analysis, some roadless areas were recommended for inclusion in the National Wilderness Preservation System and others were assigned various non-wilderness prescriptions. The Inventoried Roadless Area (IRA) within and adjacent to the proposed Study Area is designated MA 2 and MA 12. MA 2 consists of those portions of Bridger Bowl under SUP, including ski trails, chairlifts, as well as areas that exhibit potential for development or expansion of facilities to meet the increasing demand for downhill skiing. The Bridger IRA does not include any portion of the current Bridger Bowl SUP. MA 12 provides habitat for summer or winter wildlife use in a variety of terrain and vegetative types. These areas also offer dispersed recreation opportunities.

3.7.1 AREA OF ANALYSIS

The Bridger IRA comprises most of the higher elevation lands in the Bridger Mountains. The Study Area for this project covers about 101 acres of IRA, which is limited to the Slushman drainage to the south of the existing SUP area (see Figure 2-4).

History and Description

A portion of the Bridger Bowl SUP area (about 292 acres) was within the original Bridger IRA, including lands along the ridge in the western portions of Sections 24 and 25, T1N, R6E. In conjunction with the analysis for Bridger Bowl's MDP update and SUP renewal, the Bridger IRA boundary was validated as directed by Regional policy. The IRA boundary line was adjusted in Sections 25 and 36, T1N, R6E, to exclude the harvest activity that occurred in the Slushman drainage in the late 1980s. This sale was conducted in 1982, before the IRA boundary line was developed. Continuing north, the IRA boundary line was moved onto the ridge in Sections 24 and 25. This natural feature is easily located on the map and in the field. The line was identified as 50 feet west of the ridge crest.

Bridger Roadless Area #1543 was originally defined on a map at a scale of one inch to two miles, as prepared for the Forest Plan. Boundaries are a generalized line at this scale and cannot be identified with specific features on the ground. The Northern Region Office (Forest Service Memo 9/20/96) directed each Forest to validate the existing IRAs, as displayed on the Forest Plan maps, and generate the current IRA on a 1:24,000 topographic map (i.e., a typical US Geologic Survey quad sheet). The memo also directed Forests to adjust the current boundary according to the procedure and protocol included in the memo. This protocol deals only with the validation of the inventory of existing roadless areas in the Forest Plan. It does not address the evaluation of these areas for future wilderness designation.

When the Bridger IRA boundary was established, approximately 485 acres of land in Section 13, T1N, R6E, was privately owned. In 1993, the Forest Service acquired this parcel, which became part of the NFS land base. Following the direction for updating and monitoring IRA boundaries,

it was determined that this parcel does not fit the criteria for inclusion in an IRA (Forest Service 1996). Therefore, the IRA boundary line continues north along the ridge in Sections 14 and 11 to Ross Pass.

With the adjustment of the Bridger Bowl SUP western boundary and reduction of SUP area in 2002, approximately 100 acres of SUP area was removed from the IRA in Sections 24 and 25, T1N, R6E. The Bridger Bowl SUP was adjusted along the western border so that its boundary was the same as the IRA boundary (Forest Service, 2002). Existing facilities along the ridge crest and outside of the IRA include buildings and a surface tow. In addition, ridge skiing occurs in this area and is a feature unique to the skiing opportunities offered by Bridger Bowl.

Backcountry skiers currently utilize the Slushman drainage within the Bridger IRA. Some skiers access the area from within the Bridger Bowl SUP boundaries and ski through the closed SUP boundary and into the IRA. Other skiers climb up the mountain through private lands surrounding the base area. It is also possible to obtain access through NFS lands; the most common areas are Brackett and Middle Cottonwood drainages.

3.7.2 WILDERNESS CHARACTERISTICS

The Bridger IRA was analyzed for its wilderness qualities in the Forest Plan. The wilderness attributes for this area were generally described as low when compared with other roadless areas on the Forest. No public comments were received expressing a desire for the Bridger Range to become wilderness during the Forest Plan comment period. The Record of Decision did not recommend the Bridger IRA for wilderness inclusion. The wilderness option will be considered again when the Forest Plan is revised, but it is currently beyond the scope of analysis for this Proposed Action. The extent of wilderness characteristics displayed within the Bridger IRA is described below:

Natural Integrity and Apparent Naturalness

The natural integrity of the IRA within the Study Area has been affected along the eastern boundary. An electronics site is located on the ridge, as are existing Bridger Bowl facilities, including buildings and a surface tow.

The natural appearance of the roadless area is impeded by the lack of topographic screening. The narrowness of the area permits views of residential developments on adjacent valley lands. The Bridger Bowl ski area is apparent from the ridge. Clearcut timber units are visible in the lower elevation areas outside of the roadless area, as are harvest units across the canyon in the Bangtail Mountain range.

Remoteness and Solitude

The area along the ridge is a popular viewing site for raptors during their annual fall migration from late August through early November. The ridge is accessed by walking up through the Bridger Bowl ski area. Other popular accesses to the ridge are the "M" trail route or via Truman Gulch or Ross Peak routes to the north. Three to five trips are required to the electronic site for maintenance each year. The usual mode of transportation to the electronic site for maintenance is by helicopter.

During the ski season, Bridger Bowl patrols the ridge area within the SUP for avalanche hazards and there is often considerable noise associated with avalanche hazard reduction. Ridge skiing and snowboarding inside the IRA boundary occurs daily throughout the ski season. Signs of human activity and encounters with other users are likely throughout the year.

Primitive recreation opportunities are impaired by the narrowness of the IRA. Some activities, particularly winter uses, pose significant challenge and risk due primarily to the high avalanche hazard.

Special Features

The largest known concentration of migrating golden eagles in the lower 48 states fly south along the Bridger Range in their annual fall migration. Golden eagles and several other species of raptors fly over the Bridger IRA during migration.

Manageability and Boundaries

The long narrow shape of the IRA limits the opportunity for enjoyment of wilderness values because human activities adjacent to the roadless area and activities within the roadless area are evident to the users. Development is occurring on private land on both sides of the Bridger Range, which adds to the evidence of human activities nearby. The eastern boundary of the IRA has been moved 50 feet west of the ridge crest, which is a readily defined topographic feature. The roadless area boundary within the Study Area to the south follows the Slushman drainage.

3.8 AIR QUALITY

Congress passed the Clean Air Act (CAA) in 1963, and it has been amended in 1972, 1977, and 1990. The purpose of the CAA is to protect and enhance air quality while ensuring the protection of public health and welfare. The CAA established National Ambient Air Quality Standards (NAAQS), which must be met by state and federal agencies as well as private industry. States are given primary responsibility for air quality management. Section 110 of the CAA requires each state to develop a State Implementation Plan (SIP), which identifies how the state will attain and maintain NAAQS.

In Montana, many of the federal and state ambient air quality standards are similar for criteria pollutants. The SIP is promulgated through the Montana Clean Air Act (MCAA) and implementing regulations. The regulations provide specific guidance for maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The MCAA created the Montana Air Quality Bureau (MQAB) [now managed under Montana Department of Environmental Quality (MDEQ)] and gave it the regulatory authority to implement and enforce the codified regulations. Table 3.8-1 outlines federal and state air quality parameters.

Table 3.8-1
Montana State Air Quality Parameters

Pollutant	Time Period	Federal (NAAQS)	Montana (MAAQS)
Carbon Monoxide (CO)	Hourly Average	35 ppm	23 ppm
	8 – Hour Average	9 ppm	9 ppm
Fluoride in Forage	Monthly Average	-	50 µg/g
	Grazing Season	-	35 µg/g
Hydrogen Sulfide (H_2S)	Hourly Average	-	0.05 ppm
Lead (Pb)	90 – Day Average	-	1.5 µg/m3
	Quarterly Average	1.5 µg/m3	-
Nitrogen Dioxide (NO_2)	Hourly Average	-	0.30 ppm
	Annual Average	0.053 ppm	0.05 ppm
Ozone (O_3)	Hourly Average	0.12 ppm	10 ppm
	8 – Hour Average	0.08 ppm	- -
PM_{10}	24 – Hour Average	150 µg/m3	150 µg/m3
	Annual Average	50 µg/m3	50 µg/m3
$PM_{2.5}$	24 – Hour Average	65 µg/m3	-
	Annual Average	15 µg/m3	-
Settleable Particulate	30 – Day Average	-	10 g/m2
Sulfur Dioxide (SO_2)	Hourly Average	-	0.50 ppm
	3 – Hour Average	0.50 ppm	-
	24 – Hour Average	0.14 ppm	0.10 ppm

Pollutant	Time Period	Federal (NAAQS)	Montana (MAAQS)
	Annual Average	0.03 ppm	0.02 ppm
Visibility	Annual Average	-	3 x 10-5/m

Source: Montana DEQ

The NAAQS are for the six criteria pollutants: carbon monoxide, nitrogen oxide, ozone, sulfur dioxide, lead, and particulate matter. There are numerous types of pollution that could be controlled, but particulate matter is the primary pollutant of concern at Bridger Bowl. The NAAQS require that concentrations of PM_{10} do not exceed a 24 hour average of 150 $\mu g/m^3$ (micrograms per cubic meter) of air. Average annual arithmetic concentrations are not to exceed 50 micrograms per cubic meter of air.

The August 1977 CAA amendments designated areas of the nation into PSD (Prevention of Signification Deterioration) classes. Class I airsheds are given the most protection from human caused air pollution in order to protect their pristine character. The nearest Class I area is Yellowstone National Park, which is 55 miles to the south. Class II airsheds allow for a greater amount of human caused pollution; Bridger Bowl is a Class II airshed. At this point, the EPA has not identified any Class III airsheds.

Air quality within the Bridger Range and at Bridger Bowl has consistent wind dispersion and very limited local pollution sources (Story, Pers. Comm., 2003). Existing sources of emissions at Bridger Bowl include construction equipment, vehicles, road dust, residential wood burning, and smoke from logging slash disposal. Emissions are very limited with no local visible sources of impairment. Wind dispersion throughout the entire ski area is robust, with no persistent inversions or localized concentrations of emissions (Story, Pers. Comm., 2003). Bridger Bowl is within Montana airshed 8A Gallatin (MDSL, 1988). The entire Bridger Bowl SUP area is considered to be in attainment by the MDEQ. The nearest non-attainment area is Butte for PM_{10} (73 miles to the west).

No specific information is available concerning existing air quality at Bridger Bowl. Three stationary sources of air pollution on the Montana Air Quality Division inventory with emissions greater than 100 tons/year occur within 60 miles of the Bridger Range. The Louisiana Pacific lumber mill at Belgrade (10 miles west) is permitted for annual totals of 85 tons/year of total suspended particulates (TSP), 74 tons/year of Volatile Organic Compounds (VOCs), 1 ton/year of SO_2, and 10 tons/year of NO_2 for a total of 170 tons/year (MDEQ emissions database, 1996). The Holman, Inc. cement plant at Trident (25 miles northwest) is listed as emitting 525 tons/year of TSP, 2,040 tons/year of SO_2, 484 tons/year of NO_2 for a total of 3,049 tons/year of total emissions. The Luzenac America Talc Plant at Three Forks (31 miles west) is listed as emitting 62 tons/year of TSP, 4 tons/year of SO_2, 41 tons/year of NO_2, and 3 tons/year of VOCs for a total of 110 tons/year of total emissions. The emissions from these sources are predominantly dispersed to the northeast with no visible effects within the Bridger Range (Story, Pers. Comm., 2003). No other sources of industrial emissions occur in the analysis area other than very small local sources.

The major source of emissions in the Gallatin Valley is the city of Bozeman, which is a source of vehicle exhaust, wood burning smoke, and road dust. Bozeman emissions visibly do not impact Bridger Bowl as a result of predominant wind direction (Story, Pers. Comm., 2003). Bozeman emissions generally disperse to the east during daylight hours and to the northwest by down valley breezes during nighttime. The main concentration of Bozeman emissions observable during winter inversions is along the East Gallatin River between Bozeman and Belgrade. Particulate monitoring equipment operated by the MDEQ has consistently indicated compliance of Bozeman air quality with NAAQS (MAQB, 1991). Other types of emissions in the Gallatin Valley include vehicle and agriculture equipment exhaust, road dust, wood smoke from residential areas, smoke from pile burning, broadcast burning, and wildfires. Although the Bridger, Gallatin, and Madison Ranges have had a low frequency of wildfires during the last 20 years, wildfire smoke accumulated within the area during periods of extensive regional wildfire activity in 1988 and 1994. The primary sources of wildfire emissions are from central and southern Idaho and southwest Montana. Smoke can also impact the Bridger Range from wildfires in Yellowstone National Park as occurred in 1988 and 1994. The Boswick fire in 1991 impacted Bridger Bowl with heavy smoke over the ridge and several small spot fires.

The MDEQ has estimated that for southwest Montana, including the Bridger Range, a NO_2 background of 6 $\mu g/m^3$ (annual average) and 1 hour NO_2 maximum of 75 $\mu g/m^3$ are appropriate. These estimates can be improved and localized when more data is available. An average annual PM_{10} background concentration, for the purpose of emission concentration screening modeling, can be assumed to be about 8 $\mu g/m^3$ (MDEQ, 2002).

The valley locations of Bridger Bowl, primarily the lands in the base area, have some potential for cumulative concentrations of smoke and urban, industrial, and transportation emissions, but visible inversion conditions do not occur. Up valley winds during daytime and down valley wind (cold air drainage) at night can dominate valley winds more than overall prevailing wind direction on ridgetops.

Generally, drainages in the Bridger Range do not develop temperature inversions that trap smoke and reduce smoke dispersal. Dispersion of emissions within the Bridger Range is very high due to the mountainous terrain and high wind activity. The Wind Energy Resource Atlas of the United States (Elliott et al., 1986) shows the Bridger Range as an area of high wind energy.

3.9 CULTURAL RESOURCES

Protection of significant prehistoric and historic resources is prescribed in a number of laws, including the Antiquities Act of 1906, the Historic Preservation Act of 1966 (as amended), and the Archaeological Resource Protection Act of 1979. Implementing regulations are codified in 36 CFR parts 60 and 800. Forest Plan standards and guidelines are designed to comply with these regulations, which are found on p. II-17 of the Forest Plan.

The Bridger Mountains have been used prehistorically since post-glacial times. Archaeological surveys have revealed patterned use of the Bridgers, as indicated by successive archaeological complexes, with the prominent use appearing to be during the Middle Period (circa 6,000-1,500 years ago). Flathead Pass was a prominent Native American trail, noted in the Lewis and Clark journals. Historical uses in the proposed Study Area are not as intense as other adjacent areas. Evidence of the expected historical uses can be found across the Bridger landscape. Early ranching operations are evidenced by livestock driveways, cairns and developments such as springs and mine shacks. Mining was not prominent in this area, but evidence of coal operations can be found scattered throughout several drainages.

The Study Area specific to this proposal revealed no evidence of prehistoric or historic activities. This fits the expectations of the Region 1 Programmatic Memorandum of Agreement/Gallatin Site Inventory Strategy, which deemed the specific Study Area as low in potential.

3.10 RECREATION

3.10.1 INTRODUCTION

The study area for general recreation is within the greater Bozeman community, the GNF, and the State of Montana. The study area for alpine skiing includes the local and regional markets for Bridger Bowl.

Substantial terrain, quality snow, favorable weather, the population and colorful history of the town of Bozeman and its proximity to Bridger Bowl have served to sustain and grow the ski area into a successful local and regional winter resort. Skier visits have averaged approximately 155,350 per year over the past fifteen seasons for which there is data (1988/89 through 2002/03). The current mix of visitors to Bridger Bowl is approximately 65 percent local, 10 percent from other locales in the state of Montana, and 25 percent out-of-state.

The goal for the GNF is to provide a broad spectrum of recreation opportunities in a variety of Forest settings by recognizing and managing the high quality recreational, vegetative, and wildlife resources found on the GNF (USDA, 1987, p. II-1). Forest-wide standards and guidelines for recreation on the GNF include:

- The private sector would be encouraged to provide facilities and services on private land where needed to serve the public.

- Expansion of Bridger Bowl, Big Sky, and the potential development of Ski Yellowstone ski areas would be given priority before any new proposals for downhill ski areas are approved.

Bridger Bowl lies within MA 2, which is designated and managed for developed winter recreation. The area has potential for development or expansion of facilities to meet the increasing demand for downhill skiing. Recreation Opportunity Spectrum (ROS) categories assigned to Bridger Bowl are *Rural* and *Urban*.

The proposed SUP expansion areas (Slushman Creek and SF Brackett Creek) lie within MAs 2, 11, and 12; these areas are classified within the ROS as all classes but *Primitive*, incorporating a variety of recreation experiences. Other recreation standards applicable to the proposed SUP expansion areas include:

General Recreation in the Bridger Mountains

The Bridger Mountains provide diverse recreation opportunities. There are a variety of other activities in both developed and dispersed recreation settings for the summer and the winter. There has been considerable growth and variability in recreation use on the GNF from year to year over the past decade. A complete summary of total recreation use by activity type on the District for these years is provided in the project file.

The Gallatin Valley provides access to NFS lands, with as many as ten trailheads in the Bridger Mountains alone. As people drive along Bridger Canyon Road (BCR) from the town of Bozeman, Bridger Bowl provides the first public access in the canyon to NFS lands. This special

use permit holder is a local business with strong ties to the community that provides developed winter recreation opportunities to the public on NFS lands.

The town of Bozeman manages fifteen parks for public recreation, which encompass two summer swimming pools, two tennis courts, two basketball courts, and two winter skating rinks. There are also six golf courses in the vicinity of Bozeman. Other private recreation opportunities include bowling alleys, spas and pools associated with local motels, as well as outfitters that provide horseback riding and guided fishing and hunting trips on NFS lands.

3.10.2 DEVELOPED WINTER RECREATION

Alpine Skiing[2]

Bridger Bowl, Inc. is a locally owned and operated non-profit organization whose mission is to "plan, develop, and maintain facilities and services … [to] provide the best possible skiing experience at a reasonable cost" (MDP 2002). The "best possible ski experience" is defined as uncrowded runs, minimal lift lines, and a variety of slope types based on ski area focus groups conducted over the past several years by Bridger Bowl. Ski area bylaws demonstrate that the area is committed to providing affordable and outstanding skiing, "to the residents of Gallatin County, … the citizens of Montana, and … to areas outside Montana" (bylaws, revised 1999).

At just more than 15 miles from the town of Bozeman, Bridger Bowl has strong local support. It offers the character and feel of a local resort that accommodates the needs of the community. As part of on-going operations, Bridger Bowl provides ski instruction to students from the surrounding 56 different public schools at reduced prices. The program has grown over the past 10 years from approximately 3,900 in 1992-1993 students to 4,100 students in 2002-2003. Additionally, adult ski school lessons have grown from 100 to 1,261 lessons over the same period.

The Eagle Mount program provides ski instruction for persons with physical and developmental disabilities. In the 2001/02 and 2002/03 seasons, Eagle Mount provided over 700 lessons for program participants at Bridger Bowl. The program shares a facility with the ski patrol in the base area and assists all disabled skiers, not just those who participate in lessons.

Lifts

Seven chairlifts serve the ski area guests including one quad, two triples, and four doubles. Additionally, one surface lift accesses the ridge; this lift is for ski patrol personnel and is not open to the public. Two thousand vertical feet are lift served; the remaining 600 feet are accessible only by foot.

Currently, the Alpine chairlift is of an aging design that contributes to loading and unloading difficulties, with line swing and bounce that require the lift be run below design capacity.

[2] At ski areas, one may see people using Alpine, snowboard, telemark, cross-country, and other specialized ski equipment, such as that used by disabled or other skiers. Accordingly, the terms "ski, skier, and skiing" in this document encompass all lift-served sliding sports typically associated with a winter sports resort.

Additionally, the steepness of the terrain at the upper portions of the terrain served by this lift causes difficulty for lower ability level skiers.

The Bridger chairlift is a fixed grip double that was built in 1964 with an hourly capacity of 875 skiers. The lift was updated with a new top drive terminal and haul rope in 1995. However, the capacity of this lift is lower than the capacity of the terrain in this area.

The Deer Park chairlift is a double chair with a hourly capacity of 1,100 skiers. The upper terminal is in need of repairs and the expert level terrain near the top of the lift is hard for lower ability skiers to navigate. In addition, the existing lift has an outdated bottom tension terminal that is disproportionately large and extends into the circulation path for skiers going between the Deer Park Chalet and Pierre's Knob contributing to an already congested area.

The bottom terminal of the Virginia City chairlift is a fixed grip double lift located on private lands with an hourly capacity of 1,200 skiers. The existing bottom tension terminal is located adjacent to the day lodge and contributes to base area congestion on the south side of the day lodge.

Trails

Flanked by two large bowls to the north and south, Bridger Bowl offers a variety of downhill skiing terrain. The terrain is comprised of approximately 1,500 skiable acres on NFS and private lands, with a base elevation of 6,100 feet and a vertical rise of 2,600 feet. Developed ski terrain is comprised of 69 named trails on approximately 407.1 acres of developed ski terrain. Much of the ski area consists of informal networks of openings in trees, rock bands, and cliffs. The developed lift and trail network supports a capacity of 3,200 skiers and accommodates a range of skier abilities from beginner to expert.

Table 3.10-1 illustrates the distribution of existing developed ski terrain by skier ability level. The table shows Bridger Bowl to have fairly well balanced distribution of terrain compared to the ability levels in the market. However, the market demand for low intermediate, intermediate, and advanced terrain is not met by the current distribution of lift capacity; as a result, these skiers are using the available novice terrain. Use of these novice areas by skiers of higher ability levels results in congestion in these areas as well as the potential for skier safety conflicts. Additional intermediate and advanced terrain is needed.

Table 3.10-1
Bridger Bowl Existing Terrain Distribution by Ability Level

	Skier/Rider Market Demand[a] (percent)	Skier/ Bridger Bowl Distribution (percent)	Normalized Terrain Distribution[b] (percent)
Beginner	5	1	2
Novice	15	43	15
Low Intermediate	25	17	25
Intermediate	35	25	37
Advanced Intermediate	15	8	12
Expert	5	6	9

[a] Skier/Rider Market Demand is the theoretic percentage distribution of skiers by their ability level.

[b] Normalized Distribution is the percentage distribution of existing Bridger Bowl lift and terrain capacity. This column should be used in discussions regarding the distribution of terrain by ability level. This is also a function of the mountain shape, which is steeper near the ridge and less steep as one travels down the face of the mountain.

Ski Area Capacity

Ski area capacity is primarily a function of lift and ski terrain capacity. Capacity is calculated in terms of Skiers at One Time (SAOT) or Comfortable Carrying Capacity (CCC)[3]. The 2002 MDP proposal calculates the current SAOT of the ski area at 3,200. This is based on the National Ski Areas Association methodology as described in Ski Area Management magazine (November, 2001). This particular model combines the basic SAOT capacity modeling with lift ride times and skier speed. The assumptions of the Bridger Bowl SAOT calculations and the Comfortable carrying capacity model run for this proposal were compared to determine the current CCC. The comparison indicates that some lift line times and slope lengths varied, however, for the purposes of the analysis in this SDEIS a CCC of 3,200 is used.

Since the SAOT capacities in the 2002 MDP have now been rectified with the CCC calculations in this SDEIS, SAOT and CCC are used synonymously for the remainder of this document. The CCC model has been developed to complete more detailed analysis of ski area capacities including variability in lift line times, skier speeds, and the density of skiers per acre on various slopes. CCC is also used to balance skier service needs (parking, food service, restrooms, etc) with mountain capacity. CCC represents the theoretic level of skier and operation satisfaction and a quality recreation experience on NFS lands.

The number of skiers on a particular trail is controlled by the capacity of the lift and the speed of the skier. The calculated skier density within each "pod" of ski trails is shown below. These calculations are based on a day at a CCC of 3,200 and a peak day of 4,000 skiers, with all lifts operating. Bridger Bowl conducts counts of lift riders and lift lines at regular intervals and has data form these counts over the last 10 years. Lift lines vary considerably during heavy snow

[3] Comfortable Carrying Capacity (CCC) is defined as the maximum level of utilization of a ski area (the total number of skiers that can be accommodated at any given time) that guarantees a pleasant recreational experience while at the same time preserving the quality of the environment.

period or holiday periods, depending on time of day, lifts and slopes open and general skier ability levels.

Table 3.10-2 illustrates the calculated existing condition for lift lines showing a "typical" distribution of lift lines. The table also shows the density of skiers in a given lift "pod," with skier densities less than the typical desired condition. This desired condition is based on calculations for skier densities at resorts across western North America. It is also a function of the area of a ski trail assigned to each lift and the ability level of the ski trails assigned.

Table 3.10-2
Existing and Desired Skier Density on a day with 3,200 Skiers

Lift	Ride time (minutes)	Line Wait Time (minutes)	Persons in Line	Skier Density on Trail	Desired Trail Density	Difference (+/-)
Snowflake	1.14	2	27	29	29	0
Virginia City	7.79	2	20	9	12	-3
Powder Park	8.38	2	27	8	12	-4
Bridger	8.01	6	83	1	3	-2
Deer Park	5.89	4	70	2	6	-4
Pierre's Knob	9.03	8	190	2	6	-4
Alpine	8.30	6	105	2	8	-6

Source: SE Group and Bridger Bowl

For every lift, Bridger Bowl's skier density is lower than the desired condition, which indicates un-crowded skiing conditions. In the Snowflake beginner area, current skier density equals or exceeds the desired density. This condition is normal and does not reflect the actual conditions during ski school operations. When ski school is operation, students are grouped together and may be stopped on the slope for instruction, which accounts for a lower density of skiers actually skiing on beginner slopes.

Skier densities below the desired condition indicate that the slopes are less crowded than the "typical" condition which includes large destination resorts (such as Vail, CO; Keystone, CO; and Park City, UT). The skier densities below desired conditions at Bridger Bowl likely reflect the local attitude toward "crowded" conditions. The ski slopes are currently perceived as crowded during peak periods of holidays and heavy snow. Individual lift lines can approach 30 minutes for certain periods when upper mountain lifts are closed due to potential avalanche conditions.

For several years, Bridger Bowl has conducted skier focus groups. In addition, Bridger Bowl commissioned a survey by mail in 1999. The survey resulted in 635 responses of which 192 were Bridger Bowl Association members. In summary, the 1999 survey concluded that skier services, including cafeteria functions, and parking were the greatest concern. For mountain facilities, 78 percent of the respondents wanted changes to the lifts, and 40 percent requesting changes to terrain. Continuing focus groups have added definition to the survey data. These groups have helped define the desired skiing experience, which is identified as an experience

with "less crowded" skiing - uncrowded runs and minimal lift lines - and a variety of slopes. The focus groups also addressed their desires for expansion to the Slushman area (south) and Bradley Meadows (north).

Skier Support Services

Skier support services include food service, restrooms, ticket sales, ski school, ski patrol, ski area administration, child care, ski rental, and retail areas. Most Bridger Bowl skier services are located in the base area on private lands. The Jim Bridger Lodge is approximately 19,820 square feet; it was remodeled in 1987. The original Deer Park Chalet was replaced with a more modern facility in 1997; this building is approximately 14,325 square feet. The new ski patrol building was completed in 2002. It offers improved facilities for the ski patrol and includes additional space for the Bridger Ski Foundation as well as the Eagle Mount program. A new day lodge is currently under construction on the site of the old ski patrol facility. The new day lodge will be compliant with the Americans with Disabilities Act (ADA) and provide expanded skier services, consolidate administrative offices, provide more ticket windows and rental space, including specialized rental space for the school programs. Construction on the new day lodge started in 2003 and is anticipated to be complete for the 2004/05 season.

Skier Demographics

The local day skier market area for Bridger Bowl generally encompasses the area within a two-hour or 100-mile driving radius, which comprises a population base of approximately 115,400.[4] As stated previously, approximately 65 percent of the Bridger Bowl skiers come from the local market area (primarily Bozeman and Livingston), while 10 percent are other Montanans, and 25 percent are from out-of-state. A primarily local clientele is associated with busy weekend and holiday periods, while the ski area is underutilized during the week. This makes for inefficient and expensive operation of the ski area during the week as well as crowded facilities on the weekends and holidays.

Skier Visitation

As shown in Table 3.10-3, growth in Montana skier visitation over the past ten years has exceeded the growth witnessed on a national basis. Recent record use levels are due in part to aggressive advertising efforts by the State Travel and Promotion Division, local and regional growth in population and expanded alpine skiing operations (at Big Mountain, Big Sky, and Red Lodge), which attract greater numbers of out-of-state skiers.

[4] Includes Park, Gallatin, Madison, Sweet Grass, Jefferson, Broadwater, Wheatland, and Meager counties. Montana Department of Commerce, *CEIS: Montana Population Projections*, February 1998.

Table 3.10-3
Skier Visit Trends (1000s)

Season	United States Skier Visits	Montana Skier Visits	Bridger Bowl Skier Visits (5 year average)	Bridger Bowl Skier Visits (actual)
1992/93	54,000	966	135	145
1993/94	54,600	989	143	174
1994/95	52,500	1,063	152	193
1995/96	53,983	1,141	161	151
1996/97	52,520	1,186	167	173
1997/98	54,100	1,027	167	143
1998/99	52,100	1,058	167	174
1999/2000	52,200	1,169	163	172
2000/01	57,300	1,151	164	158
2001/02	54,400	1,199	166	185
2002/03	57,600	1,084	167	146
Percent Change over Time	**6.7%**	**12.2%**	**23.9%**	

Source: NSAA, Forest Service, Ski Area Operators, SE Group, 2002/03 Kottke National End of Season Survey.

Many factors that are beyond control affect annual skier visitation; the most notable is weather and snowfall patterns. In Table 3.10-3, the numbers for running average compared to the actual skier visits for Bridger Bowl demonstrate this. As a result, the running average Bridger Bowl skier visits reflects an approximately 23% change over the 10-year period.

Weighted averages are used to measure skier visit trends to reduce the influence of year-to-year snowfall amount and timing. National and Montana skier visits are compilations of all reporting areas within these geographic locations. This compilation factors out weather influences; some areas will have good snow while others may have too much or too little snow during critical periods. Skier visits at Bridger Bowl, as measured in weighted averages over the past five years, appear to remain approximately the same. However, as shown in Table 3.10-3, skier visits varied over several consecutive seasons from 158,000 in 2000/01 to 185,000 in 2001/02 and back to 146,000 in 2002/03 due to snow and weather conditions. The 185,000 actual skier visits in 2001/02 was the second highest recorded after the 1994/95 season, during which Bridger Bowl had 195,000 visits.

An analysis of the peak day size changes over the past 20 years indicates that the size of the peak day has decreased from the highest days in 1993/94 (4,525 skiers), 1995/96 (4,311 skiers), and 1997/98 (4,393 skiers); to the 1999/2000 season of 3,607 skiers and 3209 skiers in 2000/01 season. Throughout the late 1980s and early 1990s Bridger Bowl saw increases in the peak day skier visits. These peak days occurred primarily during the Christmas holiday season, which was

then the peak revenue generation time for the resort. In 1989, skier visits during the Christmas week began to exceed the CCC of the resort.

In 1995/96, the size of the peak Christmas week visitation began to decline, and has not recovered. This is likely due to skier dissatisfaction as represented in the focus group information, local skiers recognizing a busy period and choosing not to ski during the period and the increase in capacity at Big Sky, Red Lodge and Big Mountain, all of whom compete with Bridger Bowl for the holiday market.

During the same time frame (1993 to present), Bridger Bowl has seen peak days due to heavy snowfall (i.e., "powder days") increase. The 1992/93 ski season marked the shift in skier behavior as skier visits in heavy snowfall (greater than 6 inches overnight) increased dramatically. Prior to 1993, the average peak snowfall skier visits were 1,835 visits per day. After 1993, average peak snowfall skier visits increased to 3,030 skiers, an increase of 65 percent in peak powder day skier visits. In 1992/93, peak snowfall skier visits exceeded CCC for the first time. This has occurred at least once during five separate seasons since that season, including the last two years, during which peak snowfall visits were 3,378 in 2001/02 and 3,456 in 2002/03.

Peak snowfall days often present additional challenges for Bridger Bowl. Holiday and weekend skier use is generally spread across all seven lifts. Peak snowfall days see a greater proportion of skiers accessing the steeper terrain of the four upper mountain lifts. This tends to increase lift lines on these four lifts, and increases skier densities on the slopes. All four lifts and the associated ski terrain are protected through avalanche hazard reduction activities by Bridger Bowl ski patrol. Due to the need for avalanche hazard reduction, these lifts may be slow to open or may remain closed on the largest heavy snow days when hazard reduction requires more time.

In the most difficult conditions, heavy snows or poor visibility may require that only terrain that does not require avalanche hazard reduction can be opened. In the current lift and trail organization, Pierre's Knob lift is the only upper mountain lift that can be opened. These days see lift lines in excess of 20 minutes as peak snowfall crowds are forced to the Pierre's Knob lift for access to skiing. This exceedingly long lift line time can occur even if the ski area in not at capacity.

Market Share and Competition

Market and functional analyses were undertaken as part of the Bridger Bowl master planning process. Key findings from these analyses and information updates are included in this document. A copy of the Bridger Bowl Master Plan (February, 2002) is located in the project file and is available for review at the Bozeman Ranger District. Some of the findings of the analyses are summarized below.

Review and analysis of relevant national data indicate that there is an ever-increasing level of customer awareness of quality, service, and value in the ski experience. Progressive ski areas and resorts have catered to the changing demands of the skier population by providing convenient air access, quality accommodations, a heightened service orientation, a more refined, and technologically improved ski experience, and numerous year-round recreational amenities.

Ski areas that have invested in faster and more comfortable ski lifts, snowmaking, terrain expansion, increased trail grooming, and other quality improvements have created higher quality skiing, and they have typically captured additional market share.

These developments have also led to an overall improvement of standards and a higher level of expectation among the skiing public. Conversely, stagnation (i.e., lack of improvements or failure to maintain standards consistent with visitor expectations) has lead to the erosion of market share and eventually a decline in skier visit performance. Stagnation is largely responsible for the 25 percent reduction in the number of ski areas nationwide over the past 13 years. The closure of Montana ski areas, including Beef Trail, Deep Creek, and Wraith Hill, over this time period has mirrored the national trend.

In order to avoid this stagnation, the Bridger Bowl Board of Directors adopted a new Mission Statement in 1996. Their mission is to plan, develop, and maintain facilities and services in a financially sound manner at Bridger Bowl, which would provide the best possible skiing experience at a reasonable cost to local, regional, and destination skiers. Bridger Bowl has maintained a growth in annual skier visits while the competition has developed and expanded. As shown in Table 3.10-3, stable and increasing annual skier visits are a measure of total use of the ski areas.

Thirteen ski areas operate in Montana, ranging from small, local areas with few lifts and support facilities, to larger destination oriented resorts with national recognition. Big Mountain, Big Sky, and Red Lodge Mountain are Bridger Bowl's primary competitors. Together, all four areas account for more than 68 percent of all skier visits in Montana; this has remained relatively constant over the last decade. Big Sky has experienced the most substantial growth in visitation and has moved from third to the most popular ski area in the state. This growth is largely due to major capital improvements to the ski facility and available lodging. While much of this gain has resulted from increased destination visitors (approximately 60 percent of total visitation), Big Sky has also captured additional skiers from the local and regional markets; Big Sky currently generates 30,000 to 40,000 skier visits from the Bozeman area alone (Big Sky Resort, Ski Area Management, Personal communication, February 1998). To a certain extent, this has been at the expense of the other regional ski areas.

Ski Area Utilization

Another measure of demand in the market place is ski area utilization. Utilization is the relationship between the daily capacity of the ski area (CCC) and actual skier visits, and it is expressed as the percentage of total capacity which is "occupied" by skiers on any given day. In other words, the utilization rate is a measure of the use of a winter recreation area on NFS lands, and it is a measure of the resort efficiency. A low utilization indicates over-capacity of the infrastructure; high utilization indicates an efficiency balance between capacity and skier demand, but can indicate crowding and under capacity, especially at smaller, regional and day ski areas, when skier visits are controlled by weekend and holiday periods or heavy snowfall (NSAA Economic Analysis of United States Ski Areas; RRC Associates, January 2003).

Bridger Bowl has also experienced utilization levels significantly above industry averages over the years, which is indicative of an active skier market and high local demand. On a regional

comparison basis, the Rocky Mountain region experienced a utilization of 35.5 percent for the season 2001- 2002. On a comparable size basis, the national average utilization is 40 percent. As shown in Table 3.10-4, utilizations of 45 percent to 47 percent at Bridger Bowl is very high, particularly for a day and/or weekend oriented ski area.

Table 3.10-4
Utilization at Bridger Bowl

Year	Days Open	Annual Utilization
1997 – 98	112	40%
1998 – 99	115	47%
1999 – 00	115	47%
2000 – 01	122	40%
2001 – 02	122	47%
2002 - 03	102	45%
Average	**114**	**44%**

While exceeding a ski area's comfortable capacity on several occasions during a given season is not uncommon, most operators look for expansion opportunities once a ski area consistently surpasses average industry utilization levels, in order to enhance the skiing experience, maintain a competitive edge, and thereby sponsor additional growth in visitation.

Nordic Skiing

Other than lift-served skiing, Bridger Bowl does not offer any other developed winter recreation activities (i.e., cross country skiing, ice skating, snowtubing). The Bohart Ranch, located approximately one mile north of the ski area, provides a quality Nordic skiing center, offering equipment rentals and sales, lessons, and 25 km of groomed trails. The Nordic trail system is currently located on Bohart Ranch and NFS lands north of the existing Bridger Bowl SUP boundary. Bohart Ranch received approximately 9,600 Nordic visits in 1996/97 and has experienced increasing use each year since opening more than 15 years ago (MacInnes, personal communication, 1998).

3.10.3 DISPERSED WINTER RECREATION

Backcountry Skiing

For years, dispersed backcountry skiing and snowboarding, have occurred on NFS lands in the Bridger range and adjacent to Bridger Bowl. Although Bridger Bowl provides the first access to NFS lands along BCR, access to the adjacent backcountry terrain is not authorized through the existing ski area, due primarily to public safety concerns. The Forest has a long history of concern for public health and safety especially in the Slushman drainage. This area is well known for its avalanche potential. Slushman drainage is immediately adjacent (south) to the ski area and outside of the SUP boundary. Bridger Bowl does not provide patrol or avalanche hazard reduction to any areas outside the SUP boundary.

Both the Forest Service and the ski area have concerns with the number of people skiing out of bounds from higher elevations within the SUP area into the Slushman drainage and Bradley Meadows. The concerns centered on avalanche hazards and difficult search and rescue team

access to these areas. However, the desire to access the ridge above Bridger Bowl, as well as the bowls to the north and south of the permitted ski area, for backcountry skiing has continued to grow.

Visitors have continued to access NFS lands through Bridger Bowl property. This occurs in the early morning and late afternoon, both during and outside of the operating season of the ski area. As a result, snow safety/avalanche hazard reduction activities have been delayed or cancelled due for public safety reasons. When visitors are within the permitted ski area boundary during control periods and the mountain closed to the public, their location cannot be verified prior to a controlled explosion, nor can it be determined if the visitors are located within or adjacent to a potential slide path.

Further safety concerns involve snow grooming operations during the ski area closed hours. Grooming normally occurs during night times and twilight hours. Visibility is limited to areas lit by the grooming vehicle and further reduced in powder snow or during snow storms. Vehicle operators cannot anticipate where visitors will be during closed hours; this creates the potential safety hazard. In 1998, the GNF issued a further order prohibiting uphill travel, except when riding lifts within the SUP boundary, 24 hours per day (Use Restriction Bridger Bowl Ski Area Order Number 98-11-06-02, December 18, 1998).

Bridger Bowl has given an easement to the Forest Service across their private lands for access to NFS lands within the SUP boundary. This access is primarily for administration and management activities. On NFS lands, this road is designated Forest Service Road (FSR) 3200. FSR 3200 also provides summer access to NFS lands near Bridger Bowl. Under the terms of the SUP, the Forest Service retains the right to use or permit others to use any part of the permitted area, including FSR 3200, provided such use does not interfere with the right and privileges authorized by the SUP to Bridger Bowl. Interference can include affecting the safe operation of the permitted facility. The determination of interference is at the Forest Service's discretion. Because the road is used as a groomed ski run in winter, the aforementioned 1998 use restriction order effectively closed FSR 3200 beyond the plowed portion of the road during the operating season of the ski area except to users under permit authorization.

Forest users also access the NFS lands adjacent south and north of the permitted ski area through other private lands near the base area of Bridger Bowl. However, there is no public access across these lands. Private landowners in the area may have allowed access across their lands in the past, but most areas are now closed to access across privately held property. Similar ski terrain is available for backcountry skiing and dispersed recreation use north of Bradley Meadows, including Ross Pass and Saddle Mountain; however, access to these areas is less convenient than it is to those areas adjacent to the Bridger Bowl SUP area.

Recreational snowmobiling is currently prohibited within the Bridger Bowl SUP area, as well as in the Slushman drainage. Due to potential conflicts with Nordic skiers and wildlife, snowmobile use within the South Fork Brackett Creek drainage is discouraged although technically permitted under MA 12. Other dispersed recreation activities that occur throughout the year on public and private property outside the SUP area but within the vicinity including hunting, sledding, hiking/mountain biking, and horseback riding.

Summer Recreation at Bridger Bowl

While no developed recreation activities are offered at Bridger Bowl, the area provides opportunities for a variety of dispersed recreation. FSR 3200 is authorized for summertime use. People often park at the trailhead and hike within and adjacent to the SUP area. Hiking trail #538 traverses the Bridger Bowl permit area from north to south, generally between the elevations of 6,500 and 7,000 feet, crossing numerous existing lift and trail alignments. Summer use of this trail segment has increased over the past few years as it is often accessed by hikers and mountain bikers (Bridger Bowl, personal communication, 1998). Additionally, Bridger Bowl hosts a raptor viewing platform from which up to 17 birds of prey species can be seen during their migration south, between late August and early November. The trail to access the viewing platform extends from the top of the Bridger Lift and traverses near the patrol ridge lift to the ridge. This is one of the few renowned flyaway trails in North America, and it receives frequent use in the summer.

3.11 VISUAL RESOURCES

Visual resource management is directed by the Visual Management System[5] and the GNF Forest Plan (Forest Plan). The Visual Management System (VMS) has been used to analyze the visual conditions on National Forest Service lands (NFS) at Bridger Bowl. The VMS helps establish Visual Quality Objectives (VQOs) for various landscapes and helps define how the landscape will be managed, the level of acceptable modification in the area, and under what circumstances modifications may be allowed. VQOs range from Retention to Unacceptable Modification.

The Retention VQO provides for management activities that are not visually evident when compared to the characteristic landscape. Partial Retention indicates that management activities remain visually subordinate to the characteristic landscape. Under the VQO of Modification, management activities may visually dominate the original characteristic landscape, but alterations must borrow from naturally occurring forms, colors, or textures so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area. Maximum Modification is defined as areas where management activities may dominate the characteristic landscape. When viewed as foreground or background, activities may not appear to completely borrow from naturally established form, line, color or texture; however, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding landscape. Unacceptable Modification exists when the overall extent of management activities is excessive and poorly related to scale of landform and vegetative patterns in characteristic landscape.

Viewing distance is important in determining how change is perceived across a landscape. In addition to VQOs, the VMS also uses distance zones to describe the part of a characteristic landscape that is being inventoried or evaluated. The three distance zones are described below.

Foreground: The limit of this zone is based upon distances at which details can be perceived. Normally in foreground views, the individual boughs of trees form texture. The foreground is limited to areas within and not to exceed ½ mile of the observer, but it must be determined on a case-by-case basis, as any distance zoning should be. Generally, detail of landforms and special landscape features (including human alteration) are more pronounced when viewed within the foreground.

Middle ground: Alterations in the middle ground (½ to four miles from the observer) become much less distinct. Texture normally is characterized by the masses of trees in stands or uniform tree cover. Individual tree forms are discernable in very open or sparse stands only.

Background: As the perspective shifts to the background, distance has a modifying and diluting effect to both landscape texture and color. This zone extends from the middle ground (minimum of four miles between the observer and the area being viewed) to infinity. In very open or sparse timber stands, textures begin to be lost. Shape, however, may remain evident beyond 10 miles, especially if it is inconsistent with other landscape forms. Beyond 10 miles, alteration in landscape character becomes obscured.

[5] Agriculture Handbook 462

The Forest Plan provides visual resource management and direction for activities that may alter the natural landscape (USDA, 1987, p. II-3). The Forest Plan establishes a range of VQOs for individual Management Areas (MAs) within the GNF (USDA, 1987, p. II-16), and those are further refined by the VQO polygon map. Bridger Bowl's current SUP area is allocated as MA 2. The proposed Slushman expansion area is also designated MA 2. The proposed northern expansion areas into SF Brackett Creek are within MA 12. Although GNF standards do not apply to adjacent private lands, these areas still meet VQOs, which are applied to observers along BCR.

The VQOs assigned to the Bridger Bowl SUP area is Partial Retention on the developed ski slopes (USDA, 1987, p. III-4). The VQO standards for MA 12 range from Retention to Partial Retention (USDA, 1987, p. III-37). The Forest Plan Visual Quality Objective Map (revised July, 1987) indicates that the proposed expansion area to the north is designated Retention on the upper slopes (above Bradley Meadow). As a result, facilities in this area must be harmonious with the landscape for those users within the SUP and observers along BCR.

Scope of the Analysis

The visual resource study area for Bridger Bowl is the ski area as viewed looking west from Bridger Canyon Road (BCR). The critical viewing area analyzed in this SDEIS include areas along BCR from approximately three miles south of the Bridger Bowl access road to two miles north of the access road (see Figure 4-5). The existing ski area can be seen directly from this area. The ski area is seen by highway travelers in both directions, homeowners with westward views, and recreationists along BCR and in the Bangtail Mountains.

The Study Area can be classified into three elevation zones. These areas are considered middleground as viewed from BCR. The upper zone is characterized by the rocky cliff areas extending along the ridge and upper elevations of the ski area. Saddle Mountain and the ski area ridge are the prominent landmarks. The rocky cliff area is characteristic of the entire Bridger Range. Peaks to the north, including Sacajawea Mountain exhibit similar characteristics. The rocky cliff areas are aligned in vertical patterns from the summit to the tree line. Natural vegetation openings caused by snow slides also reflect this vertical pattern.

The middle zone is comprised of a mix of open grassy meadow and closed canopy of spruce and fir trees. The area to the south of the existing SUP is comprised primarily of open meadow with widely scattered individual trees. The openings for developed trails within the existing ski area mimic this pattern. Ski area activities have been part of this setting for over 40 years and are not readily apparent; in fact, they are subordinate to the landscape character. In summer, lift access roads are visible to the stationary observer. The east facing ridge and Bradley Meadows area are characteristic of the mix of openings and tree cover on the northern portions of the study area. The lower zone includes existing base area facilities and parking lots that are not visible from BCR.

The foreground viewing zone, as viewed from BCR includes a mix of tree cover and a few meadow openings, primarily agricultural areas.

3.12 SOCIO-ECONOMICS

This section summarizes current socio-economic data relevant to the proposed project, including data on population, housing, local economic activity, and fiscal information pertinent to Bridger Bowl. The City of Bozeman and the surrounding Gallatin Valley area are considered the primary socio-economic impact area.

Bozeman is the Gallatin County seat and the home of Montana State University. Yellowstone National Park and the GNF are located nearby. The city is located along Interstate 90, in a high mountain valley at an elevation of 4,795 feet above sea level, and is the site of several cultural activities and attractions.

Agriculture is the primary industry in Montana, but Gallatin County also has over three thousand business, including science and technology, recreation, tourism, education, and manufacturing. The work force is rated as well-educated, with 49.5 percent of Bozeman's population holding a college degree, and 73.7 percent having participated in some post-secondary education (Gallatin Development Corp., 2000).

Population

Historic, current, and projected population data for Gallatin County and the City of Bozeman are presented in Table 3.12-1. The county ranks as the fifth highest populace in the state with a population of 64,831 in 2000. Gallatin County has experienced considerable growth in the past decade, with steady growth expected into the next century. Ninety percent of Gallatin County's residents live either in Bozeman or within a thirty-minute drive of the city. The population is very homogenous, with fewer than five percent of residents of non-white ethnicity.

Table 3.12-1
County and City Population Figures

				Projections 2005-2015		
	1990	1995	2000	2005	2010	2015
Gallatin County	50,463	59,578	64,831	69,720	74,310	78,830
Percent change	-	18.1%	8.8%	7.5%	6.6%	6.1%
Bozeman	22,660	27,776	27,509	-	-	-
Percent change	-	22.6%	-1.0%	-	-	-

Sources: US Bureau of the Census, MT Dept. of Health & Human Services, Woods & Poole Economics, Gallatin Development Corp.

Housing

Characteristics of the housing supply in Bozeman are presented in Table 3.12-2. The City of Bozeman and its surrounding area are primarily year-round residential, with relatively little seasonal or occasional-use housing compared to other ski resort areas. As of 2000, less than two percent of the housing units in the area were designated as seasonal or occasional-use. The overall vacancy rate as of 2000 was only 5.9 percent. These numbers reflect the fact that Bridger

Bowl largely serves the local population as its primary market, with destination visitors accounting for a much smaller share.

Table 3.12-2
Housing Supply Characteristics for 2000

	Bozeman City	Bozeman Suburban Area
Total housing units	11,577	16,283
Occupied owner	6,859	5,780
Occupied renter	6,218	5,940
Vacant	718	966
Seasonal	175	282
Total vacancy rate	6.2%	5.9%
Median value owner occupied	$137,300	$151,400
Median contract rent	$494	$498

Source: US Bureau of the Census

The average sales prices of single family homes in the Bozeman area have roughly doubled between 1990 and 1997 according to data from the Gallatin Association of Realtors. Average home prices in the city have gone from about $70,000 to almost $140,000 in the past ten years, while homes in suburban Bozeman increased from about $80,000 to around $150,000. Average sales prices for homes with more than an acre of land in suburban Bozeman have gone from roughly $130,000 to about $240,000 in the same time frame.

Annual building permits for construction of new residential homes increased from fifty-eight million dollars of new residential construction in 1998 to over seventy-three million dollars in 2001, peaking at over eighty million dollars in 1999 and 2000. The new construction represents mostly single-family homes, with a smaller number of affordable-housing units and vacation homes mixed in. Table 3.12-3 lists the total number of housing starts and value of building permits from 1998 to 2001.

Table 3.12-3
New Housing Starts in Bozeman Jurisdictional Area 1997-2001

	1998	1999	2000	2001
Housing Starts	414	546	415	307
Total Value of Building Permits (in Thousands)	$58,392	$83,830	$81,406	$73,468

Source: Bozeman City/County Planning Office, Gallatin Development Corp.

Employment and Spending

Throughout the last decade, the labor force (i.e., number of people able to work) and the number of people employed in the Bozeman area has increased steadily. The labor force increased by 23 percent from 1995 through 2001. The local unemployment rate has shown a slight decline during the same period, and has been consistently lower than the state unemployment rate. Table 3.12-4 shows labor force and employment figures for 1995-2001.

Table 3.12-4
Bozeman Area Labor Force and Unemployment Rate

Year	Labor Force	Employed	Unemployment Rate	Montana State Unemployment Rate
2001	44,240	43,132	2.5%	4.6%
2000	44,843	43,652	2.7%	5.0%
1999	42,697	41,491	2.8%	5.2%
1998	40,699	39,428	3.1%	5.6%
1997	39,280	38,114	3.0%	5.4%
1996	37,849	36,886	2.5%	5.3%
1995	36,091	35,121	2.7%	5.9%

Source: Montana Department of Labor and Industry, Gallatin Development Corp.

Table 3.12-5 displays the 2001 employment and wage information by major industry group in Gallatin County. The table reflects the diversity of employment characteristics for the county, with 27 percent of the labor force in the retail trade category, 24 percent in services, 21 percent in government, and 9 percent in manufacturing. Montana State University is the single largest employer in the area, with approximately 2,000 people on the payroll.

Table 3.12-5
Gallatin County Average Employment Characteristics 2001

Industry	Employment	Wages	Per Worker
Agriculture, Forestry, Fish*	478	$7,800,147	$16,318
Mining*	68	$1,942,393	$24,728
Construction	2,863	$79,700,194	$27,838
Manufacturing (including Technology)	2,763	$79,231,788	$28,676
Transportation, Communication, Utilities*	1,011	$27,351,922	$27,054
Wholesale Trade	1,329	$38,198,118	$28,742
Retail Trade	8,697	$133,698,981	$15,373
Finance, Insurance, Real Estate*	1,161	$35,378,294	$30,472
Services	9,202	$204,109,562	$30,472
Government*	6,252	$165,122,177	$26,411

*1999 Annual Averages
Source: Montana Department of Labor and Industry, Gallatin Development Corp.

Bridger Bowl is among the twenty largest private employers in Gallatin County. As shown in Table 3.12-6, Bridger Bowl currently employs 18 people year-round and another 262 people on a seasonal basis, yielding roughly 81 year-round full-time equivalent jobs. Year-round full-time equivalent is based on a 50 week work year and 40 hours per week. Bridger Bowl seasonal employees work roughly 35 percent of the year, with part-time employees estimated to average about 20 hours per week. The ski area's payroll has increased by approximately 50 percent since 1990, and it reached $1.9 million in 2002. Based upon data published by the U.S. Chamber of Commerce, it is estimated that the average job in the hotel and amusement industry (which includes ski area employment) generates an additional 1.88 jobs within the socio-economic impact area. Accordingly, it is estimated that Bridger Bowl's total direct and indirect impact on employment in the Gallatin Valley area equates to 526 jobs including full-time, seasonal, and part-time work, or approximately 152 full-time equivalent jobs.

Table 3.12-6
Estimated Employment Derived from Bridger Bowl

Employment Source	Total Employment	Total FTE Employment
Direct employment at ski resort		
Full-time year-round	18	18
Full-time seasonal	60	19
Part-time seasonal	202	44
Total Bridger Bowl employment	**280**	**81**
Indirect employment from spending off-site		
Within Bozeman/Gallatin Valley	526	152

Sources: Bridger Bowl; What 100 New Jobs Mean to a Community, U.S. Chamber of Commerce Economic Policy Division 1993.

Fiscal Considerations

The Bridger Bowl Inc., operator of Bridger Bowl, is a non-profit corporation organized in the state of Montana. In addition to the employment figures noted previously, the ski area distributes revenue to local, state and federal entities as outlined in Table 3.12-7. The total of direct taxes and fees paid in 2002/2003 was just under $273,112.

Table 3.12-7
2002/2003 Taxes and Fees Generated by Bridger Bowl

Taxes/Fees	2002/2003
Forest Service Special Use Permit	$30,005
Federal Unemployment & Social Security	$134,637
State Unemployment	$42,289
State & County property taxes	$64,178
Total	**$273,112**

Source: Bridger Bowl

Ski Area Economics

As noted earlier in this report, roughly 65 percent of Bridger Bowl's skier visits are attributed to local residents, another 10 percent to other residents of the state of Montana, and 25 percent are attributed to out-of-state skiers. As the local population has grown, demand for skiing has grown at a comparable rate. Table 3.12-8 shows operating characteristics for the ski area over the past ten seasons. Bridger Bowl has received sufficient natural snowfall over the course of each season to remain open into early or mid-April; however, opening dates for the ski area have fluctuated greatly, differing by as much as a full month from one season to the next (such as 1994/95 vs. 2002/03), due largely to the timing of natural snowfall. A late start to the season and a limited amount of terrain open during the vacation week between Christmas and the New Year due to a lack of natural snowfall translates to lower skier visit numbers, decreased revenues, and

fees paid, and reduced income for many employees. Weekend traffic (roughly 30 days during the year) accounts for about 45 percent of total skier visits in most seasons, while the other 55 percent is usually spread out over the 85 or so midweek days, including the holiday week between Christmas and the New Year.

Table 3.12-8
Operating Characteristics 1993/94 to 2002/03

Year	Skier Visits	Annual Snowfall	Days Open	Opening Date	Closing Date
2002/03	146,383	238	102	12/26	4/6
2001/02	185,387	266	122	12/7	4/7
2000/01	158,275	182	122	12/8	4/08
1999/00	172,169	242	115	12/17	4/09
1998/99	174,243	323	115	12/10	4/04
1997/98	143,173	286	112	12/22	4/12
1996/97	172,539	373	124	11/29	4/06
1995/96	151,125	227	108	12/22	4/07
1994/95	192,551	365	131	11/25	4/09
1993/94	174,110	230	115	12/10	4/03

Source: Bridger Bowl management

Over the past few years, skier focus groups have identified a quality recreation experience as on with uncrowded slopes, low ticket prices, and access to ridge skiing. These skiers have identified some of the deficiencies in what the Bridger Bowl recreation experience provides. Prior to the completion of the parking expansion, the new base lodge, the ski patrol building, and the remodeling of the Jim Bridger Lodge, base area facilities were over-crowded and unable to accommodate skier visitation during peak days. Generally, the lack of expansion to provide new, different, and varied terrain has hindered Bridger Bowl from meeting the expectations of its skiers. As a result, the resort has faced the potential for reduced economic viability. Refer to the Recreation section (Section 3.10) for more information on this subject.

Emergency Services

Law enforcement to the ski area is provided by the Gallatin County Sheriff. BCR is a State Highway with primary law enforcement by the Montana Highway patrol.

Fire protection is provided by the Bridger Canyon Volunteer Fire Department. Fire equipment is housed at Bridger Bowl in a 1998 expansion of the Bridger Bowl maintenance building. The fire equipment will be housed in this building until 2008, at which time the Fire Department plans to construct another building. Another equipment storage building is located approximately eight miles south along BCR. The Bridger Canyon Volunteer Fire Department has mutual aid agreements with the surrounding fire protection agencies and the GNF. Ambulance Services are provided by private operators under contract to Gallatin County.

Bridger Bowl ski patrol consists of 28 full and part time patrollers. The Bridger Bowl ski patrol provides rescue assistance within the SUP boundary. The ski patrol also provides avalanche hazard reduction activities within the SUP area.

Environmental Justice

As directed by the Civil Rights Act of 1964, NEPA, and Executive Order 12898, all federal actions, programs, and policies shall identify and prevent and/or mitigate, to the greatest extent practicable, disproportionately high and adverse human health and environmental effects on minorities and low-income populations. Table 3.12-9 shows population statistics within Gallatin County and Montana. As shown in Table 3.12-9, the total minority and low income populations in the social and economic analysis area (Gallatin County) are comparable to those in the state of Montana as a whole(U.S. Census 2000). At the census tract level, several areas within the city of Bozeman have poverty levels significantly higher than those of the state or the county (up to 30 percent) (US Census 2000). No concentrations of minority populations were found at the census tract level (US Census 2000). More detailed information used in this analysis is available in the project file.

Table 3.12-9
2000 Population Statistics for Gallatin County and Montana

	Gallatin County	Montana
Race		
White	96.2%	90.6%
Black or African American	0.2%	0.3%
American Indian and Alaska Native	0.9%	6.2%
Asian	0.9%	0.5%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%
Some other Race	6.9%	0.6%
Two or More Races	1.2%	1.7%
Hispanic or Latino[6]	1.5%	2.0%
Living Below Poverty Level	**12.8%**	**14.6%**

Sources: US Bureau of the Census

The analysis area is not in close proximity to any American Indian Reservations. As described in Section 3.9, no past or current traditional American Indian uses have been identified near the analysis area.

A complete discussion of dispersed recreation on NFS lands in the vicinity of Bridger Bowl is included in Section 3.10. Dispersed recreation may provide alternative recreational opportunities to low-income individuals who cannot afford to ski at Bridger Bowl.

[6] As defined by the US Census Bureau, "People who identify their origin as Spanish, Hispanic, or Latino may be of any race."

3.13 TRANSPORTATION

3.13.1 RESORT ACCESS

Bridger Bowl is approximately 15 miles northeast of Bozeman, Montana. It is accessible by driving north on State Highway 86, which is also known as Bridger Canyon Road (BCR). BCR is maintained by the Montana Department of Transportation (MDT) and patrolled by the Montana Highway Patrol. The road begins at the intersection of North Rouse Avenue and Griffin Drive in the northeast portion of the City of Bozeman, and extends for approximately 14.5 miles to the intersection of the Bridger Bowl access road. BCR continues past the Bridger Bowl access road and eventually leads to the community of Wilsall where the road intersects US Highway 89, approximately 22 miles beyond the turnoff to the ski area.

BCR is a two-lane paved roadway between Bozeman and the ski area turn-off. The road traverses rolling terrain and gains approximately 1,200 feet of elevation between Bozeman and the ski area turnoff. The road is equipped with yellow centerline striping and white shoulder stripes that delineate the two 12-foot wide driving lanes. The posted speed limit at the West End of Bridger Creek Road is 35 mph, transitioning to 45 mph, and then to 70 mph by the time it crosses the Bridger Creek Bridge.

There are two additional major "T" intersections along the upper portion of BCR at the junctions with Kelly Canyon Road and Jackson Creek Road. BCR is the principal access road serving the residents living in Bridger Canyon, Kelly Canyon, and along Jackson Creek. There are more than 100 driveways accessing BCR between its intersection with Rouse/Griffin and the Bridger Bowl access road.

The Bridger Bowl ski area is accessed by Forest Service Road (FSR) 3200, which is a two-way gravel road from BCR. It extends generally to the west, leading to the ski area parking, administrative offices, and maintenance area. The easternmost portion of this road is also used to access the Bridger Pines Subdivision, which is located adjacent to and northeast of the ski area. As the access road nears the parking area, the two-way operation of the road changes into a one-way loop that circles the parking area in a counter-clockwise direction. A pullout area has been provided for skier drop-off at the top of the loop near the main day lodge. FSR 3200 also continues through the developed ski area and provides additional access onto NFS lands.

3.13.2 TRAFFIC

General Traffic Volumes for Bridger Creek Road

MDT collects traffic volume data at several locations on Bridger Creek Road (BCR) as part of their statewide traffic counting program. The 1999 EIS used MDT data from 1995 and 1996 as well as traffic count data conducted specifically for the document in 1997. The most current data available are the Average Annual Daily Traffic (AADT) volumes for 1997-2002 collected by MDT. A combination of data has been used in the SDEIS. Each piece of data collected by MDT and sub-contractors for the 1999 DEIS is correct based on its particular source and intended function. Due to the way the data was collected and used, the numbers between the data sets should not necessarily be compared on a one-to-one basis to determine accuracy or validity.

Three monitoring sites have been identified as best representing traffic along BCR as a result of Bridger Bowl. These three sites are included in the table below and throughout the analysis.

Table 3.13-1
BCR Average Annual Daily Traffic Volumes 1997-2002

Year	MP-8 near Kelly Canyon	MP-15 south of Bridger Bowl	MP-17 north of Bridger Bowl
1997	2,090	NA	NA
1998	2,580	730	540
1999	2,000*	810	570
2000	1,770	820	620
2001	2,670	820	590
2002	2,400	910	650
AAGR	2.1%	4.9%	4.3%

* Estimated based on pre-1997 traffic counts
Source: Montana Department of Transportation

Historic data collected by the ski area provides background information about the magnitude and frequency of peak ski days at Bridger Bowl. Weekend and holiday use is significantly greater than typical weekday levels. One exception to this is the week between Christmas and New Year's Day when the mid-week activity is higher than typical weekdays. Otherwise, peak ski days occur on Saturdays and Sundays. As displayed in Table 3.13-2, traffic count data collected follows this trend (Peccia, 1997).

Table 3.13-2
BCR Peak Hour Traffic Volumes p.m.

	Week Day (vehicles per hour)	Weekend Day (vehicles per hour)
MP-8	504	813
MP-15	387	720
MP-17	70	70

Source: Robert Peccia and Associates Inc., 1997

Level of Service

A Level of Service (LOS) analysis was performed on several segments of BCR and on the major intersections along BCR to determine the impacts of the current operation at Bridger Bowl. The LOS analysis was performed in accordance with the methods outlined in the Transportation Research Board's *Highway Capacity Manual, Special Report 209*. Traffic facilities are graded in the LOS analysis based on their performance and ability to handle the traffic volumes. The results of the LOS analysis are presented in the form of a grading system ranging from A through F.

LOS for a road segment is primarily a function of the number of travel lanes, grades, and passing availability based on passing sight distances and opposing traffic volumes. The LOS at an

intersection is primarily a function of the number of approach lanes, turning movement volumes, and amount of opposing traffic. A facility that receives a LOS A is considered to operate very well with little or no traffic congestion or vehicle delay. A LOS F rating is an indication of system failure or a saturated condition producing significant amounts of traffic congestion and vehicle delay. LOS C or better is desirable, LOS D is considered borderline, while LOS E and F are considered unacceptable.

The LOS analysis on BCR was performed using the peak AM and PM traffic data that included traffic from Bridger Bowl. The analysis was performed using both weekday and weekend traffic conditions. Bridger Bowl traffic used in the analysis represents average peak weekend and weekday conditions. The peak hours used in the analysis correlated to the peak hours of traffic generation at Bridger Bowl. The results of the LOS analysis for the road segments are presented in Table 3.13-3 and the results of the intersection analysis are shown in Table 3.13-4.

Table 3.13-3
Road Segment Level of Service (LOS) Analysis

Segment of BCR	Week Day Peak Hour (p.m.) (without/with ski area traffic)	Weekend Day Peak Hour (p.m.) (without/with ski area traffic)
Kelly Canyon Rd. to Jackson Creek Rd.	LOS B / C	LOS B / D
Jackson Creek Rd. to Bridger Bowl Access Rd.	LOS A / B	LOS A / D

Source: Robert Peccia and Associates, Inc.

The results of the road segment Level of Service analysis indicate that the traffic generated by the ski area increases the traffic on BCR. The resulting LOS B or C on a typical weekday is considered to be acceptable operation for a two-lane highway. Weekend service levels with ski area traffic during peak hours fall to a LOS D.

Table 3.13-4
Intersection Level of Service Analysis

Intersection	Week Day Peak Hour (p.m.) (with/without ski area traffic)	Weekend Day Peak Hour (p.m.) (with/without ski area traffic)
Kelly Canyon Rd. & BCR	LOS A/A	LOS A/A
Jackson Creek Rd. & BCR	LOS A/A	LOS A/A
Bridger Bowl Access Rd. & BCR	LOS A/A	LOS A/B

Source: Robert Peccia and Associates, Inc.

The intersection analysis reveals that without Bridger Bowl traffic, the three main intersections along BCR are functioning at an acceptable LOS A. On days when Bridger Bowl is experiencing peak activity, all of these intersections continue to operate at an acceptable LOS B or better.

Traffic Safety along BCR

Traffic safety data is also collected by MDT. Information was gathered and made available for Highway 86 from Bozeman to the Bridger Bowl access road for July 1, 1998 through June 30, 2003. Over the course of this time period, 185 incidents were recorded. These traffic incidents did not necessarily result in injury or fatality. Approximately 101 of these incidents involved one vehicle only, while the others involved two or more vehicles.

Of these reported incidents, approximately 45 percent occurred during the spring, summer, and fall months, while approximately 55 percent occurred in the winter months during which Bridger Bowl operates (mid-November through mid-April). Approximately 115 of theses incidents occurred during the day, while 54 occurred at night, and 11 occurred at dawn or dusk. The other five incident times were not reported. General categories were developed based on tracking information to describe the reason for the traffic incident. Approximately 76 incidents were the result of careless driving, 24 incidents were related to driving too fast, and 22 were alcohol or drug related. The remainder of these incidents falls into the other category, or the reason was not recorded at the time of the incident.

Bridger Bowl Access Road

Historic data at the ski area indicates that over the past ten years the average peak skier day has been 3,389 skiers. Peak morning traffic occurs between 8:30 a.m. and 9:30 a.m., while peak afternoon traffic impacts occur between 4:00 p.m. and 5:00 p.m. Based on this data, an AVO of 2.8, and typical levels of bus transport, it was determined that the number of vehicle trips that would be generated on a peak ski day with 3,389 skiers would be 671 vehicles per hour on the Bridger Bowl access road. This traffic volume reflects the traffic generated by the ski area traveling in both directions on the access road during the peak hour of a peak day.

A separate analysis was also conducted to assess the traffic impacts that would occur on a typical weekday (non-holiday) resulting from average peak weekday ski activity at Bridger Bowl. It was estimated that 1,600 skiers are present on an average peak week day that is not a holiday. This level of activity generates a peak hour traffic volume of 317 vehicles on the Bridger Bowl access road.

3.13.3 PARKING

Bridger Bowl hired an engineer to design a parking expansion to meet the criteria set forth in the Bridger Canyon Zoning Ordinance. In 2000, the resort expanded its parking facilities on adjacent private lands. Parking must accommodate guests, buses, employees, and ski area related vehicles (including service and maintenance vehicles). Available space varies during the ski season depending on snow depths and snow storage. Parking space can be reduced during the heaviest snowfalls, as well as through accumulation of snow as the season progresses. By early spring, snow storage can eliminate up to 20 percent of the total available parking in the lot. However, reduced space availability is not usually a problem during the height of the season (Christmas/New Year's holiday). Individual vehicle parking habits can also affect the availability of space in the lot on any given day since spaces in the lot are not marked. In the event that demand exceeds supply, guests park along the Bridger Bowl access road.

Ski Area Vehicle Occupancy

Maximum parking lot vehicle counts were compared to total ticket sales and season pass usage for three weekdays in February 1997 to determine a skier-to-vehicle rate for Bridger Bowl. This rate is used to estimate parking requirements for the ski area. Based on this comparison, the actual weekday skier-to-vehicle occupancy rate was determined to be 2.4 skiers per vehicle. A similar comparison of several weekend days during the past several years resulted in a rate of 2.7 skiers per vehicle. These rates are similar to those of other ski areas in the west, which typically average about 2.7 skiers per vehicle. Overall, Bridger Bowl's vehicle occupancy is a function of the ski area's local draw, and the fact that the drive from Bozeman to Bridger Bowl is a short and easy drive, which provides little incentive for skiers to carpool, and creates more demand for parking at the resort.

Transit Service

Several types and sizes of buses bring skiers to Bridger Bowl throughout a typical ski season. On school days (not weekends or holidays), one to three school buses bring kids from various school systems in the state to the ski school at Bridger Bowl. Local buses also carry kids from nearby areas to the ski area on Saturdays, Sundays, and holidays.

3.14 INFRASTRUCTURE AND UTILITIES

Introduction

The study area for infrastructure and utilities is the public and private lands associated with Bridger Bowl. This analysis also describes the electric power line that runs from the town of Bozeman along Highway 86 to the ski area.

Forest Plan Direction

There is no specific Forest Plan direction related to infrastructure and utilities. As a result, this analysis describes the existing conditions at Bridger Bowl with respect to water (domestic and wastewater), power (electric), fuel storage, and mountain access roads.

Domestic Water

The base area at Bridger Bowl utilizes one well for the Jim Bridger Lodge, the ski patrol building, and the new lodge, which is currently under construction. The water supply system consists of a well and pump, chlorination system, and a 3,400-gallon holding tank. An additional pump will be installed to direct water to the new lodge as well as a backflow preventer and two 300-gallon pressure tanks. The well produces at 34 gallons per minute (gpm) and is capable of supplying up to 22,440 gpd during regular hours of operation. Based on data collected between the 1989/90 and 1998/99 seasons, average water consumption per skier per day was 3.5 gallons as measured at the wastewater treatment plant. In 2002, waterless urinals were installed in the Jim Bridger Lodge, and as a result of this and other water conservation efforts, water use has been reduced to three gallons per skier per day (Bridger Bowl management, 2003). In a conservative estimate using the 3.5 gallon rate, the existing well can accommodate approximately 6,400 people per day, which is in excess of the existing demand at the resort. Recent water sampling (conducted in May, 2002) resulted in measured Nitrate/Nitrite levels of 0.71 mg/L (Montana Microbiological Services, June 2002). The Federal water quality standards for nitrate and nitrite are a maximum of 10 mg/L, respectively (EPA, 1986).

The Deer Park Chalet has its own well with a sustained yield of 20 gpm. This system also has a 3,900 gallon storage reservoir and two pressure tanks to service the facility. This well was also tested for nitrate and nitrite in 2002; analysis showed in measured Nitrate/Nitrite levels of 0.71 mg/L (Montana Microbiological Services, June 2002).

According to water use meters at the resort, Bridger Bowl utilized a total of approximately 770,000 gallons of potable water during the past fiscal year.

Wastewater

The Deer Park Chalet has its own re-circulating sand filter treatment system, which was built in 1996 to accommodate approximately half of anticipated visitation at the time. The system includes a tank with a minimum volume of 9,450 gallons, a 2,880 gallon pump chamber, a 32 feet by 56 feet re-circulating sand filter, a 7,080 gallon re-circulating tank, and a 2,880 gallon dosing tank, which pressure doses a drain field adjacent to the base area's drain field with 2000 lineal feet of distribution line.

In August 2001, Bridger Bowl received permission from the Montana Department of Environmental Quality (MDEQ) to construct a re-circulating sand filter wastewater treatment system with a capacity to serve approximately 5,400 skiers per day. This system was constructed and incorporated into the existing wastewater treatment system in 2002 to serve the ski area. The system uses one 22,000-gallon septic tank and a pump to transport effluent to the re-circulating sand filter system located approximately 150 feet south of the Sunny Side trail. Effluent is treated twice, and then 20 percent is discharged to the ground via a pressure dosed subsurface drain field. The remaining 80 percent is treated one more time and then discharged to the drain field.

Power

Electric power is distributed to Bridger Bowl via Northwestern Energy. An overhead power line extends from the town of Bozeman along Highway 86 to the ski area. Once the line enters the ski area, it delivers power using lines owned by Bridger Bowl to each of the lifts and facilities via underground and overhead distribution cables. The primary buried power line originates in the base area and continues up Trail 61 before splitting and stepping down at the primary metering can and disconnect at the junction of trails 61 and 62. From this junction, three spurs distribute power to the ski area facilities via the Bridger Bowl power line system. The southern spur follows an existing mountain access road to provide power to the top terminal of the Virginia City lift and the bottom terminals of the Pierre's Knob and Deer Park lifts. The northern spur follows the mountain access road to provide power to the top terminal of the Powder Park Lift and continues down Trail 52 to power the lower terminal of the Alpine Lift.

The third spur power line breaks from the northern spur directly below the Bridger Lift bottom terminal. This buried line provides power to the Bridger Lift bottom terminal and then continues up the lift corridor to provide power to the upper terminals of both the Bridger and Deer Park lifts. An overhead line transmits power from a connection to the north spur along the Bridger lift at the 7,400 foot elevation, crossing over the lower North Bowl and 3 Bears run to the top of the Alpine Lift.

Each of the base area facilities uses electricity for lighting. At the Deer Park Chalet, electricity is also used for heating and cooking purposes. Over the past several years, Bridger Bowl has had an average utilization of approximately 1,406,000 kilowatts of electricity per year.

Fuel Storage

At the maintenance shop, there is one 3,000-gallon fuel storage tank, which has two separate compartments for diesel and gasoline storage. One compartment is 2,000 gallons in size and holds diesel required for the operation of resort vehicles. The other 1,000-gallon compartment holds unleaded gasoline.

Each lift is typically run on electricity, but also has an auxiliary power unit (APU) in case of a power failure or mechanical breakdown. Many of these APUs are diesel although some are powered by gasoline. These units are run for approximately one hour per week to keep them in operating condition in case of actual need.

There are also two propane storage tanks in the base area. The resort's propane supplier is AmeriGas. One 1,000-gallon tank is adjacent to the maintenance shop. This tank is refilled four or five times a year. A 30,000-gallon tank serves both day lodges. This is utilized for heat and as a cooking power source in the resort's kitchens.

Mountain Access Roads

Due to the extent of the ski area, there are three primary mountain access roads that fork off the Bridger Bowl access road within the SUP area. These roads are utilized during the summer for lift maintenance access. One road goes to the top of the Alpine Lift. Another travels to the top of the Bridger Lift and also accesses Deer Park Lift. The third road accesses Pierre's Knob. Total existing Forest Service, Bridger Bowl roads, and other private roads within the Study Area equal approximately 15.9 miles.

3.15 NOISE

Sound travels through the air as waves of minute air pressure fluctuations caused by vibration. In general, sound waves travel away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the source. Sound levels at different distances can also be affected by factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease noise levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) can also affect the degree to which sound is attenuated over distance. For a given noise source, additional factors affecting the noise impact at a receiver include who is listening, existing sound levels, how long and when the noise event takes place.

The primary sources of noise at Bridger Bowl include construction and maintenance activities, vehicular traffic, explosives used for avalanche hazard reduction activities and trail modifications, and snowmaking. Daytime operations (of lifts and facilities) during the winter create minimal noise. Snowmaking equipment is typically operated at night and occurs for a short duration during the early season. Avalanche hazard reduction through the use of artillery and other explosives cause short sporadic noise that is very loud and can be heard throughout the Bridger Canyon. Bridger Bowl is in a fairly remote forested area that is moderately populated; however, noise from the ski area can occasionally be heard in areas outside the SUP boundary, in private residences located in and adjacent to the base area of the resort.

The Montana State Code does not have any known noise rules or regulations. Additionally, there are no known noise ordinances or regulations in Gallatin County; therefore, there are no noise restrictions for the operations at Bridger Bowl.