Smoky Canyon Mine
Panels F & G Draft EIS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 3
Affected Environment

3.1 Geology, Minerals and Topography

3.1.1 Regional Geologic Setting

The Study Area is within the middle Rocky Mountain and Basin and Range physiographic provinces and is in the central part of the Over-Thrust Belt, a major orogenic zone extending through the North American continent in a general north-south trend. **Figure 3.1-1** shows the general geology map of the Project Area (**Figures 3.1-2** and **3.1-3** are east-west cross sections through the Panels F and G areas).

Rocks present in the Study Area are marine sediments deposited during Mississippian, Pennsylvanian, Permian, and Triassic time in a basin that extended across much of eastern Idaho, northern Utah, western Wyoming, and southwestern Montana. Carbonate deposition gave way to deposition of fine-grained clastic material in a deep water setting, which included deposition of reduced sulfide and organic rich, black shales. The Middle Permian Phosphoria formation is present over a wide area of this basin and comprises one of the largest resources of phosphate rock in the world with the richest phosphorite accumulations being found in the Meade Peak member in southern Idaho and western Wyoming (Perkins and Piper 2004).

Compressional forces during the Cretaceous Period resulted in major folding and faulting of the Paleozoic and Mesozoic sediments throughout the Rocky Mountain region. These sediments were folded on a regional scale into north-south trending anticlines and synclines that expose the phosphate resources within the Meade Peak member of the Phosphoria formation along steeply dipping fold limbs. Rocks outcropping in the Study Area lie within the Meade thrust plate, one of several thrust plates developed as part of the Rocky Mountain Overthrust Belt (Evans 2004). Sedimentary rocks were thrust an estimated 18 to 20 miles along bedding planes during early compression associated with the Laramide orogeny, with subsequent folding late in the single compressive event (Cressman 1964). A number of thrust fault traces are present east of the proposed mine panels. Block faulting began as part of the Basin and Range Province about 17 million years ago and continues to affect the region today.

3.1.2 Stratigraphy

A generalized stratigraphic section for the area is presented on **Figure 3.1-4**. Detailed stratigraphic descriptions are provided by Cressman (1964), Montgomery and Cheney (1967), McKelvey et al. (1959), Lowell (1952), and Deiss (1949). The following are brief descriptions of primary sedimentary units in the Study Area, from oldest to youngest (Maxim 2004a).

Brazer Limestone
The Mississippian Brazer Limestone is about 1,300 feet thick and consists of massively-bedded, cliff-forming, limestone with interbeds of sandstone and siltstone. Some 150 to 250 feet below the top of the Brazer Limestone is a 50-foot thick softer, swale-forming siliceous shale bed. The Brazer Limestone outcrops at the base of the mountain slope east of Panel G (Boulder Creek Anticline) and along Freeman Ridge and Snowdrift Mountain to the west of Panels F and G (Snowdrift Anticline).

Wells Formation

The Pennsylvanian and Permian Wells formation is divided into two members. The upper member is approximately 1,000 feet thick and consists of fine-grained sandstone with interbeds of limestone and dolomite. The 100-feet thick Grandeur Limestone member of the Park City formation is present at the top of this member and is locally mapped as part of the Wells formation. The lower member of the Wells formation is a 500-feet thick medium-bedded, gray cherty limestone with interbeds of sandstone. The Wells formation forms ridges that crop out along the east side of Panels F and G on the east side of the Webster Syncline, and also along the west flank of the Webster Syncline forming Freeman Ridge and Snowdrift Mountain (**Figure 3.1-2**). This thick formation of sandstone and limestone contains the primary regional aquifer in the Study Area with recharge occurring on the mountain slopes and discharge occurring at lower elevations on the east margin of the Webster Range (**Figures 3.1-2** and **3.1-3**). The West Sage Valley Branch and Meade thrust faults shown on **Figures 3.1-1** to **3.1-3** form the eastern boundary of the Wells formation and Brazer Limestone outcrops in the Study Area. The fault planes extend miles to the west in the subsurface beneath the entire Study Area.

Phosphoria Formation – Lower Meade Peak Member

The Permian Phosphoria formation is divided into two members, the Meade Peak member and the overlying Rex Chert. Rocks in the Meade Peak member locally consist of about 75 to 120 feet of dark, carbonaceous, argillaceous and phosphatic shale and mudstone, which host phosphate ore beds. The phosphatic ore is generally found in the Upper Ore and Lower Ore zones, which are separated by the Center Waste Shale. The Upper Ore is overlain by the Hanging Wall Mudstone and the Lower Ore is underlain by the Footwall Mudstone. The Phosphoria formation outcrops on both flanks of the Webster Syncline (**Figures 3.1-1** to **3.1-3**). The overall package of units that comprise the Meade Peak member has low permeability and is not typically water-bearing, except where faulted and fractured. The Meade Peak member generally is considered a barrier (aquitard) to groundwater movement between more permeable units above (Rex Chert) and below (Wells formation). Some zones within the Meade Peak member are known to contain selenium and metals that can be mobilized when exposed to water and oxygen. The contact between the Lower Meade Peak and the underlying Grandeur Limestone is marked by the thin (typically less than 1 foot thick), fossiliferous, grey-black chert known as the 'Fishscale' bed.

The Meade Peak member has been altered in some locations of the Project Area, especially within the Panel F deposit where rocks have been offset along transverse fault structures. Unaltered rock is "hard, carbonaceous, calcareous to dolomitic, and lower in phosphorite than altered phosphorite, whereas the altered rock is partially consolidated, low in organic matter and carbonate, and 3-10 percent higher in phosphate content" (Derkey et al. 1984). Studies by Derkey et al. (1984) and Grauch et al. (2004) suggest that alteration within the Meade Peak member is highly variable and locally gradational. This variation is especially evident within the Center Waste Shale of the Panel F deposit.

Phosphoria Formation – Upper Rex Chert Member

The upper Rex Chert member of the Phosphoria formation consists of about 150 feet of medium-bedded resistant chert and cherty limestone, interbedded with non-resistant cherty shale and mudstone. The resistant Rex Chert forms ridges whereas the Meade Peak Member forms covered swales and slopes. Locally, the Rex Chert is water-bearing and forms part of a local groundwater flow system. In the northern part of Panel F, the Rex Chert is locally replaced by the Franson Limestone member of the Park City formation.

Figure 3.1-1 Surface Geology and Faults

Figure 3.1-2 Panel F Area Cross Section

Figure 3.1-3 Panel G Area Cross Section

Figure 3.1-4 Stratigraphic Section

Dinwoody Formation
The Triassic Dinwoody formation is divided into upper and lower members that together are as much as 1,600 feet thick. It is composed of interbedded, calcareous siltstone, limestone, shale, and clay. The lower member contains more clay and shale beds than the upper member where limestone is more common. The Dinwoody formation outcrops along the western side of Panel F within the Webster Syncline (**Figure 3.1-2**).

Alluvium
Unconsolidated alluvium and colluvium of Quaternary age are present on slopes and along drainages. These deposits consist of gravel, sand, silt, and clay, with widely varying dimensions. In the drainages, thickness of alluvium typically is less than 10 to 20 feet. Greatest thickness of alluvium is assumed to be in portions of Crow Creek Valley.

3.1.3 Structural Setting

Two major thrust plates, the Absaroka and Meade plates, are recognized in the region. Six major thrust faults associated with these plates have been identified to the east of the Webster Range (**Figure 3.1-1)**. The Boulder Creek Anticline and the Webster Syncline are major north-south trending folds existing across the Project Area and were probably formed contemporaneously with thrusting (Cressman 1964, Montgomery, and Cheney 1967).

East-west trending tear faults and normal faults, which probably occurred during Cenezoic-age Basin and Range faulting, offset the thrust faults, fold axes, and individual rock units. Three major normal faults have been mapped in the Study Area: Deer Creek Fault, Wells Canyon Fault, and Sand Wash Fault (**Figure 3.1-1**). These three normal faults extend deep into the sedimentary section. Other normal faults shown on **Figure 3.1-1** have shorter lateral extent. Panel F has experienced greater faulting in the northern part of the deposit. As a result, considerably more alteration is observed in the Meade Peak sediments of Panel F.

Surface outcrop areas of the Wells formation and Meade Peak member of the Phosphoria formation are shown on **Figure 3.1-1**. Panels F and G are located along the outcrop of Meade Peak rocks, with the Wells formation outcropping immediately east of the mine panels. Younger rocks of the Rex Chert member (Phosphoria formation) and Dinwoody formation crop out along the west side of Panels F and G. As shown on **Figure 3.1-1**, the outcrop of units along the Webster Syncline is narrower (i.e., steeper dip of beds) in the Panel G area compared to the broader width of outcrop along the syncline limb west of Panel F.

3.1.4 Seismicity and Geotechnical Stability

Seismicity
The Project Area lies within a Zone III seismic region (UBC 1991) extending from northern Arizona through the Wasatch Front in Utah to the Yellowstone and Hebgen Lake regions in Wyoming and Montana. The Idaho Geological Survey has mapped the southeastern part of Idaho, east of the Snake River Plain as having the highest of three seismic shaking rankings (IGS 2004). About 20 earthquakes capable of damaging structures (greater than 5.0 on the Richter Scale) have occurred within this seismic region from 1880 through 1994 (USGS, BLM, and USFS 1975; UISS 2000).

Although several earthquakes have occurred in recent years, there is no reported evidence they have caused surface features such as scarps, displacement of streams, or creation of sagponds

(USFS 1981; Mariah Associates 1990). USGS (2004a) and Idaho Geological Survey (2004) maps of Quaternary faults do not indicate any such faults being present in the Project Area. The closest earthquake recorded between 1880 and 1994 occurred approximately three miles north of the Smoky Canyon Mine near Draney Peak and had a Richter Scale magnitude of 5.9 (Schuster and Murphy 1996). Other significant earthquakes in the vicinity of the Project Area include one that occurred in 1930 near Grover, Wyoming about 12 miles to the southeast of Smoky Canyon, and two along the Utah/Idaho border in 1914 and 1963. These three earthquakes were assigned intensities (Modified Mercali Scale) of 6, 7, and 7, respectively. An earthquake in the area occurred April 21, 2001 centered about 27 miles northwest of Afton, Wyoming. The preliminary magnitude of this earthquake was 5.3. Within a 100-kilometer radius of the mine site, two additional seismic events that exceed 4 on the Richter scale have been reported since 2001. These include an event of magnitude of 5.4 in 2001 and another registering 4.2 in 2002 (Maxim 2004a).

Geotechnical Stability

Factors related to geotechnical stability of highwalls and overburden disposal site slopes have been identified through past operations at the Smoky Canyon Mine. Factors related to stability of highwalls include the type and strength of rock, degree of rock alteration, steepness of the final highwall slope, presence of any groundwater, spacing and orientation of fractures and faults, and blasting practices. Stronger rock, which is less fractured and altered, will produce more stable highwalls than weaker or more altered or fractured rock. Groundwater discharges from a highwall can also destabilize it. In general, highwalls at Smoky Canyon have proven to be stable over the duration of the mining operations. Mine designs are adapted as needed to respond to indications of highwall instability.

Factors related to stability of overburden fill slopes include the topography of the surface underlying the overburden pile, stress such as shock loading or overloading, slope heights, reduction of material strength by introduction of water, and the scheduling of reclamation contouring. Past instability of overburden fill slopes at the Smoky Canyon Mine has been related to high fill heights and excess water content due to excess incorporation of snow or snow melt into the material. Mine practices have been modified based on experience to preclude future slope failures.

In addition to the geotechnical stability of the mine facilities themselves, the haul/access roads outside the mine panels that are included in the Proposed Action and action alternatives have their own slope stability considerations. Landslide prone soil areas have been mapped in the Soil Survey of the CNF (USDA 1990). Cutslope stability hazard ratings for road construction have been assigned to soil families assuming roads are built on uniform slopes with cuts greater than 5 feet high, a 1H:1v final cut grade, and revegetation following construction. Additional discussion of these soils, and the soils map are found in **Section 3.4** of this document.

3.1.5 Overburden Characterization

Mineralogical and chemical characterization of overburden expected to be produced from the Panels F and G operations has been completed to help anticipate potential environmental effects from handling and disposing of this material (Maxim 2004b and 2004l). Baseline geochemistry analyses of whole rock metal content, acid generation potential, paste chemistry, and total organic carbon content were completed for 225 samples from 52 drillholes, for the purpose of characterizing geochemistry of overburden lithologies and spatial variability in chemistry as a function of geology. The relative volumes of different overburden lithologies are shown in **Table 3.1-1**.

TABLE 3.1-1 PANELS F AND G OVERBURDEN DESCRIPTION

GEOLOGIC UNIT	RUN OF MINE PERCENTAGE
PANEL F	
Chert	37.7
Franson Limestone	3.6
Hanging Wall Mud	5.8
Center Waste Shale	52.9
Total	100
PANEL G	
Chert	37.6
Hanging Wall Mud	10.2
Center Waste Shale	52.2
Total	100

Potential for Acid Rock Drainage (ARD)

ARD is produced when sulfide minerals contained in rock chemically react with oxygen and water to produce sulfuric acid and other reaction products. This acidic condition can lead to the dissolution of metals that are more soluble in water at low pHs. Other minerals in rock (primarily carbonates) can neutralize acid and cause the precipitation or co-precipitation of dissolved constituents. The potential for generation of ARD is a function of the amount of sulfide minerals present in mine waste and the amount of available minerals to neutralize any generated acid (Lapakko 1993). To assess the potential for acid rock generation, the amount of oxidizable sulfide minerals, or Acid Generation Potential (AGP), and the amount of neutralizing materials, or Acid Neutralizing Potential (ANP), in the material being assessed are typically measured. A ratio of these measurements (ANP:AGP) determined by the acid base accounting (ABA) test indicates the potential for acid to be generated. Although any material with an ANP:AGP ratio above 1.0 could be considered non-acid generating, the BLM ARD risk threshold is based on an ANP:AGP ratio of 3:1 (BLM and USFS 2000).

Representative samples of cuttings from rotary drill holes completed in 2001 and 2003 by Simplot were collected to test ANP:AGP of the major stratigraphic potential overburden units proposed to be mined. One of the Panel G Center Waste Shale samples had an ANP:AGP value less than 1 while 7 had values between 1 and 3. The remaining 16 (67 percent) had ANP:AGP values greater than 3. One of the 16 Panel G Footwall Mud samples had ANP:AGP values between 1 and 3. All other Panel G overburden samples had ANP:AGP values greater than 3. Only 5 of 20 altered and 7 of 20 unaltered Center Waste Shale samples from Panel F had ANP:AGP values between 1 and 3. All other Panel F samples had ANP:AGP values greater than 3. ABA data for both Panels F and G were similar and indicated that overburden would not present a significant risk of ARD. These data indicate that local oxidation of sulfide minerals may occur, but the overall ABA value for all overburden indicates it is unlikely to promote ARD. This is in line with conditions at the existing Smoky Canyon Mine and other phosphate operations in southeast Idaho.

Trace Elements and Sources

Selenium and other metals and metalloids occur in the Phosphoria formation in elevated concentrations relative to average crustal abundances (USFS et al. 1976, Desborough et al. 1999, Herring et al. 1999, Munkers et al. 2000).

Assay Data on Selenium

Herring et al. (2000) sampled measured sections in the Phosphoria formation at the Smoky Canyon Mine and assayed these samples for various metals and selenium. They showed selenium occurs in the Meade Peak Phosphatic Shale member of the Phosphoria formation primarily in the Hanging Wall Mudstone, Center Waste Shale and Footwall Mudstone beds where selenium concentrations ranged from 6 to 708 mg/Kg. The selenium concentration in the Rex Chert member was 1 mg/Kg. They also noted that selenium concentrations varied greatly between samples. This variability is due to different degrees of alteration and weathering based on depth below the ground surface and structural features such as fractures and faults.

Munkers (2000) discussed drill core assays of the Phosphoria formation obtained from the Smoky Canyon Mine. These data showed that the largest concentrations of selenium occurred in the Center Waste Shale. Most of these concentrations were below 150 mg/Kg, but three zones in this unit had concentrations as high as 250 to 300 mg/Kg.

Selenium in the Phosphoria formation occurs in several forms. The USGS has identified selenium associated with organic matter (kerogen) in carbon-rich rocks and also with the mineral pyrite (Desborough et al. 1999). Munkers et al. (2000) noted that most of the selenium in the Smoky Canyon Mine rocks occurs as selenide (Se^{-2}) in ionic substitution for sulfur in pyrite; however, native selenium (Se^{0}) has also been identified (Munkers et al. 2000). These forms of selenium are insoluble; however, upon exposure to surface conditions and weathering, selenide and elemental selenium can be oxidized to more soluble forms. In the overburden in the vicinity of Pole Creek north of the Project Area, Möller (1997) found that approximately two percent of the selenium in samples analyzed from the overburden disposal facility occurred as the more soluble form, selenite (Se^{+4}), although its chemical or mineralogical occurrence was not described. The most soluble forms of selenium, selenate (Se^{+6}), and certain organo-selenium compounds are not found in the undisturbed overburden material.

Cadmium commonly occurs in ionic substitution for zinc in the sulfide mineral sphalerite (ZnS). Desborough (1977) found cadmium to occur in sphalerite in the Meade Peak Member in Coal Canyon, Wyoming. Munkers et al. (2000) reported that sphalerite is common in siltstones in overburden samples from the Meade Peak Member collected at the Smoky Canyon Mine. Accordingly, and by extension, it is probable that cadmium occurs in sphalerite in the Middle Waste Shale; however, concentration in organic compounds is also probable.

The mineralogical occurrence of other metals in the Middle Waste Shale has not been well documented; however, Desborough (1977) studied metal occurrences in vanadium-rich zones in the Meade Peak member in eastern Idaho and western Wyoming. He determined that trace elements and metals occurred in sulfide minerals (zinc in sphalerite), oxides (molybdenum, titanium and vanadium), silicates (chromium), and organic compounds (chromium, silver, vanadium), as well as an indeterminate occurrence for nickel. Lead, arsenic, and other metals and metalloids were not studied. A similar diversity of mineralogical and organic-compound occurrences can be assumed, although it has not been documented, for the occurrence of metals in the Center Waste Shale at the Smoky Canyon Mine. The absence of low pH conditions in the overburden, and waters that pass through it, substantially inhibits the leaching and mobilization of most metals and metalloids, other than selenium.

The USGS (Perkins and Foster 2004) studied affinities and distribution of selenium and other elements in the Meade Peak member and determined that, in unweathered rocks, sulfides (mainly pyrite and sphalerite) host the majority of the cadmium, copper, selenium and zinc and a large proportion of the nickel and vanadium. Most of the non-sulfide fraction of these elements in unweathered rocks is associated with organic matter and oxyhydroxides, and a small amount of the selenium is present in elemental form. Silicates and oxides host the majority of the chromium and vanadium in unweathered rocks. In weathered rocks, acid-soluble oxyhydroxides are the primary hosts for all these elements except chromium and uranium, which are associated with relatively stable minerals.

Cadmium, manganese, nickel, and selenium were measured in whole rock assays from Panels F and G samples. Samples of potential overburden were collected as previously described, and assayed to assess the total content of metals and metalloids present in the overburden. A total of 114 samples from drill holes in the proposed Panel F were tested along with 102 samples from Panel G, representing the stratigraphic units that would comprise overburden to be mined under the Proposed Action and action alternatives.

Lithology-related trends in selenium concentration are similar at both Panels F and G with the greatest selenium concentrations observed in Center Waste Shale (**Table 3.1-2**). A greater mean selenium concentration was calculated for unaltered Center Waste Shale compared to altered Center Waste Shale from Panel F. Selenium concentrations decrease in the following order at each lease area; Center Waste Shale > Footwall Mudstone (Panel G) > Hanging Wall Mudstone. Wells formation, Rex Chert, and Franson Limestone (Panel F) had mean selenium concentrations ranging from 1.5 to 3.6 mg/Kg and were considerably lower than the other lithologies (Maxim 2004b).

In **Table 3.1-2**, Franson Limestone is described only for Panel F because it does not occur in the overburden of Panel G. Likewise, Center Waste Shale is present in distinctly different alteration states in Panel F, which is not present to a significant degree in Panel G.

TABLE 3.1-2 WHOLE ROCK SELENIUM CONCENTRATIONS (MG/KG)

	FRANSON LIMESTONE	REX CHERT	HANGING WALL MUD	CENTER WASTE SHALE	CENTER WASTE SHALE (ALTERED)	CENTER WASTE SHALE (UNALTERED)	FOOTWALL MUD	WELLS FORMATION
PANEL F								
Number of Samples	15	20	20	0	20	20	0	19
Minimum	0.7	1.3	2.1		3.4	3.9		0.7
Mean	2.2	3.3	20.7		56.3	87.3		2.6
Maximum	10	5.9	76.5		370	400		7.2
Standard Deviation	2.6	1.3	21.1		82.9	99.5		1.7
PANEL G								
Number of Samples	0	23	18	24	0	0	16	21
Minimum		0.6	2.9	6.4			4.9	0.5
Mean		1.5	12.7	68.3			14.9	3.6
Maximum		3.5	74.5	177			24.9	11.2
Standard Deviation		0.8	16.6	51.2			6.3	3.5

From: Maxim 2004b

Paste Extract Test Data

Electrical conductivity (EC), pH, cadmium, manganese, nickel, and selenium were measured from saturated paste extracts. Samples of potential overburden from Panels F and G were collected as previously described and analyzed to assess which metals and metalloids would be expected to be leachable from overburden. A total of 114 samples from drill holes in Panel F were tested along with 102 samples from Panel G, representing the stratigraphic units that would comprise overburden to be mined under the Proposed Action and Action Alternatives.

Metal concentrations measured in saturated paste extracts were generally low, with many samples having concentrations that were at or below detection limit levels. Cadmium was not detected in paste extracts from any sample (**Table 3.1-3**). Detections of nickel were limited, with only Panel G Center Waste Shale samples registering detections for more than 3 samples.

TABLE 3.1-3 METAL DETECTIONS IN PANELS F AND G SATURATED PASTE EXTRACTS

	FRANSON LIMESTONE	REX CHERT	HANGING WALL MUD	CENTER WASTE SHALE	CENTER WASTE SHALE (ALTERED)	CENTER WASTE SHALE (UNALTERED)	FOOTWALL MUD	WELLS FORMATION
PANEL G								
Number of Samples Analyzed	0	23	18	24	0	0	16	21
NUMBER OF DETECTIONS								
Cadmium (DL = 0.1[1])		0	0	0			0	0
Manganese (DL = 0.1)		13	1	9			0	0
Nickel (DL = 0.1)		0	2	11			1	1
Selenium (DL = 0.01)		0[2]	7	22			6	1
PANEL F								
Number of Samples Analyzed	15	20	20	0	20	20	0	19
NUMBER OF DETECTIONS								
Cadmium (DL = 0.1)	0	0	0		0	0		0
Manganese (DL = 0.1)	0	8	6		0	5		0
Nickel (DL = 0.1)	0	0	0		1	3		1
Selenium (DL = 0.01)	0	0	10		15	19		2

[1] Detection limits reported in mg/Kg.
[2] Selenium was reported at the detection limit in one Deer Creek chert sample.
From: Maxim 2004b

Manganese was not detected in paste extracts from any Footwall Mudstone, Wells formation, or Franson Limestone sample. Mean manganese concentrations for Panel G were the greatest in paste extracts from Rex Chert and Center Waste Shale (0.2 mg/Kg for both rock types). For Panel F samples, Rex Chert had the greatest mean manganese concentration (0.2 mg/Kg).

Selenium was detected most frequently in paste extracts of Center Waste Shale, including altered and unaltered Panel F samples. Selenium was not measured above the detection limit in Rex Chert or Franson Limestone samples. Saturated paste selenium concentrations

(**Table 3.1-4**) generally followed the same trend as whole rock total selenium concentrations (i.e. Center Waste Shale > Hanging Wall Mudstone > Footwall Mudstone > Wells formation ≈ Rex Chert ≈ Franson Limestone). However, for Panel F samples, altered Center Waste Shale produced paste extracts with selenium concentrations that were considerably lower than those of unaltered Center Waste Shale and Panel G Hanging Wall Mudstone (Maxim 2004b).

The USGS (Herring 2004) conducted leaching experiments with Meade Peak rock samples obtained from a number of locations in southeastern Idaho and also noted that less-altered rock tended to produce higher leachate concentrations of selenium and other elements compared to altered rock, which typically had much lower leachate concentrations.

TABLE 3.1-4 SATURATED PASTE EXTRACTABLE SELENIUM CONCENTRATIONS (MG/KG)

	FRANSON LIMESTONE	CHERT	HANGING WALL MUD	CENTER WASTE SHALE	CENTER WASTE SHALE (ALTERED)	CENTER WASTE SHALE (UNALTERED)	FOOTWALL MUD	WELLS LIMESTONE
PANEL G								
Number of Samples	0	23	18	24	0	0	16	21
Minimum		< 0.01	< 0.01	< 0.01			< 0.01	< 0.01
Mean[1]		0.01	0.05	0.31			0.02	0.01
Maximum		0.01	0.44	1.23			0.17	0.01
Standard Deviation		0	0.10	0.39			0.04	0
PANEL F								
Number of Samples	15	20	20	0	20	20	0	19
Minimum	All samples below detection		< 0.01		< 0.01	< 0.01		< 0.01
Mean			0.06		0.11	0.38		0.01
Maximum			0.26		0.71	1.3		0.02
Standard Deviation			0.08		0.17	0.45		0.002

[1] Mean values were calculated using the detection limit (0.01 mg/Kg) for samples with selenium concentrations that were below detection.
From: Maxim 2004b

Electrical conductivity (EC) measurements provide an indication of total solute release from rock samples. Saturated paste EC data indicate that solute release from Panels F and G samples was greatest from Center Waste Shale followed by Hanging Wall Mudstone and Footwall Mudstone. EC was greater in unaltered Center Waste Shale than in altered Center Waste Shale.

Saturated paste pH measurements ranged from 4.9 to 8.7 with mean values for individual lithologies ranging from 6.8 to 8.3. For each lease area, Center Waste Shale samples registered the lowest pH values, and Wells formation limestone registered the greatest, which is in agreement with ABA data.

3.1.6 Applicable Regional and Site-Specific Studies for COPCs

In addition to generally applicable literature for selenium and other COPCs relative to this Project, there are directly applicable, regional, and site-specific studies that are summarized in this section. Taken together, these regional and site-specific studies provide a broad understanding of the sources, release mechanisms, transportation pathways, potential receptors, and known and potential effects of selenium and other COPCs in the phosphate production area of Southeast Idaho. This existing understanding, combined with applicable site-specific data, is the basis for the evaluation of potential environmental effects from selenium and other COPCs for the Panels F and G Proposed Action and Alternatives.

U.S. Geological Survey Regional Studies

In response to a request from the BLM, the USGS initiated in 1997 a series of geologic, geo-environmental, and resource studies in the Western Phosphate Field. The results of these studies have been released in a series of individual publications available from the USGS along with a book that discusses the history, geology, geochemistry, economics, and environmental aspects of the Western Phosphate Field (Hein ed. 2004). The USGS book contains a number of chapters that provide selenium-related information that is generally applicable throughout the phosphate production area of Southeastern Idaho.

The occurrence of various COPCs in the Meade Peak member are discussed in Chapter 8 (Grauch et al. 2004) of the USGS book. Cadmium, nickel, selenium and zinc were found to be most abundant in sulfide mineralization and in oxyhydroxide minerals in more weathered rock. Selenium also appeared to be associated with natural organic materials in the rock. The significance of these findings are that: 1) the COPCs can be transported from the rocks into the environment as dissolved and adsorbed species; and 2) release of these elements from rocks will be strongly dependent on pH, Eh, and exchangeable ion contents in the water pathway.

Presser et al. (2004b) described a number of sites in Southeastern Idaho that have been impacted by selenium released from phosphate mines. Temporal analysis of water quality monitoring at phosphate mines indicated that selenium concentrations at overburden seeps typically varied during the year with peak selenium concentrations often occurring during the spring. This leads to varying selenium concentrations in receiving streams. Selenium concentrations in macrophytes and forage fish from certain locations in Southeastern Idaho were shown to exceed published risk thresholds for higher trophic levels species (USDI 1998). They referred to dietary exposure of selenium leading to the deaths of sheep and horses at six sites since 1996. Selenium concentrations in forage plants on some phosphate mine overburden fills were found to exceed published thresholds for dietary toxicity for horses and sheep with concentrations in alfalfa being greater than grasses.

Presser et al. (2004b) described selenium loading during 2001 and 2002 in the Blackfoot River watershed, which contains most of the phosphate mines in Southeastern Idaho. There was typically little difference between total and dissolved selenium in the water samples, indicating selenium was being transported largely in dissolved species. Selenite represented less than 10 percent of the dissolved selenium, which was typically a mixture of selenate and organic selenide. Over 70 percent of the selenium load in the watershed occurred during the high-flow season, mostly as selenate. During low flow, the organic selenide concentration increased, suggesting elevated biotic productivity and enhanced selenium uptake in food webs. They referred to 1998 risk assessment findings by the IDEQ indicating some stream segments in the Blackfoot River watershed were being impacted by selenium contamination exceeding the EPA Ambient Water Quality Criteria, Freshwater Continuous Criterion Concentration (0.005 mg/L, 40 CFR 131.36).

Stillings and Amacher (2004) presented data collected from a natural wetland formed from phosphate mine drainage. Selenium concentrations at the overburden seep were higher in the spring of 1999 following a winter with heavy snowfall than the following year after a winter with less snowfall. Selenium concentrations in the water decreased with distance from the source while selenium concentrations in wetland sediments were greatest near the source and decreased with distance. This suggests that selenium sequestration in wetland sediments is an important factor for selenium attenuation. Most of the selenium in the sediment was adsorbed and/or coprecipitated with iron oxides, although organic matter also sequestered selenium. Selenium concentrations in wetland vegetation showed a trend similar to the sediment with higher concentrations closest to the source, indicating plant uptake as another factor in attenuation of selenium in the wetland environment.

Hamilton et al. (2004) discussed occurrences of selenium and other trace elements in water, sediment, aquatic plants, aquatic invertebrates, and fish from nine stream sites in the Blackfoot River watershed in 2000. Selenium concentrations in water were below the limit of detection for all sites except East Mill Creek where both the upper and lower sites had selenium concentrations above the 0.005 mg/L water quality criterion. Stream sediment selenium concentrations were also highest in East Mill Creek. Selenium concentrations in aquatic plants correlated well (0.97, $P<0.0001$) with sediment concentrations and indicated selenium transfer from the streams to the local food webs. Selenium concentrations in aquatic invertebrates showed a strong correlation (0.94, $P<0.002$) with concentrations in aquatic plants. Comparison of the invertebrate data with hazard assessment protocols by Lemly (1995) indicated probable adverse effects to larval fish in certain streams. Fish tissue selenium concentrations were highest in speckled dace and lowest in redside shiners. The selenium concentrations in fish tissue followed the same pattern of accumulation as in surficial sediments, aquatic plants, and aquatic invertebrates. The speckled dace is a bottom browser that feeds on invertebrates and plant material. They discussed the importance of collecting data from a variety of ecosystem components (water, sediment, vegetation, invertebrates, and fish) and considering the synergistic effects of all these components when trying to determine if certain aquatic ecosystems are at risk from selenium contamination. They concluded that the available data support the premise that selenium concentrations in several aquatic ecosystem components were sufficiently elevated to cause adverse effects to aquatic resources in the Blackfoot River watershed.

Mackowiak et al. (2004), presented information on uptake of selenium and other COPCs into plants and the implications of this for grazing animals in Southeastern Idaho. Data were presented from samples of vegetation taken at a phosphate mine overburden site, a wetland below an overburden fill, and also from samples taken at undisturbed sites both on and off the outcrop pattern of the Meade Peak member. Plants at the undisturbed sites all had selenium concentrations less than 2 mg/Kg, within the maximum tolerable dietary content (2 mg/Kg, National Research Council 1980) for most classes of livestock, and well below the 5 mg/Kg critical threshold value for animal forage diet (National Research Council 1980). Mean vegetation selenium content from the overburden fill site was 38 mg/Kg. Alfalfa contained nearly 80 mg/Kg, which was about four times more than grasses at the same site. Mean selenium values for legumes, grass and tree species growing on the overburden were all greater than the 5 mg/Kg threshold. In contrast, forb and shrub species had lower mean selenium values close to the threshold. From the data collected, they concluded that forage selenium concentrations from the overburden site were a concern with regard to toxicity effects in grazing animals. Acute or chronic poisoning was predicted for grazing animals selectively ingesting certain high-concentration forage species from several sites at the overburden fill.

The delay in onset of acute poisoning post-ingestion (12 to 36 hours) might result in these animals becoming ill or dying in areas that are away from the primary vegetation contamination areas. They indicated capping seleniferous overburden with non-seleniferous material has merit for long-term mitigation, but studies demonstrating the optimal capping thickness that prevents root penetration into the seleniferous material have not yet been done. Attenuating mobile selenium with iron materials was suggested as being potentially useful for remediation of contaminated sites. They indicated that the lowest-cost method for mitigating accumulation of selenium in forage plants growing on overburden fills was selective control of plant species used in revegetation. Good candidates for low selenium uptake species include certain grasses and native forbs and shrubs. Existing reclamation revegetation on overburden sites can be manipulated with herbicides and physical treatments to change the existing species mix to ones that are more favorable.

University of Idaho Studies

University of Idaho researchers have conducted studies supported by the Idaho Mining Association (IMA) to investigate potential effects of selenium on wildlife and livestock. The results of these studies were not peer reviewed or approved by the BLM, USFS, or IDEQ.

Hardy (2003) studied the effects of dietary selenium on cutthroat trout obtained from the Blackfoot River and the Henry's Lake Fish Hatchery. These fish were studied over a 2 to 2.5 year period at the Hagerman Fish Culture Experiment Station where the fish were raised in a clean environment and fed a diet containing elevated selenium levels.

Fessler (2003) researched selenium toxicity in sheep on reclaimed phosphate mine areas in Southeastern Idaho. The sheep were first all exposed to normal (low) levels of selenium. Then the low and high selenium groups were exposed to selenium forage concentrations on reclaimed phosphate mines that would fall within various published "toxic" levels for four weeks after which they were again grazed on normal selenium forage and water for two weeks (depuration phase). During the study, one of the test groups escaped the enclosure, so the selenium exposure of these animals was uncertain.

Dr. John Ratti collected over 500 bird eggs in 1999 and 2000 from reference sites and drainages affected by phosphate mining sites in Southeastern Idaho (Garton et al. 2002a, 2002b).

Regional Studies by Idaho Mining Association and Idaho Department of Environmental Quality

Following livestock losses associated with excessive selenium uptake in 1996, the five active phosphate mining companies in Southeast Idaho joined together with the IMA to form the IMA Selenium Subcommittee. An Interagency/Phosphate Industry Selenium Working Group was subsequently established to facilitate cooperation between the mining industry, tribal entities, and state, federal, and local agencies. The IMA Subcommittee retained the services of Montgomery Watson, a consulting firm, to conduct a series of regional studies throughout the phosphate mining area of Southeast Idaho with the intent of characterizing the extent and magnitude of selenium and other COPC releases to a variety of environmental media. These investigations included sampling of surface waters, groundwater, sediments, soil, vegetation, aquatic biota, and wildlife for a range of constituents of concern including: cadmium, manganese, nickel, selenium, vanadium, and zinc. The results of these investigations are documented in the following reports:

- Fall 1997 Interim Surface Water Survey Report, Montgomery Watson (1997).
- 1998 Regional Investigation Report, Sampling and Analysis Plan, Southeast Idaho, Phosphate Resource Area, Montgomery Watson (1998).
- Final 1998 Regional Investigation Report, Southeastern Idaho Phosphate Resource Area Selenium Project, Montgomery Watson (1999).
- Draft 1999 Interim Investigation Data Report, Southeastern Idaho Phosphate Resource Area Selenium Project, Montgomery Watson (2000).
- Draft 1999-2000 Regional Investigation Data Report for Surface Water, Sediment and Aquatic Biota Sampling Activities, May – June 2000, Southeastern Idaho Phosphate Resource Area Selenium Project, Montgomery Watson (2001).

The agencies disagreed with some of the content in the last two reports related to the 1999 and 2000 investigations, and these reports were not finalized or approved by the agencies.

The 1997 results from these studies showed that surface water samples collected from or near phosphate mine facilities contained elevated concentrations of selenium with about half the samples exceeding the water quality criterion (0.005 mg/L).

The 1998 studies were expanded to include surface water, groundwater, stream sediments, soils, vegetation, and trout fillets. Over 70 percent of the surface water samples collected at mine sites exceeded the EPA selenium ambient water quality criterion, and 20 percent of the stream samples outside of mine areas exceeded the criterion. Seeps emanating from overburden fills and French drains had the highest concentrations of selenium. In general, sediment, soil, and vegetation sample analyses indicated elevated levels of the COPCs at mine facilities compared to sample locations remote from mines.

In 1999, additional investigations were conducted to collect surface waters at select stream locations and to characterize selenium and cadmium concentrations. Ten of the 12 surface water samples collected in May exceeded the EPA criterion. Investigations of selenium concentrations in elk and cattle tissue were also conducted. The elk liver and skeletal muscle sampling program found that elk harvested by hunters near phosphate mines typically had higher tissue selenium concentrations than those taken away from mines. Of the 160 elk livers analyzed, 156 had liver selenium concentrations less than the maximum concentration observed by IDFG in other parts of Idaho (6 – 7 mg/Kg ww). The four livers with higher concentrations exhibited selenium concentrations ranging from 7.4 to 13 mg/Kg. A screening human health risk assessment indicated there was not a human health concern with consumption of elk liver containing 13 mg/Kg selenium (MW 2000).

In August 2000, the IDEQ took over coordination of future area-wide investigations, for regulatory purposes, to establish agency oversight of investigations and to formulate regional cleanup guidelines to assist lead agencies in implementing future site-specific remedial efforts. The IDEQ subsequently retained Tetra Tech, Inc. to conduct additional area-wide investigations as necessary, conduct an area wide human health and ecological risk assessment, and prepare an area wide risk management plan. Tetra Tech first evaluated the existing data to identify data gaps (Tetra Tech 2001a). Another early product of this work was completion of the conceptual site model for the Project (Tetra Tech 2001b). All the existing information and risk assessment prepared by the IMA was reviewed for applicability in preparing a human health and ecological risk assessment (Tetra Tech 2001c).

The IDEQ ecological conceptual site model is reproduced here as **Figure 3.1-5**. A separate conceptual site model was prepared for the human health risk assessment. The source of the COPCs was identified as phosphate mine overburden. Potential transport media and pathways were described as:

- Wind erosion and dust transportation to eventual deposition on surfaces downwind.
- Percolation of precipitation recharge through overburden to seeps, drains, groundwater, and potentially surface water.
- Storm water runoff transporting dissolved COPCs and particles eroded from exposed overburden surfaces to surface streams and places of sedimentation. COPCs can subsequently be exchanged between surface water and sediments downstream of the sources.

Terrestrial and aquatic plants can uptake COPCs from contaminated water, soil, and sediments. In the case of selenium, its concentration in plants can be greater than its concentration in the water, soil, or sediment. For ecological receptors, the most important exposure pathways (greatest ecological risk) include: ingestion of particles (dust, soil, sediment), surface water, and ingestion of contaminated plants or prey.

Three potentially exposed human populations were identified as recreational hunters and fishers, Native Americans, and subsistence lifestyle receptors. The complete exposure pathways included ingestion of wildlife and cattle that graze on contaminated forage, ingestion of fish taken from contaminated aquatic habitats (water, vegetation, and/or sediment), ingestion of contaminated terrestrial or aquatic plants by Native Americans, and ingestion of contaminated homegrown produce by subsistence lifestyle receptors.

Following evaluation of all data, including that from additional area-wide investigations conducted during 2001, a draft Human Health and Ecological Risk Assessment was released by IDEQ in July 2002 for a formal 45-day public review and comment period. The Final Human Health and Ecological Risk Assessment was released by IDEQ in December 2002 (Tetra Tech 2002a). The 165-page document is a detailed analysis of the area wide data including nine extensive appendices of technical information and responses to public comments. The major conclusions of the risk assessment were:

- There is a low probability of significant human health effects based on current conditions. Potentially significant human health risks were indicated only in the case of subsistence use of resources in a limited number of highly impacted areas, which was considered highly unlikely.

- There is a low probability of population level impacts to regional wildlife based on current conditions and the low percentage of impacted areas in comparison to unaffected surrounding habitat.

- There is a high probability of subpopulation and/or individual effects occurring for ecological receptors residing in the vicinity of highly impacted areas. For example, small animals such as rodents, with home ranges of only a few acres, have a higher probability of adverse effects if they live in impacted areas.

Figure 3.1-5 Ecological Conceptual Site Model

- There is a potential for risks to aquatic and riparian ecological receptors residing in highly impacted areas as indicated by significant exceedances of conservative benchmarks for surface water, sediment, and fish tissue concentrations.

The COPCs for future site-specific studies are: cadmium, chromium, nickel, selenium, vanadium, and zinc. The IDEQ recommended that chromium, nickel and vanadium be excluded from mine-specific surface water and vegetation analyte lists but remain on soil and sediment lists. Selenium and cadmium are considered to be the primary hazard drivers on a regional basis.

The IDEQ then prepared a draft Area-Wide Risk Management Plan that was released for public review between May through July 2003. The Final Area-Wide Risk Management Plan was released by IDEQ in February 2004 (IDEQ 2004a). The Area Wide Risk Management Plan is intended to provide discretionary guidance to agencies responsible for site-specific, non-time critical removal actions at phosphate mines under the Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA). This removal action process for any one site includes site-specific inspection/investigations (SI), engineering evaluation/cost analysis (EE/CA), removal action implementation, and removal closeout to include post-removal controls and monitoring. Each EE/CA and corresponding Agency Recommended Alternative will be subject to formal public comment to solicit input from stakeholders and interested parties.

Based on the results of the detailed risk management evaluation, the IDEQ recommended removing copper from the list of COPCs for all environmental media, since the observed concentrations are well below the risk-based action levels. Because of low media-specific concentrations observed in previous sampling events, IDEQ also recommended removal of chromium, nickel, and vanadium from future mine-specific surface water and vegetation analyte lists, but suggested these remain on soil and sediment analyte lists. These constituents exhibit relatively low concentrations in the regional water data and do not appear to present measurable risks associated with plant uptake. The Risk Management Plan contains four regional removal action goals with associated removal action objectives. In addition, the Plan includes Area Wide Action Levels for the COPCs in a variety of environmental media.

In June 2001, the Idaho Division of Health, Bureau of Environmental Health and Safety, issued a Health Consultation report on selenium in beef, elk, sheep and fish in the phosphate production area of southeast Idaho (BEHS 2001). The health consultation only addressed public health significance of exposure to selenium in wild game and livestock and did not address health implications to Native Americans. The BEHS concluded that sheep or cattle taken directly off seleniferous pasture to slaughter, and the liver of elk grazing on pasture with elevated selenium could present an indeterminate public health hazard but more information is needed to evaluate the risk. Elk muscle and cattle subjected to depuration before slaughter were not considered a public health hazard. Cutthroat trout from East Mill Creek did not appear to present a public health hazard.

The same agency released another Health Consultation in May 2003 on selenium in fish from the upper Blackfoot River watershed (BEHS 2003). The BEHS advised in this report that children under the age of seven should not eat more than four meals per month of Yellowstone Cutthroat and Brook Trout from East Mill Creek. No rainbow trout were captured in this stream. Idaho fishing regulations designate the upper Blackfoot River watershed as a catch and release fishery and keeping Yellowstone Cutthroat Trout from the river, or its tributaries, is illegal.

Smoky Canyon Mine Studies

The Simplot Smoky Canyon Mine conducted sampling of vegetation and growth medium in 2000 at reclaimed areas of the mine to identify any relationships between selenium concentrations in the growth medium and the reclamation vegetation (JBR 2001). Statistically designed soil and vegetation sampling was conducted in six areas of the mine having different reclamation treatments. Samples were analyzed for selenium and other COPCs. Good correlation was found between selenium concentrations in vegetation and extractable selenium concentrations in the growth medium. Selenium concentrations were lowest to highest in samples of Timothy, smooth brome grass, wheat grass, clover, alfalfa, and Sanfoin. Grass typically had low (< 5 mg/Kg) selenium concentrations even when total selenium in the growth medium was greater than 5 mg/Kg. Legumes and other forbs were responsible for most of the elevated average selenium concentrations in vegetation. Selenium concentrations in vegetation were elevated where the growth medium was seleniferous shale and were at baseline levels where seleniferous overburden had been capped with chert and salvaged topsoil. Where vegetation was rooted in ROM overburden with no topsoil, average selenium concentrations in vegetation ranged from 5.8 to 31.7 mg/Kg. Where vegetation was growing in topsoil over ROM overburden, average selenium concentrations ranged from 4.8 to 7.1 mg/Kg. Where vegetation was growing in topsoil over chert, the average selenium concentration was 0.36 mg/Kg. The IDEQ removal action level for selenium in vegetation is 5 mg/Kg (IDEQ 2004). None of the removal action levels for other COPCs were exceeded in the vegetation samples from this study.

Simplot conducted Site Investigations at the Smoky Canyon Mine during 2003 and 2004 under a CERCLA Administrative Order on Consent (AOC) with the USFS and other state and federal agencies (NewFields 2005). These investigations documented sources of COPCs at the mine, the contaminant migration pathways, and apparent impacts by comparing the concentrations of COPCs with removal action levels developed by the IDEQ in the Area-Wide Risk Management Plan (IDEQ 2004).

The results of these investigations for vegetation indicated that selenium was the only COPC that exceeded any IDEQ removal action level. Mean selenium concentrations of forage (grass and forbs) samples collected from two overburden disposal areas at the mine with thin or no topsoil exceeded the removal action level, whereas concentrations from more extensively reclaimed (thicker topsoil or chert cap) areas were at or below the removal action level. None of the browse (woody plants) samples exceeded the removal action level.

Selenium concentrations in two overburden seeps and three runoff retention ponds during parts of the year were greater than the removal action level intended to protect livestock water use (0.05 mg/L). Concentrations in the same two seeps and one retention pond were greater than the removal action level intended to protect transient wildlife that may use the water for drinking (0.2 mg/L).

Exceedances of the selenium standard in surface water (0.005 mg/L) were primarily focused to Pole Canyon Creek below the Pole Canyon Dump, Hoopes Spring, and lower Sage Creek below the confluence with Hoopes Spring. The creek below the Pole Canyon Dump is apparently affected by its being routed beneath the dump in a French drain, a former design practice no longer followed. Elevated selenium in Hoopes Spring was attributed to groundwater infiltration originating from the base of the Pole Canyon Dump. Water from Hoopes Spring contributes more than one-half the flow in lower Sage Creek, thus lower Sage Creek has also been affected by seepage from the Pole Canyon Dump. Selenium concentrations in Crow Creek below the confluence with Sage Creek did not exceed the selenium standard.

COPC concentrations in sediments were less than removal action levels at all locations, except lower Pole Canyon Creek, which contained sediments that exceeded removal action levels for all COPCs except copper.

Selenium concentrations in fish were at or below background concentrations (8.3 mg/Kg dw) as reported in the Area-Wide Risk Assessment in all locations except Hoopes Spring and lower Sage Valley where the fish concentrations ranged from 14.1 to 31.8 mg/Kg dw and 13.5 to 19.3 mg/Kg dw, respectively. According to the Site Investigation Report (NewFields 2005), EPA has identified protective concentrations ranging from 9.5 to 15 mg/Kg dw for salmonid species including rainbow and cutthroat trout. Based on measured selenium concentrations, risk to aquatic invertebrates appeared to be acceptable in all areas except lower Pole Canyon Creek.

Smoky Canyon Tailings Pond Studies

A number of baseline studies, environmental analyses (EISs and EAs), wetland mitigation plans, and closure plans have been prepared in the past for Simplot's Smoky Canyon tailings ponds. These studies have been previously introduced in **Section 2.2.2**. In addition, Simplot has entered into a site-specific Administrative Order on Consent (AOC) for the Smoky Canyon Mine with the IDEQ, EPA, BLM, USFS, and USFWS to characterize sources, contaminant migration pathways, and potential environmental and human health effects associated with the operation of the Smoky Canyon Mine. The entire mine site has been divided into Areas A (the mineral extraction and mill area on federal land) and B (the tailings impoundments area located on Simplot-owned property).

Considerable data have been collected and interpreted in the following reports for Area B to describe the tailings ponds and the environmental conditions in their vicinity:

- Groundwater and Environmental Media Investigation Work Plan, November 2002;
- Baseline Ecological Risk Assessment Work Plan, Supplemental Information on Exposure Estimation and Risk Assessment Methods, December 2002;
- Baseline Ecological Risk Assessment Report, July 2003;
- Groundwater and Environmental Media Investigation Report, September 2003; and
- Final Tailings Impoundment Recommendations Report, January 2004.

Extensive site sampling and surveying was conducted in 2002 and included water, sediment, vegetation, invertebrates, fish, mammals, and waterfowl. Additionally, the Idaho Department of Fish and Game (IDFG) conducted surveys for bald eagles, waterfowl, and shorebirds. Recommendations were made to minimize residual water in the ponds during final closure as well as amending the growth medium and selecting specific reclamation vegetation species to reduce selenium uptake by vegetation (MFG 2004a). More specifics on the proposed tailings pond closure are included in **Section 2.3.7**.

Monitoring of surface water in Tygee Creek downstream from the tailings impoundments has indicated that there was not evidence of adverse effects from the impoundments to surface water quality. No water quality standards were exceeded, and overall water quality in the stream has improved over the historic baseline since a second tailings pond was constructed (MFG 2004). Groundwater studies indicated there was no evidence of adverse effects from the impoundments to the groundwater with little potential for migration of tailings pond water into the subsurface. Concentrations of metals and metalloids were at or near detection levels in shallow groundwater immediately down gradient of the tailings impoundments (MFG 2004).

Exposure modeling suggested that individual waterfowl or subpopulations that reside at the tailings impoundments may be exposed to concentrations that exceed toxicity benchmarks for chromium and selenium. Migratory or transient waterfowl exposure was below levels of potential concern (MFG 2004). Reduction and control of shoreline nesting habitat at the tailings ponds was requested by the IDEQ, BLM, EPA, and USFWS to protect waterfowl from excessive exposure to COPCs. Overall, mammalian populations were determined not at risk of adverse effects, but individual omnivores and predators that spend most of their lives at the ponds could be at risk from exposure to COPCs (MFG 2004). Risk to individual bald eagles was shown to be below a level of potential concern unless they obtained over 50 percent of their prey from the tailings ponds.

3.1.7 Mineral Resources

Phosphate rock minerals are the only significant global source of phosphorus. The main economic use of phosphate rock is production of phosphate fertilizers, primarily diammonium phosphate (DAP). Fertilizers are increasingly important to feed the growing world population because, although demand for food will increase, the area of cultivated land is not expected to increase significantly. For this reason, commercial fertilizers will become increasingly important to meet the nutritional requirements of the world's population (USGS 1999). The United States is the world's largest producer and consumer of phosphate rock. More detailed information on U.S. and international phosphate markets is presented in **Section 3.16**.

Phosphate rock and fertilizer production is expected to remain steady or increase slightly in Idaho and Utah for the foreseeable future because this output is primarily used domestically (USGS 2003a). Simplot began construction operations at Smoky Canyon Mine in 1982 and is the largest phosphate rock producer in Idaho. Over 50 million tons of phosphate ore reserves were projected to exist at the Smoky Canyon site before mining began (USFS 1981).

Phosphate Leasing Program and Description of Existing Rights

Domestic phosphate ore mining rights are granted under a federal leasing program, in accordance with the Mineral Leasing Act of 1920 (as amended) and applicable regulations. Mineral leases are administered by the BLM. These leases, purchased by mining companies, convey the right to mine and develop phosphate resources within the lease, in accordance with applicable federal, state and local requirements.

Mineral Economics

Costs associated with mining include removal of overburden as well as mining and processing costs of the ore. Because deeper ores require excavation of a larger pit, the ratio of overburden to ore, or stripping ratio, increases with pit depth. As ore depths increase, economic return decreases, and at a certain depth, mining of the phosphate ore becomes uneconomic. The depth at which ore recovery becomes uneconomic is also affected by ore grade, weathering, and other factors including capital costs and operational costs specific to the operation. Economics are also affected by supply and demand, foreign producers, and by proximity of deposits to processing facilities.

Proximity to existing mining and processing facilities affects mine economics due to capital expenditures and uncertainty of reserves. A large capital expense is necessary to build and staff new mining and processing facilities, so the use of existing facilities allows new deposits to be mined more economically. The Proposed Action and alternatives would use the existing facilities at the Smoky Canyon Mine to mine the phosphate ore in Panels F and G, concentrate the ore, and pipe the concentrate slurry out from the mine to the Simplot fertilizer plant in Pocatello.

3.1.8 Topographic Resources

The Project Area is located within two of the large-scale ecological units called subsections discussed in the EIS for the CNF RFP (USFS 2003b). The western portion of the Study Area is in the Webster Ridges & Valleys subsection while the rest of the Study Area is in the Pruess Ridges & Hills subsection (USFS 2003b). The Webster Ridges & Valleys subsection occurs at low to high elevations with slopes ranging from 10 to 65 percent. The Pruess Ridges & Hills subsection occurs on mid-to-high elevation sites with slopes ranging from 15 to 60 percent. These landscapes include mountainsides, canyons, ridges and valleys eroded from sedimentary rocks that are folded in generally north-south trending patterns.

The Smoky Canyon Mine existing mine panels are located on the eastern flank of the Webster Range, which is the dominant topographic feature in the Study Area. The Webster Range is a generally north-south trending mountain range that extends for about 33 miles from Lanes Creek on the north to the Pruess Range on the south. Freeman Ridge and Snowdrift Mountain are prominent ridges on the west limb of the Webster Range in the Study Area. Elevations in the Study Area range from about 6,500 feet in the lower end of the South Fork Sage Creek, Manning Creek, and Deer Creek drainages, to about 8,500 feet along Freeman Ridge west of Panels F and G.

The Boulder Creek Anticline is located on the east flank of the Webster Range. The surface topography of the Boulder Creek anticline mimics the orientation of its sedimentary units, forming a gentle ridge parallel to the Webster Range from Deer Creek on the south to Smoky Canyon on the north. The west side of this Boulder Creek Anticline ridge is a topographic swale in the overall east-facing slope of the Webster Range. Along this swale, part of the Phosphoria formation has been eroded. The Smoky Canyon Mine panels follow this exposure of the Phosphoria. South of Deer Creek, the Boulder Creek Anticline ridge is not present along the east slope of the Webster Range, but the phosphate deposits still occupy the topographic swale that parallels Freeman Ridge and Snowdrift Mountain along their east side.

Numerous east-trending drainages flow down the east side of the Webster Range and feed Tygee, Sage, and Crow Creeks. The more prominent of these drainages from north to south are Smoky Creek, Pole Creek, Sage Creek, and South Fork Sage Creek. Further south there are Deer Creek and Wells Canyon, which are tributary to Crow Creek. Crow Creek flows north and northeast out of the Study Area in a flat-bottomed alluvial valley bounded on the south by the Gannet Hills and on the north by Tygee Ridge.

3.1.9 Paleontological Resources

Sedimentary rocks of southeastern Idaho have paleontological resources consisting of vertebrate, invertebrate, and paleobotanical fossils including fish and shark remains. Fossils found in the Smoky Canyon Mine area are not unique to the Study Area or southeastern Idaho. They are found throughout the region wherever similar formations exist (JBR 2001a).

The Paleozoic and Triassic-age bedrock units are generally fossiliferous. Fossils in the Wells formation were described by G.H. Girty (Mansfield 1927) as predominantly consisting of bryozoa and brachiopods with wide distribution (BLM and USFS 2000).

The Meade Peak member of the Phosphoria formation contains abundant pelecypods, gastropods, and brachiopods, as well as ammonites, nautiloids, crinoids, bryozoa, and sponge spicules. The base of the Meade Peak member contains a thin marker bed identified as the fishscale bed, which contains disarticulated fish fossils including heliocoprion fossils (BLM and USFS 1992). The Rex Chert member of the Phosphoria formation contains brachiopods, crinoid fragments, and sponge spicules (Mansfield 1927).

3.2 Air Resources and Noise

The Study Area for air resources, relative to the Smoky Canyon Mine F and G Panels Expansion Project, consists of the immediate Study Area, the surrounding airshed (designated as Airshed 20), and out from the Study Area to a radius of 100 kilometers (60 miles) based on the Class I National Ambient Air Quality Standards (NAAQS). The NAAQS are defined in the federal Clean Air Act as levels of pollutants above which detrimental effects on human health and welfare may occur. Class I areas have the highest air quality protection standards while Class II areas have a moderate level of protection. All lands within the Project Area have been designated Class II. The nearest Class I area to the Project Area is the Bridger Wilderness, approximately 70 miles east of the CNF.

In general, the climate is typical of Rocky Mountain areas influenced by major topographic features. Nearby mountain ranges (e.g. Snowdrift Mountain and Freeman Ridge) trend primarily north to south and have an impact on local winds, as well as temperature and precipitation patterns in the immediate area. Based on the Smoky Canyon Mine's SWPPP, the annual precipitation in the vicinity of the Smoky Canyon Mine is 30-35 inches (Simplot Agribusiness 2004).

The valleys in the immediate Project Area have elevations that range from approximately 6,200 feet AMSL to 6,700 feet AMSL. These valleys have a middle-latitude steppe climate. The summers tend to be warm to hot and are typically dry. Winters are typically cold and the ground cover is snow packed.

Afton, Wyoming has a mean monthly average temperature of 61.7^{o}F in July and a mean monthly average temperature of 16.4^{o}F in January (WRCC 2004 from www.wrcc.dri.edu/summary/climsmid.html).

3.2.1 Air Resources

The State of Idaho regulates and controls air pollution through Title 39 of the Idaho Code. The USFS, which administers much of the Study Area land, protects air quality through compliance with these rules, regulations, and procedures under the IDEQ. The Smoky Canyon Mine has an air quality permit issued by the IDEQ. This air permit was issued in the early 1980s and applies to the control of haul road fugitive dust by limiting speed and applying water sprays and to the identification of the mill's boiler as a point source of emissions.

The State of Idaho has adopted EPA's NAAQS for criteria air pollutants. The criteria pollutants are ozone, carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter with aerodynamic diameter less than or equal to 10 microns and 2.5 microns (PM_{10} and $PM_{2.5}$), and lead (Pb). The NAAQS are shown in **Table 3.2-1**.

TABLE 3.2-1 STATE OF IDAHO AND NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	CONCENTRATION
Ozone	1 hour 8 hours	235 μg/m^3 (0.12 ppm) 157 μg/m^3 (0.08 ppm)
Carbon Monoxide (CO)	1 hour 8 hours	40,000 μg/m^3 (35 ppm) 10,000 μg/m^3 (9.0 ppm)
Nitrogen Oxides (NO_x)	Annual Arithmetic Mean	100 μg/m^3 (0.05 ppm)
Sulfur Dioxide (SO_2)	3 hours 24 hours Annual Arithmetic Mean	1,300 μg/m^3 (0.5 ppm) 365 μg/m^3 (0.14 ppm) 80 μg/m^3 (0.03 ppm)
Particulate Matter as PM_{10} (Aerodynamic diameter $\leq$ 10 microns)	24 hours Annual Arithmetic Mean	150 μg/m^3 50 μg/m^3
Particulate Matter as $PM_{2.5}$ (Aerodynamic diameter $\leq$ 2.5 microns)	24 hours Annual Arithmetic Mean	65 μg/m^3 15 μg/m^3
Lead (Pb)	Quarterly Arithmetic Mean	1.5 μg/m^3

Note: μg/m^3 = micrograms per cubic meter; ppm = parts per million
Source: Code of Federal Regulations, 40 CFR Part 50, National Primary and Secondary Air Quality Standards

Ambient air quality standards for NO_x, SO_2, and PM_{10} must not be exceeded at any time during the year in areas with general public access. Short-term standards for CO, NO_x, and SO_2 can be exceeded only once annually. Compliance with the 24-hour PM_{10} and $PM_{2.5}$ standards is based on the 98th percentile of 24-hour concentrations averaged over three years. The ozone standard, which pertains to an area that meets the standard when the 3-year average of the annual 4th-highest daily maximum, 8-hour concentration is less than or equal to 0.08 ppm. The 1-hour standard applies only to airsheds that were in non-attainment status when the ozone rules changed in 2002.

According to EPA (1998, as cited in USFS 2003b), air quality on National Forest System lands is typically excellent. However, on occasion, pollutants from communities, industries and agricultural activities outside of the Forest can adversely affect air quality within the Forest. Management activities within the Forest, such as prescribed burning and use of unpaved forest roads, can produce particulate matter and carbon monoxide emissions.

The air quality in the vicinity of the Smoky Canyon Mine is good to excellent because of the site's remote location and relatively limited industrial activity in the area. The Air Quality Index (AQI) is a daily EPA rating system, evaluating the mix of air pollutants one is likely to breathe. If an airshed receives an AQI rating of 100, there are health-based concerns. Lincoln County, Wyoming had only 1 day with an AQI over 100 in the last 4 years. This was reported from the FMC Skull Point Mine near Kemmerer. Caribou County experienced 12 days with an AQI over 100 in 2001. According to IDEQ, these exceedances were all recorded at the fence line of Monsanto's elemental phosphorous plant in Soda Springs. No other monitors showed AQI values over 100 in the Caribou County monitoring network (EPA 2003. September 2004 from http://epa.gov/air/data/monvals).

Air quality in the Study Area is designated as in attainment or unclassifiable for all NAAQS and Idaho Ambient Air Quality Standards. No violations of the national or state air quality standards have been documented in the region since the 2001 episode. There is no record of Simplot's Smoky Canyon Mine ever receiving a Notice of Violation or having caused an NAAQS exceedance episode in regard to air quality.

The closest non-attainment area is located in the Portneuf Valley airshed in the area of Pocatello and Chubbuck, Idaho, which has exceeded NAAQS for PM_{10}. While there were three exceedances of the 24-hour PM_{10} standard in 1999, this episode did not register as a violation of the standard since no other exceedance occurred prior to December 31, 2001. The area's 24-hour PM_{10} standard has not been violated since 1993 (IDEQ 2004a). IDEQ has requested the EPA redesignate this airshed as "attainment".

The main emissions that are generated by mining operations include particulate matter generated from in-pit operations and haul truck traffic. These sources are both considered fugitive sources and are regulated by opacity standards and controlled by fugitive dust mitigation measures. Fugitive dust mitigation measures are usually stated in the sources air permit, as in Smoky Canyon's permit, or in a separate fugitive dust control plan.

Air Quality Monitoring Data

The IDEQ has conducted ambient air sampling and data collection in the region. The majority of the sampling and data collection sites within the airshed are located to the north and west of the Smoky Canyon Mine. These sites typically monitor background levels for criteria pollutants near and around Pocatello and Soda Springs, Idaho. The closest monitoring locations in Lincoln County, Wyoming are more than 50 miles south of the Project Area near industrial facilities around Kemmerer, Wyoming.

Twelve years (1990 through 2002) of PM_{10} ambient air quality data has been collected at the Caribou County monitoring locations, with monitors located in Soda Springs recording higher values than those located throughout other portions of the county (EPA 2003; September 2004 from http://epa.gov/air/data/monvals). The annual average ambient concentration of PM_{10} throughout this period has been approximately one-half of the NAAQS limit. In 2003, the 2^{nd} high, 24-hour average PM_{10} concentration exceeded the NAAQS in the Caribou County. The state of Idaho ended PM_{10} monitoring in Caribou County in 2002. $PM_{2.5}$ monitoring began in 2002. There were no exceedances of PM_{10} or $PM_{2.5}$ in 2002 or 2003. The previous exceedance for PM_{10} for this county was in 1992. However, in each of the other years within the monitoring period, average annual 24-hour PM_{10} concentrations were recorded at approximately one-third of the standard.

Air Quality Source Classification

The area surrounding the Smoky Canyon Mine Project Area is designated as Class II, as defined in the federal Prevention of Significant Deterioration (PSD) program (IDEQ 2002a). Moderate degradation of air quality is allowed to occur within certain prescribed limits above baseline levels within a Class II designated area. Industrial sources desiring to locate or expand within a Class II area must demonstrate that the increased emissions will not cause significant degradation of air quality in all classified areas and will not cause visibility degradation in Class I areas.

Within designated Class I PSD areas, the level of deterioration allowed, and therefore the standards prescribed, are much more stringent. Class I areas typically include wilderness areas and National Parks. Within 125 miles of the Smoky Canyon Mine Project, the Federal Mandatory Class I areas include: Yellowstone National Park, Grand Teton National Park, the Bridger Wilderness Area in Wyoming, and Craters of the Moon National Monument in Idaho. A general distance guideline in evaluating Class I area impacts is 60 miles. The Federal Clean Air Act legally mandates that Class I areas be evaluated for haze and visibility impacts if a new or major-modification facility is planned within 60 miles of a Class I area. A major action, (i.e. construction) or event (wildfires) are also subject to visibility and haze impacts analyses. **Table 3.2-2** presents the distances and directions to the nearest Class I areas. The Smoky Canyon Mine occurs more than 70 miles away from the nearest Class I areas, thus an evaluation for impacts to these areas was deemed unnecessary for Chapter 4.

TABLE 3.2-2 FEDERAL MANDATORY CLASS I AIRSHEDS NEAREST THE SMOKY CANYON MINE PROJECT

AREA	DIRECTION FROM PROJECT	DISTANCE FROM PROJECT (MILES)
Grand Teton National Park	Northeast	77
Bridger Wilderness Area	East	75
Yellowstone National Park	North	102
Craters of the Moon National Monument	Northwest	120

Existing Sources

Within the designated airshed (Airshed 20) of the Smoky Canyon Mine, there are four active mine sites. Mining operations emit primarily fugitive particulate matter from mining, truck hauling, and ore crushing. Heavy equipment internal combustion engines used in the mining process (loading, hauling, electrical generation, etc.) generate primarily gaseous (NO_x, SO_2, CO, and VOC) emissions and measurable quantities of fine particulate matter.

Table 3.2-3 identifies those stationary industrial air emission sources within Caribou, Bingham, and Bear Lake Counties, Idaho and Sublette and Lincoln Counties, Wyoming that have air quality permits issued by the states of Idaho or Wyoming. Operating by the regulations stated in their permits and by the regulations in the Idaho Code and Wyoming Air Quality Control Regulations, these facilities are permitted to emit PM_{10}, as well as products of combustion (NO_x, SO_2, CO, and VOC) from engines, kilns, boilers, crushing and other processes. The majority of the sources are located more than 20 miles away from the Smoky Canyon Mine. The Soda Springs area has four major sources, but based on the winds and meteorological factors, these sources have little impact on the Smoky Canyon Mine area.

Unpermitted and mobile sources of air pollutants are common in rural settings. Agricultural operations, agricultural burns, forest prescribed burns, open burning/wildfires, road traffic, off-road vehicle use, and construction in the immediate area are all sources of fugitive particulate matter in the Study Area. The EPA estimates that these types of air pollution sources contribute up to 52 percent of the particulate matter emissions in adjacent Lincoln County (EPA 2003; September 2004 from http://epa.gov/air/data/monvals).

TABLE 3.2-3 PERMITTED INDUSTRIAL EMISSION SOURCES - (WITHIN 60 MILES)

SOURCE	COUNTY, STATE
NW Pipeline Compressor Station, Peagram	Bear Lake, ID
NW Pipeline Compressor Station, Soda Springs	Bear Lake, ID
Professional Manufacturing, Inc.	Bear Lake, ID
Montpelier School District	Bear Lake, ID
Cargoll, Inc.	Bear Lake, ID
Basic American Foods Dehydrator	Bingham, ID
Smoky Canyon Mine	Caribou, ID
Kerr McGee Vanadium Chemicals	Caribou, ID
P4 Production L.L.C. (Monsanto)	Caribou, ID
Nu West Phosphates Fertilizers	Caribou, ID
FMC Dry Valley Mine (Not active)	Caribou, ID
Saddle Ridge Compressor Station	Sublette, WY
Big Piney Compressor Station	Sublette, WY
Exxon - Labarge Dehydration Facility	Sublette, WY
Amoco Pipeline - Labarge Station	Sublette, WY
Exxon Shute Creek Natural Gas Processing Plant	Lincoln, WY
PacifiCorp Naughton Power Plant	Lincoln, WY
Pittsburg & Midway Bituminous Coal & Lignite Mine	Lincoln, WY
Johnson Ready Mix	Caribou, ID
Brancroft Grain	Caribou, ID

In addition to IDEQ regulations on air quality, the CNF is subject to the Montana/Idaho State Airshed Group Smoke Management Plan, and the EPA Interim Air Quality Policy on Wildland and Prescribed Fires (USFS 2003b). The objective of compliance with these requirements is to reduce impacts from smoke and protect public health. Smoke from fire management activities and wildfire has potential to affect air quality and visibility on the CNF and surrounding areas. Fires produce carbon monoxide, nitrogen oxides, volatile organic compounds, and particulate matter.

3.2.2 Noise

To properly assess the noise resources for any area, an explanation of noise effects; consideration of the topography, climate, flora; and current ambient noise is required. The affected environment for noise impacts is usually limited to a distance of 880 yards from the source based on current wildlife studies (Fletcher 1980). However, if residential housing has the potential to be impacted, the affected environment includes the distance from the source of the noise to the residence. The basic equations for determining noise attenuation are based on the ISO 9613-2 Acoustics- Attenuation of Sound During Propagation Outdoors (ISO 1996). The equivalent continuous downwind octave-band sound pressure level at a receiver location, $L_{fT}(DW)$ can be calculated for each point source using the following equation:

$$L_{fT}(DW) = L_w + D_c - A$$

Where Lw is the octave-band sound power level in decibels, produced by the point sound source; D_c is the directivity correction, in decibels; and A is the octave-band attenuation, in decibels. Since the sound source is radiating into free space $D_c = 0$ for these calculations. Attenuation (A) is quantified by the summation of the following factors:

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

With these factors representing attenuation due to:

A_{div} = geometrical divergence
A_{atm} = atmospheric absorption
A_{gr} = ground effect
A_{bar} = topography and man-made barriers
A_{misc} = miscellaneous factors, including vegetation

Noise Attributes
Noise is an unwanted sound occurrence. A noise's attributes (pitch, loudness, repetitiveness, vibration, variation, duration, and the inability to control the source) determine how it affects a receptor. The study of noise involves three important characterizing parameters: pressure, power, and intensity. The power of an oscillating sound wave is composed of kinetic and potential energies. The intensity of a sound wave is defined as the average rate at which power is transmitted per cross-sectional area in the direction of travel. Noise versus sound is a subjective measurement, thus a receptor's reaction to sound is a poor measurement of noise.

Noise Measurements
The unit of sound level measurement (i.e. volume) is the decibel (dB), expressed as dBA (decibel-A weighted). The A-weighted decibel measure is used to evaluate ambient noise levels and common noise sources. Sound measurements in dBA give greater emphasis to sound at the mid- and high- frequency levels, which are more discernible to humans. The decibel is a logarithmic measurement; thus, the sound energy increases by a factor of 10 for every 10 dBA increase.

Generally, natural noise levels will be around 35 dBA in rural areas away from communities and roads. Within a rural community, the man-made noise level ranges from 45 dBA to 52 dBA (Noise Effects Handbook 1998). The day-night sound level of residential areas should not exceed 55 dBA to protect against activity interference and annoyance (Noise Effects Handbook 1998). **Table 3.2-4** presents typical sound levels in dBA and subjective descriptions associated with various noise sources.

TABLE 3.2-4 SOUND LEVELS ASSOCIATED WITH ORDINARY NOISE SOURCES

NOISE SOURCE	NOISE LEVEL	SUBJECTIVE DESCRIPTION
Commercial Jet Take-Off	120 dBA	Deafening
Road Construction Jackhammer	100 dBA	Deafening
Busy Urban Street	90 dBA	Very loud
Standard For Hearing Protection 8-Hour Exposure Permissible Exposure Limit (PEL) (MSHA) Action Level within Active Mining Facilities	90 dBA 85 dBA	Very loud Loud - to very loud
Construction Equipment at 50 feet	80-75 dBA	Loud
Freeway Traffic at 50 feet	70 dBA	Loud
Noise Mitigation Level for Residential Areas Federal Housing Administration (FHA)	67 dBA	Loud
Normal Conversation at 6 feet	60 dBA	Moderate
Noise Mitigation Level for Undisturbed Lands (FHA)	57 dBA	Moderate
Typical Office (interior)	50 dBA	Moderate
Typical Residential (interior)	30 dBA	Faint

Noise Regulations

The Federal Noise Control Act of 1972 established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. Although the Occupational Safety and Health Administration (OSHA) has the most extensive regulations in regard to noise pollution, these standards are only for noise levels within the workplace.

EPA identifies outdoor noise limits to protect against effects on public health and welfare by an equivalent sound level (Leq), which is an A-weighted average measure over a given time. Outdoor limits of 55 dBA Leq have been identified as desirable to protect against speech interference and sleep disturbance for residential areas and areas with educational and healthcare facilities. Sites are generally acceptable to most people if they are exposed to outdoor noise levels of 65 dBA Leq or less, potentially unacceptable if they are exposed to levels of 65 – 75 dBA Leq, and unacceptable if exposed to levels of 75 dBA Leq or greater (Noise Effects Handbook 1998).

Noise Issues

Loud noise can interfere with communications, cause fatigue and tiredness, reduce efficiency, affect attitudes, and distract and disrupt human activities. Noise concerns related to residential areas are mostly 'quality of life' impacts where moderate to low intensity noise can be an annoyance. An evaluation of baseline noise conditions was accessed in order to determine the potential changes from current levels.

3.2.3 Methodology and Results

The objective for this study was to assess noise-generating activities under typical operating conditions at the Smoky Canyon Mine and to measure current, typical, noise levels at various locations within the Study Area currently unaffected by the existing Smoky Canyon Mine. At the Smoky Canyon Mine area, noise measurements were taken for existing access road traffic, haul road traffic, in-pit activities, and blasting. Haul road noise levels were further segregated into flat terrain, steep grade terrain, haul and dump traffic, and haul and access road traffic. Measurements of noise were taken at different distances. Terrain and vegetation characteristics were also considered when determining the location for sound level measurements. **Table 3.2-5** shows the Leq measurements taken at the active mining areas, under typical operating conditions. **Figure 3.2-1** displays the locations where the measurements were taken.

Background noise measurements were also collected south of the existing Smoky Canyon Mine operations within the Project Area in May 2004. **Table 3.2-6** presents the background noise measurements at various locations. No unnatural sounds were heard during the background noise measurements (i.e. road traffic, car horns, etc.). **Figure 3.2-1** displays the location where the measurements were taken. These sites were selected for comparisons to be made with future noise impacts.

Figure 3.2-1 Noise

TABLE 3.2-5 SOUND LEVELS ASSOCIATED WITH EXISTING SMOKY CANYON MINE ACTIVITIES

NOISE SOURCE TYPE (SITE LOCATION)	LEQ* (DBA)	MAXIMUM MEASURED (DBA)
Smoky Canyon Access Road during morning "rush hour" commute. Measurements were taken at a distance of 120 feet from edge of road (A-6)	47.4	66.6
Panel C Haul Traffic where it crosses the Smoky Canyon road. Measurements were taken at a distance of 300 feet from edge of haul road (B-2)	60.6	73.0
Panel C Haul Traffic and Overburden Dumping Measurements were taken at a distance of 20 feet from edge of haul road (C-2)	70.4	87.5
In-Pit Loading of Haul Trucks Measurements were taken at a distance of 125 feet from loader (D-2)	74.4	87.9
In-Pit Drilling Measurements were taken at a distance of 130 feet from drill (D-5)	81.7	85.9
Panel C Blasting Measurements were taken at a distance of 3,170 feet from location of blast (BL-1).	Not Applicable	74.4

* Measurements were averaged over a 5-10 minute timeframe.

TABLE 3.2-6 BACKGROUND NOISE MEASUREMENTS COLLECTED SOUTH OF MINING OPERATIONS

NOISE SOURCE TYPE (SITE LOCATION)	LEQ* (DBA)	MAXIMUM (DBA)	MINIMUM (DBA)
Manning Creek Road near Crow Creek Road (E-1)	34.6	54.4	27.9
Crow Creek Road near Deer Creek Road w/15 mph wind (E-2)	55.7	80.8	27.8
Crow Creek Road near Deer Creek Road no wind (E-3)	38.6	55.4	28.3
Crow Creek Road Near Residence (E-4)	35.7	47.5	27.7
Diamond Creek Road Near Stream (BG-1)	41.1	52.3	37.1
Diamond Creek Road Near Summit (BG-2)	38.4	45.1	37.4
Diamond Creek Road Near South Fork Drainage (BG-3)	31.5	51.7	26.8

* Measurements were averaged over a 5-10 minute timeframe

3.3 Water Resources

3.3.1 Surface Water Resources

Simplot's current mining activities are located in several watersheds that drain the east slopes of the north/south trending Webster Range (**Figure 3.3-1**), and ultimately into the Salt River drainage in Wyoming. The northernmost part of the existing Smoky Canyon Mine operations is within the Tygee Creek basin and several of its small tributaries. The southern part of the existing operations is within Sage Creek basin. The Panels F and G include lands in the South Sage Creek, Manning Creek, Deer Creek, Nate Canyon, and Wells Canyon basins. These drainages are in the Crow Creek watershed (5th Level Hydrologic Unit Code (HUC) 1704010507) (**Figure 3.3-1**). In addition, one of the proposed transportation corridors is located alongside Crow Creek. Crow Creek flows into the Salt River (HUC 17040105) approximately five miles downstream of the Study Area boundary (**Figure 3.3-1)**.

A very small (17 acres) part of a proposed West Haul/Access Road drains toward the 34,000-acre Diamond Creek watershed (5^{th} Level HUC 1704020712). All other transportation and mining alternatives lie entirely within the Crow Creek watershed.

Snow melt, rainfall, springs, and diffuse groundwater discharge all contribute to streamflow in the Project Area and its surroundings. In general, most runoff is attributed to snow melt; surface runoff from rainfall is typically low (United States Geological Survey (USGS) et al. 1975). The USFS notes, however, that flood flow events in this area of the Forest seem to represent an unresolved statistically mixed population of events due to various combinations of snow melt, local summer convective thunderstorms, and larger late summer tropical (monsoon) moisture from more southerly latitudes (Jim Laprevote, USFS Hydrologist, personal communication Sept 10, 2004). Maxim (2004c) reports that area streams normally peak in April, May, and June, with declining flows in late summer, fall, and winter. This temporal variability is reflected in the flow data described later in this section.

For most of the Project Area streams, where segments cross the Wells formation, all or most of the streamflow is lost to the permeable sandstone/limestone bedrock. This contributes to the spatial variability of reported streamflows in the area.

None of the streams within the Project Area have been designated by the State of Idaho as Outstanding Resource Waters or as Special Resource Waters (Idaho Administrative Code IDAPA 58.01.02). Neither are any of the streams in the Project Area designated under the Wild and Scenic Rivers System, or listed in the Nationwide Rivers Inventory as potentially possessing “outstandingly remarkable values” that may make them eligible for designation in the system (National Park Service 2004). Further, the USFS has determined that none of the streams in the area are eligible for inclusion in the Wild and Scenic Rivers System (USFS 1998). The USFS (2003b) recently rated CNF lands in regard to geomorphic integrity, water quality integrity, and watershed vulnerability. The Project Area has a moderate geomorphic integrity rating, low water quality integrity, and moderate watershed vulnerability.

The RFP for the CNF (USFS 2003a) contains goals, standards, and guidelines specific to managing surface water resources under various types of activities that may occur on the CNF. In regard to mining and road construction, forest-wide guidance that applies directly to surface water resources will be reviewed and evaluated as related to impacts analysis in Chapter 4.

Further, on a watershed basis, the RFP (USFS 2003a) includes guidelines for analyzing proposed projects in regard to non-point pollutant sources, beneficial use impairments, and percent of watershed that would be in a hydrologically disturbed condition at any one time.

In addition to forest-wide guidance, Prescription 2.8.3 applies within defined aquatic influence zones (AIZs), the delineation of which depends upon water source type (perennial, intermittent, wetland, etc.). AIZs in the Project Area are shown on **Figure 3.3-2**. Numerous goals are associated with AIZs in regard to protection of surface water resources; these are not outlined specifically here, but can be found in the RFP (USFS 2003a). Similarly, standards and guidelines associated with AIZs are not repeated here, but they generally focus on avoidance of AIZs. Relevant to this Project are guidelines for culverts and other road drainage features (USFS 2003a).

Figure 3.3-1 Location Map – Water Resources

Figure 3.3-2 Aquatic Influence Zones

General watershed characteristics - including flow patterns - for each of the area streams are described below. Where data are available, stream flow measurements are summarized and discussed in regard to spatial and temporal variability. **Figure 3.3-2** designates perennial and non-perennial reaches as determined by baseline studies (Maxim 2004c). **Figure 3.3-3** shows stream (SW) and spring (SP) monitoring sites that are described in the following narrative. The Sections (**3.3.2**, **3.3.3**, and **3.3.4**) following the watershed and streamflow descriptions contain information on surface water quality, channel morphology/streambed sediment, and surface water uses, respectively.

Salt River

As the Salt River flows through Star Valley, Wyoming, east of the Project Area, it collects flow from Crow Creek and Stump Creek, both of which collect flow from smaller drainages related to Simplot's existing and proposed operations. A USGS stream gauging station (#13027500) has been recording flow data on the lower Salt River since 1954 (USGS 2004b). The station is located above the Palisades Reservoir approximately 30 miles north of the Study Area. The maximum flow documented between 1954 and September 2002 was 5,090 cubic feet per second (cfs), recorded in early June 1986. Typically, snow melt runoff influences flows at the gage site between early April and late July; flows the remainder of the year are relatively uniform, averaging between 500 and 600 cfs (Miller and Mason 2000).

The Salt River watershed drains about 925 square miles. The watershed has been rated as being in good overall condition, with low vulnerability to pollutant loadings and other stressors (USFS 2003a).

Crow Creek

With a drainage area of a little more than 100 square miles, Crow Creek originates on CNF lands to the south of the Project Area. As it flows northeast toward Wyoming, it collects flow from Wells Canyon drainage, Deer Creek, Manning Creek, and Sage Creek in the Project Area, as well as other tributaries entering from the east (**Figure 3.3-1** and **Figure 3.3-2**). Crow Creek would ultimately receive all drainage from the proposed Panels F and G lease areas.

Historic flow monitoring data for the perennial Crow Creek is sparse. The 1981 Smoky Canyon DEIS (USFS 1981) showed a range of flow in Crow Creek just below Sage Creek in the last 6 months of 1979 from 35 to 68 cfs. Maxim (2004c and 2004d) obtained more recent flow data at various sites in Crow Creek to document spatial and temporal variability, at least within the narrow time frame and drought conditions experienced during that period (**Figure 3.3-3)**. According to their records, flow increases downstream from the upstream station SW-CC-50 (0.8 cfs to 1.57 cfs) to SW-CC-800 (25 to 55 cfs), located approximately 8 miles downstream of the Sage Creek confluence. Primary sources of baseflow to Crow Creek are from several major springs in or near the Study Area: Stewart Springs in Stewart Canyon (SP-ST-100 and -200); Books Spring (SP-Books) between the mouth of Deer Creek and Nate Canyon; discharge from lower Deer Creek (between SW-DC-500 and -800); South Fork Sage Creek Springs (SP-SFSC-750); and Hoopes Spring (SP-Hoopes) in lower Sage Creek Valley. Combined baseflow discharge of these sources is about 15 cfs (Maxim 2004c). In addition, Crow Creek gains a measurable amount of flow between SW-CC-50 and SW-CC-300 due to discharge from the Wells formation into the valley alluvium (Maxim 2004c).

In May 2003, flows were measured in Crow Creek at two monitoring sites– one just upstream of the confluence with Sage Creek and one just downstream of that confluence (NewFields 2005). The flow was about 23 cfs at the upper site, and about 42 cfs at the lower site; during that same monitoring event, flow was also measured at 16 cfs near the mouth of Sage Creek.

Seasonality of Crow Creek flows is affected by irrigation withdrawals during the summer months; for example, at SW-CC-100, flows reported during the growing season in August 2003 and August 2004 (1.8 and 2.1 cfs, respectively) are much lower than the 10-11 cfs reported in October 2003, February 2004, and May 2004, outside the growing season (Maxim 2004c and 2004d). Peak snowmelt flows would be substantially greater than this.

Sage Creek

The lowermost reaches of Sage Creek, from where South Fork Sage Creek enters it to where it enters Crow Creek, are included within the Study Area. The perennially flowing Sage Creek drains Sage Valley and collects flow from the eastern slopes of the Webster Range; its watershed area is approximately 25 square miles. The reach through Sage Valley upstream of where Sage Creek exits the Webster Range has been designated as North Fork Sage Creek. Pole Canyon and South Fork Sage Creek are two of the larger subwatersheds within the Sage Creek basin. Pole Canyon flows apparently only rarely reach North Fork Sage Creek via surface flow.

There are few known flow measurements taken in Sage Creek. Tetra Tech EM Inc. (TtEMI), as part of a selenium investigation for IDEQ (Tetra Tech EM Inc. 2004), reported flow in Sage Creek below its confluence with Pole Canyon in May 2002, and May 2003, and at the mouth of Sage Creek in May 2001, May 2002, and May 2003. For the upstream site, flow was about 1 cfs in 2002 and 4 cfs in 2003. Increasing greatly downstream, flows at the mouth of Sage Creek ranged between about 9 and 13 cfs. Simplot also measured base flows at these sites in October of 2002 and 2003 (NewFields 2005). At the mouth of Sage Creek, the two October records - as well as one measurement in February 2004 - showed Sage Creek to have a base flow of between about 10 and 15 cfs. In 2003, TRC Mariah (2004) added a site on Sage Creek below it's confluence with South Fork Sage Creek to its biannual sampling program in the area; those records show flows of 17 and 12 cfs in spring and fall of 2003, respectively.

South Fork Sage Creek

South Fork Sage Creek is one of the main tributaries of Sage Creek, with a watershed area of about 6 square miles. The entire length of an unnamed tributary entering South Fork Sage Creek from the south would be within the footprint of the proposed operations at Panel F.

Unnamed springs contribute flow to the upper reaches of South Fork Sage Creek (USFS 1981; Maxim 2004c). Maxim characterizes South Fork Sage Creek upstream of South Fork Sage Creek Spring (SP-SFSC-750) as intermittent with channel reaches where the stream flows subsurface for distances between perennial pools. The unnamed tributary in Panel F is described as flowing ephemerally, with an alluvial fan at its mouth. South Fork Sage Creek looses flow where it crosses the Wells formation outcrop (BLM and USFS 2002). After exiting the Webster Range, South Fork Sage Creek joins with the mainstem of Sage Creek and drains generally south through Sage Valley before entering Crow Creek.

Figure 3.3-3 Surface Water Monitoring Stations in Study Area

Streamflows in South Fork Sage Creek have been periodically measured since 1992. Most of these measurements were obtained for Simplot by TRC Mariah Associates, Inc. as part of their ongoing surface water monitoring (TRC Mariah 2004). Flow measurements have typically been obtained twice yearly at two stations – one in upper South Fork Sage Creek about one mile upstream from the canyon mouth (USS), and the other about 1.5 miles upstream from its confluence with Sage Creek (LSS). In addition, in both the spring and fall of 1998, flows were measured at nearby sites as part of the ongoing IMA Selenium Subcommittee studies (Montgomery Watson 1999 and 2001). NewFields (2005) measured flows at USS, LSS, and other locations on South Fork Sage Creek a number of times between October 2002 and July 2004. Lastly, streamflow measurements were obtained in the same general vicinities as part of the baseline studies (Maxim 2001) for the Smoky Canyon Mine B & C Panels SEIS (BLM and USFS 2002). **Appendix 3A, Historic Stream Flow Measurement Summary**, includes a summary table of surface water flow measurements; at the upper site, flows ranged from 0 to about 17 cfs, and at the lower site, flows ranged from about 4 to about 40 cfs. Higher reported flows were measured in the spring than in the fall season. The large spring complex near the mouth of the canyon provides much of the flow reporting to the downstream site and generally fluctuates much less seasonally.

More recently, streamflows were measured on South Fork Sage Creek and an unnamed tributary to it as part of the baseline data gathering efforts for the Project (Maxim 2004c and 2004d). Site locations SW-SFSC-200 and SW-SFSC-500 are located upstream of the aforementioned historic South Fork Sage Creek monitoring locations, while SW-SFSC-800 is located at the same approximate location as the downstream historic monitoring site. These recent flow measurements are within the range of historic flow measurements, but generally lower, presumably due to several years of drought in the area. The unnamed tributary is generally dry, except for a short reach in the upper part of the channel where two small springs discharge.

As reported in the TtEMI (2004) study mentioned above, flows were also measured in South Fork Sage Creek below Simplot's current mining activity in May 2001, May 2002, and May 2003, and ranged between 4 and 5 cfs.

Manning Creek

Manning Creek drains an area of about 2.3 square miles. Maxim (2004c) indicates that the reach of Manning Creek that coincides with the F-Panel lease flows ephemerally, with a spring noted to discharge seasonally to the channel within the studied reach. Three streamflow monitoring events in 2003 indicated that this spring discharged in May but only saturated the ground, with no flow in August and September. The creek itself was dry during all seven monitoring visits between May 2002 and August 2004 (Maxim 2004d). About 0.5 miles below the studied reach, USGS mapping indicates that another spring contributes flow to Manning Creek but apparently does not sustain it for any distance downstream.

Deer Creek

Deer Creek drains an area of about 11.5 square miles. Flow in Deer Creek and its north and south forks, as with other streams draining the east side of the Webster Range, varies spatially along its alignment. Flow measurements (Maxim 2004c and 2004d) illustrate this variation, as shown in **Appendix 3A, 2003 and 2004 Streamflow Measurement Data**. Groundwater discharged from distinct springs, or from diffuse sources, can contribute to streamflow. Conversely, in-channel surface flow can be lost to the substrate but continue to flow down-canyon in a subsurface manner, either dispersing to recharge a groundwater system or reappearing as surface flow at some point downstream. Springs contribute flow to the various forks and unnamed tributaries of Deer Creek, as identified by recent baseline studies (Maxim 2004c and 2004d). According to these studies, Deer Creek is perennial below its confluence with North Fork Deer Creek, which itself becomes perennial about midway in its length. From this confluence upstream to the vicinity of SW-DC-300, Deer Creek flow is intermittent with flow occurring primarily during spring runoff. The upper reaches of Deer Creek (above SW-DC-300) and the tributaries in the vicinity of SW-DC-200 have typically exhibited perennial flow. Tributaries between SW-DC-200 and SW-DC-300 are primarily intermittent spring runoff channels. The South Fork of Deer Creek is mostly intermittent with localized reaches of perennial flow upstream of SW-SFDC-200. Similar to the South Fork of Sage Creek, Deer Creek contains isolated perennial pools between reaches of subsurface flow (Maxim 2003a).

As baseline flow data in **Appendix 3A, 2003 and 2004 Streamflow Measurement Data** and Maxim (2004c) shows, streamflow in Deer Creek and its forks not only varies spatially but also temporally. Within the drought conditions reflected in the baseline dataset, baseflow in lower Deer Creek (SW-DC-800) was measured at about 1.2 to 1.9 cfs, while spring season flows increased to almost 10 cfs in May 2003. In May 2004, measured flow at SW-DC-800 was only 5.4 cfs and increased to 6.8 cfs in June 2004 (Maxim 2004d). For either year, it was not documented when - relative to snowmelt runoff peaks - these May and June measurements were made. Flow measurements in upper Deer Creek (SW-DC-200 & -300) ranged from 0 to about 7 cfs. North Fork contributions to the mainstem ranged from about 0.3 to 2.5 cfs, and South Fork contributions were between 0 and 0.9 cfs, with highest flows measured during the spring season.

A comparison between flows contributed to Crow Creek from Deer Creek and flows contributed from South Fork Sage Creek, based upon 2003 data from May, August, and October (Maxim 2004c), indicates a much greater seasonal variability in Deer Creek. Those same data also show that, while Deer Creek drains almost twice the surface area that South Fork Sage Creek does, during base flow conditions it supplies only about one-third as much water to Crow Creek.

Wells Canyon

Wells Canyon is a 3.3 square-mile watershed that feeds into an irrigation ditch near its mouth. Baseline studies (Maxim 2003a, 2004c, and 2004d) of the stream indicate that above SP-WC-750 the stream is non-perennial, and downstream of this point it is perennial. Monitoring in two tributaries to upper Wells Canyon recorded dry conditions during all sampling events (Maxim 2004d).

Nate Canyon

Nate Canyon flows ephemerally, with no flow observed during baseline studies (Maxim 2004c and 2004d).

Diamond Creek

A short reach of a proposed haul road would be located on the west side of the Webster Range, off of Freeman Ridge, and would thus be in the upper Diamond Creek watershed. Diamond Creek is tributary to the Blackfoot River. In the vicinity of the proposed haul road, Diamond Creek flows ephemerally, but becomes perennial within a short distance downstream (Maxim 2004c). Baseline studies measured flows at SW-DMC-200 in the spring, summer, and fall of 2003; the greatest reported flow was about 0.5 cfs, reported in the spring, decreasing to a negligible amount (<0.001 cfs) in the fall. In June 2004, flow was measured at 0.08 cfs (Maxim 2004d).

3.3.2 Surface Water Quality

Regulatory Information

In Idaho, surface water quality is protected by implementing Idaho State Water Quality Standards at IDAPA 58.01.02. Within that code, the State classifies streams according to their designated beneficial uses, and applies numeric and narrative criteria based upon those uses. For undesignated surface waters (including Crow Creek within Idaho, Sage Creek, Deer Creek, Diamond Creek and their perennial or intermittent tributaries), cold water aquatic life and contact recreation beneficial uses are presumed by default according to the Idaho Code, and the relevant criteria for those uses are applied to such waters by the Idaho Department of Environmental Quality. For cold water aquatic life, the lowest of the three relevant metals values for comparison purposes were used by Maxim (2004c): Criteria Maximum Concentration (CMC) for aquatic life; Criteria Continuous Concentration (CCC) for aquatic life; and Criteria Human Consumption (CHC) for organisms. That convention is followed in this document as well. For Idaho, surface water standards for metals are based on the dissolved fraction, except for the chronic aquatic life standards (CCC) for selenium and mercury, which are based on total recoverable analysis. Further, some aquatic life metals standards are hardness dependent; Maxim (2004c) derived those numbers individually for drainages in the Study Area using the average hardness and a water-effect ratio of 1.0. **Appendix 3A, Summary of Surface Water Data**, gives the appropriate standards as derived in the baseline study report (Maxim 2004c and 2004d). Later in this section, available water quality data for surface streams are described in regard to how they meet relevant water quality criteria.

Water that originates within or flows through the Study Area eventually flows to the Salt River and crosses the Idaho border into Wyoming. Wyoming considers the Salt River to be a Class 2 water. Class 2 waters are, according to *Quality Standards for Wyoming Surface Waters*, "Those surface waters, other than those classified as Class 1, which are determined to: (i) Be presently supporting game fish; or (ii) Have the hydrologic and natural water quality potential to support game fish; or (iii) Include nursery areas or food sources for game fish." The Wyoming reach of the Salt River, as a Class 2 water, has therefore been designated as a cold water game fishery, and water quality criteria are set similar to those in Idaho.

The States of Idaho and Wyoming are both required by the Clean Water Act to regularly assess streams to determine whether or not they support their designated beneficial uses. Streams that do not are recommended by the states for 303(d) listing as impaired waters by the EPA. They are then scheduled for total maximum daily load (TMDL) analysis, whereby loading quantities for specific pollutants are set. These recommendations are revised and updated every two years; stream segments may be added, removed, or retained during this revision process. The most recent approved 303(d) list for Idaho is the 1998 list; no streams in the Project Study Area were included on that list. The 2002/2003 Draft Integrated (303(d)/305(b)) Report (IDEQ 2003a) was submitted to EPA in July 2004; meanwhile, IDEQ has begun soliciting data for the 2004 303(d) list (Marti Bridges, IDEQ, personal communication, September 1, 2004). Several Salt River Basin streams are listed in the Draft Integrated Report, including some Project Area streams, as discussed in the following paragraphs, and thus their regulatory status may be changed upon EPA approval. North Fork Deer Creek, South Fork Deer Creek, and upper Deer Creek above its confluence with the South Fork are listed in both Sections 5 and 4c of the Draft 2002/2003 Integrated Report. The Section 5 list equates to the 303(d) list of impaired waters, and the above-named reaches in the Deer Creek watershed are categorized as not supporting aquatic life beneficial uses due to sediments. The same reaches were also found to not support aquatic life beneficial uses due to habitat alterations. These reaches were initially proposed for listing based upon 1998 data collected under IDEQ's Water Body Assessment Guidance monitoring. The impairments were based upon biological indicator data obtained by IDEQ using the Stream Macroinvertebrate Index (SMI) and the Stream Habitat Index (SHI). Upper Diamond Creek also does not meet aquatic life beneficial uses due to sediments, but is included in Section 4a rather than Section 5 of the report because it has an EPA-approved TMDL. The data used to determine impairment are reported on an IDEQ website (IDEQ 2005); that website gives the activities affecting these reaches as beaver, grazing, mining, other, and/or roads.

Sediment impairment is based upon an assessment that a given stream reach does not meet the narrative criteria in the Idaho State Water Quality Standards at IDAPA 58.01.02, which simply says that "sediment shall not exceed….quantities which impair designated beneficial uses", in this case, aquatic life. In addition to being narrative -- rather than numeric -- in nature, the standard encompasses both physical and biological aspects of sediment such as water column sediments (TSS, suspended sediment, turbidity), bed sediments (stream stability, surface sediments, subsurface fines), aquatic life (macroinvertebrates, fisheries), and habitat characteristics (proper functioning condition) (IDEQ 2003a). In determining impairment of a given stream in regard to sediment, an assessor's "substantiated best professional judgment" is relied upon (IDEQ 2002b). Once a stream segment is listed on the 303(d), no further degradation (of the listed pollutant) is allowed until after the TMDL is completed and future target load allocations are developed.

For Diamond Creek, where its sediment impairment was the subject of a TMDL study (IDEQ 2001), load targets were established for two indicators representing sediment: (1) depth of riffle fines of 25 percent less than 6.25 mm and 10 percent less than 0.85 mm, based upon maximum volumes of subsurface sediments on a five-year average; and (2) streambank stability of 80 percent or higher. At times, though not done for Diamond Creek, a TSS concentration limit can be included for clean sediments, and in these cases is often in the range of 50-80 mg/L (Marti Bridges, IDEQ, personal communication, September 1, 2004). If the proposed listing of the Deer Creek segments are approved, and TMDLs need to be established for those reaches (currently scheduled for 2006 (Marti Bridges, IDEQ, personal communication, September 1, 2004)), they may include similar types of targets or could include site-, season-, and flow-specific targets (IDEQ 2003b).

Regarding other stream reaches in the Study Area and their designations in the 2002/2004 Draft, Deer Creek downstream of the impaired reaches, is listed in Section 2 as fully supporting aquatic life beneficial uses. Wells Canyon downstream of the forks, the lowermost 3.2 miles of Sage Creek, and Crow Creek from its confluence with Deer Creek to the Wyoming border were also included in Section 2 because they were found to fully support aquatic life beneficial uses. Other stream reaches within the Idaho portion of the Study Area were either not included because they are considered to be intermittent or ephemeral, or are listed in Section 3 as not yet having been assessed. Crow Creek downstream of the Wyoming border is not listed on the most recent (2002) Wyoming 303(d) list.

Chemical Characteristics of Surface Water

From 1979 to the present, Simplot has been monitoring water quality at sites upstream and downstream of mining activity at the existing Smoky Canyon Mine (TRC Mariah 2004). Where this program overlaps with the Study Area for the Proposed Panel F and G mining, these data records include monthly or bi-annual sampling results from 1992 to the present for South Fork Sage Creek at the two locations where flow measurements were made, both upstream from

Maxim's recent monitoring. These data represent background data as far as the Project is concerned, but data from 1998 forward at the downstream site represent a potentially mining impacted condition due to the existing Smoky Canyon Mine activities in Panel E. The data, along with a few samples taken by others (Montgomery Watson 2001; Maxim 2000a), generally show good water quality, with total dissolved solids typically 100-200 mg/L, with calcium, magnesium, and bicarbonate representing the major ions. More recently, samples were collected on South Fork Sage Creek, North and South Forks Deer Creek, mainstem Deer Creek, Manning Creek, Wells Canyon Creek, Diamond Creek, and some unnamed tributaries to those streams as part of the baseline studies for Panels F and G (Maxim 2004c and 2004d). Site locations are shown on **Figure 3.3-3** and water quality data are given in **Appendix 3A, Summary of Surface Water Data**. A review of these data does not identify any clear indications of spatial or temporal variability of water quality in the stream channels. Data from separate stream channels are quite similar in regard to major constituents, as are data from different locations along a given stream channel and data from different seasons at the same monitoring site. Sampling conducted for water quality from area streams was sporadic, with several stations being sampled once or twice, and some only sampled in a single season or only once in a given year. At least one value, the ORP=-39mv value taken from surface water station SW-SFSC-500, cannot be easily explained, as it generally signifies an oxygen deficit in a carbonate-dominated, shallow, surface stream. As dissolved oxygen for this sample was also given at 6.43 mg/l, this condition is unlikely, so this reading is likely to be erroneous. The lack of identifiable temporal variability may be due to the short-term nature of the monitoring period combined with the sparse frequency of sampling.

Streams in the Project Area and vicinity show calcium and bicarbonate as the predominant ions, with magnesium being the second-most predominant cation. Biannual operational monitoring (NewFields 2005) in May and October of 2002, 2003 and February of 2004 showed similar ionic content for sites in lower Sage Creek, however it appears that sulfate content was higher in lower Sage Creek than in South Fork Sage Creek. In both Maxim's and Simplot's data, lower Crow Creek was noted as having a higher sodium and chloride concentration than other stream sites, perhaps due to the Books Spring contributions. As a whole, nutrient concentrations (nitrate, nitrite, ammonia, and phosphorus) in area streams were near or less than reporting levels (Maxim 2004c and 2004d).

Data obtained by Maxim (2004c and 2004d) from the Project Area streams did not always meet aquatic water quality numeric criteria, and exceedances are shown in highlights in **Appendix 3A.** The noted exceedances were primarily metals (most commonly mercury), and were attributed to natural geologic sources (Maxim 2004c).

Selenium is the COPC with perhaps the greatest level of concern in regard to phosphate mining in southeastern Idaho. Therefore, though none of the surface water baseline samples in the Study Area (Maxim 2004c and 2004d) showed selenium exceedances, data from the nearby area streams, which are affected by the existing Smoky Canyon Mine, are presented here. Outside of, but adjacent to, the Study Area, high selenium values are reported in storm water runoff crossing waste rock dumps and seepage through overburden fills, both associated with Simplot's Smoky Canyon Mine (Simplot Agribusiness 2004; MFG 2003; NewFields 2005). Baseline data collection efforts in the Study Area focused on areas not yet subjected to mining influences, but mining has occurred in the nearby areas draining to lower South Fork Sage Creek, Sage Creek, North Fork Sage Creek, and Pole Creek. A few studies have looked at selenium in these areas during the same general time frame as Maxim was collecting water quality data in the Panels F and G Project Area. Selenium data from these studies is summarized in **Table 3.3-1** and discussed further below.

TABLE 3.3-1 RECENT SELENIUM SAMPLING RESULTS – LOWER SOUTH FORK SAGE CREEK AND SAGE CREEK – REACHES CURRENTLY IMPACTED BY MINING

DATA SOURCE *	LOCATION	DATE	FLOW RATE (CFS)	SELENIUM (MG/L)
TtEMI	Mouth of Sage Creek	May 2001	9	0.003
		June 2001	8	0.002
		Sept 2001	14	0.0051
		May 2002	12.5	0.004
		May 2003	13	0.004
Simplot	Mouth of Sage Creek	May 2002	14.5	0.004
		October 2002	13.2	0.005
		May 2003	16.3	0.004
		October 2003	10.2	0.0054
		February 2004	10.9	0.0061
Simplot	Sage Creek downstream of South Fork Sage Creek	May 2002	13.5	0.005
		October 2002	10.5	0.003
Simplot & TRC Mariah	Sage Creek downstream of South Fork Sage Creek	May 2003	17.3	0.004
		October 2003	12.4	0.006
Simplot	Sage Creek downstream of Hoopes Spring	May 2002	12.5	0.007
		October 2002	5.6	0.007
		May 2003	7.7	0.008
		October 2003	7.6	0.0088
TtEMI	North Fork Sage Creek downstream of Pole Creek	June 2001	1	<0.001
		Sept 2001	0.5	0.001
		May 2002	1	0.001
		May 2003	4	<0.001
Simplot	Sage Creek downstream of North Fork Sage Creek	May 2002	1.9	0.001
		October 2002	0.2	0.001
		May 2003	0.8	0.001
		October 2003	0.6	0.0013
TtEMI	South Fork Sage Creek downstream of Mining	May 2001	4	<0.001
		June 2001	5	0.001
		Sept 2001	4	0.002
		May 2002	4	0.002
		May 2003	4	<0.001

*TtEMI 2002b; TtEMI 2002c; TtEMI 2004; Simplot operational monitoring including from NewFields 2005; TRC Mariah 2004

TtEMI reported data collected in Sage Creek at its mouth, in North Fork Sage Creek below the confluence with Pole Creek, and South Fork Sage Creek (downstream of Smoky Canyon Mine activity) as part of an investigation for IDEQ (TtEMI 2004). During three monitoring events in 2001, they found that a sample taken in September near the mouth of Sage Creek exceeded chronic aquatic life criterion for selenium; other metals did not exceed numeric criteria at the three sites. Monitoring was repeated in May 2002 and 2003, but there were no reports of selenium or other metal exceedances at the Sage Creek sites. However, Hoopes Spring, which was sampled in 2003 did exceed the 0.005 mg/L selenium chronic criterion with a 4-day average of 0.0103 mg/L. An analysis by TtEMI suggested that Hoopes Spring was the source of selenium loading reported at the mouth of Sage Creek.

In addition, operational monitoring (K. Tegtmeyer, NewFields, personal communication July 14, 2004; NewFields 2005) in 2001, in May and October of 2002, 2003, and February of 2004 showed that the selenium criterion was consistently exceeded in Sage Creek downstream of flows from Hoopes Spring. Samples taken in Sage Creek above the confluence with Hoopes Spring did not show selenium exceedances. At two sample sites further downstream (one below the confluence with the South Fork Sage Creek and one near the mouth of Sage Creek), most (but not all) of the selenium concentrations were at or greater than the 0.005 mg/L criterion. However, samples taken by Simplot in Crow Creek in May 2003 downstream of the confluence with Sage Creek did not show selenium exceedances.

In 2003, TRC Mariah (2004) added a site on Sage Creek below the confluence with South Fork Sage Creek to its biannual sampling program. Those data showed similar water quality at this site as reported at their lower Sage Creek site, except that higher selenium concentrations were reported (0.004 mg/L in the spring and 0.006 mg/L in the fall) in Sage Creek than in South Fork Sage Creek. The source of the elevated selenium in lower Sage Creek is presumably Hoopes Spring.

Some of the general conclusions by TtEMI (2004) could be relevant to the other Study Area streams as well as to Sage Creek and the other streams they studied. Looking at previous studies, along with their 3-year study, they conclude that selenium and other metals tend to be greater during years of higher peak snowmelt runoff than during lower flow years. However, a correlation of selenium concentrations with snow water equivalent (SWEQ) was not statistically significant, possibly due to an insufficient data set; other factors including mobilization and uptake processes are also thought to contribute to selenium variability. A study by Presser et al. (2004b) indicates that selenium concentration and load in the nearby Blackfoot River downstream of numerous phosphate mines cycles seasonally with streamflows, with peak selenium concentrations following the hydrograph peak by 2-3 weeks, and most (approximately 70-80 percent) of the selenium load occurring during the 3-month high flow season of April – June when about 40-55 percent of the total annual flow occurs. The seasonality of selenium concentrations and load suggest that there is a regional reservoir of selenium that functions as a longer term supply, rather than simply reflecting a short-duration flush after a dry season (USGS 2004). Given that the majority of the Project Area data and regional selenium data have been collected during recent drought years, these studies could have implications regarding selenium levels produced once a more normal hydrologic regime returns. Data given in **Table 3.3-1** do not appear to follow a pattern of either higher Total Dissolved Solids (TDS) in the spring season as compared with fall, or to generally correlate flow with selenium. However, the data set was not extensive, nor was the timing of sample collection necessarily conducive to observing the patterns described above, so trends regarding selenium, season, and flow cannot be ruled out.

The State of Idaho also has a monitoring program that includes several of the Project Area streams. The Beneficial Use Reconnaissance Program (BURP) focuses more on biological and habitat data rather than chemical data; thus, no selenium or other COPC data are available from this source. The available BURP data are discussed below in **Section 3.3.3**.

Water Column Sediments

This subsection describes available information on sediment-related water quality data; sediment data related to streambeds are described in **Section 3.3.3**. As noted above, the Idaho water quality narrative criteria for sediments encompasses both water column and streambed characteristics. While the terms ‘suspended sediments’ and ‘total suspended solids’ (TSS) are often used interchangeably, there are differences in their definitions and in how they are analyzed. All data discussed herein are thought to refer to TSS. Further, turbidity is often related to sediments in the water column, though there can be other contributing factors.

Turbidity does have a numeric standard under the Idaho water quality standards, which is related to an allowable increase over background (50 Nephelometric Turbidity Units (NTU) increase instantaneous or 25 NTU for more than 10 consecutive days).

Though both TSS and turbidity data exist for streams within the Study Area, neither parameter lends itself to a direct comparison with water quality standards. Further, considering the spatial and temporal variability of natural sediment loads (easily varying over orders of magnitude) and turbidity in streams, the available data set is small and not likely representative. Effects of TSS and turbidity on aquatic life are dependent upon concentration (for TSS), levels (for turbidity), the duration of exposure, and the species considered; bed sediments are important as well.

In regard to suspended solids concentrations in area streams, recent data from Maxim (2004c and 2004d), TtEMi (2004), TRC Mariah (2004) and Simplot indicate TSS levels that are commonly less than detection levels (5 mg/L), and in no cases are reported levels greater than 25 mg/L. Turbidity values ranged from less than 1.0 to 52 NTUs in Maxim's 2002 and 2003 baseline data (2004c); consistently high turbidity readings in 2004 were attributed by Maxim to an inaccurate meter (Maxim 2004d). These data are not sufficient to establish statistically significant regression relationships on a stream-by-stream basis between turbidity and TSS. While, as mentioned above, there is not a numeric water quality criterion for sediment, available information implies that these values would not impair beneficial uses (IDEQ 2003b). Simplot's Storm Water Pollution Prevention Plan (Simplot AgriBusiness 2004) indicates that the monitoring benchmark for TSS in their storm water permit is 100 mg/L. Regarding the 303(d) listings for the upstream reaches of Deer Creek and its forks, the available data are not sufficient to either support or dispute the sediment impairment.

The data collection efforts mentioned above relied upon grab samples as opposed to width/depth integrated samples and did not attempt to specifically catch sediment-laden runoff. In addition, they represent a short time frame, which may not be representative. Depth-integrated sampling for sediment is the generally approved methodology for obtaining representative values for discharge-weighted suspended fluvial sediment measurements from flowing streams. USGS protocols for sampling suspended sediments (USGS 1999b) use width/depth integrated sampling to insure that samples are representative and are "discharge-weighted". This is needful due to the high variability in sediment concentrations that can exist within the water column (USGS 1970, pg 19). For these reasons, grab samples are in general not judged to be representative measures of fluvial sediments in flowing streams. Longer term data (TRC Mariah 2004) for streams in the vicinity of the Smoky Canyon Mine show greater ranges of sediment concentration, though probably still less than the true variability of a given stream.

In the Blackfoot River TMDL (IDEQ 2001), overall sediment yield from the forest land within the subbasin was estimated to be 0.006 tons/acre/year.

3.3.3 Channel Morphology and Streambed Sediment

Maxim generally described morphology and substrate for Project Area streams in their water resources baseline reports (Maxim 2003a, 2004c, 2004e, and 2004k). These descriptions are summarized below. In addition, the State of Idaho's BURP habitat data are discussed. The BURP data were obtained from IDEQ's website (IDEQ 2005) and are primarily from 1998 and 2002 monitoring events.

Crow Creek's morphology from the Wells Canyon confluence to the valley constriction ("Narrows") immediately downstream of the Deer Creek confluence is described as a Rosgen (1996) type E4 channel with a consistently stable meander riffle-pool pattern. Maxim also notes that, while not classified, Crow Creek from the Narrows downstream to the Sage Creek confluence appears similar to the upper E4 reach. In 1998 and 2002, Idaho BURP monitoring listed Crow Creek just downstream from Manning Canyon as a Rosgen type C channel (IDEQ 2005). With a high sinuosity and a low gradient, Crow Creek's floodplain is up to 0.5 miles wide. Some beaver dams are found along Crow Creek but are presumed to be limited by lack of woody vegetation (Maxim 2004e:24). Lateral migration occurs over much of the length of Crow Creek, as is typical of an alluvial valley bottom stream. The existing road alongside the stream does prevent lateral channel migration in some locations, but Crow Creek appears to be vertically stable with riparian areas dominated by herbaceous species. The road encroachment and other impacts from livestock and upstream land use has resulted in segments of Crow Creek being rated as functioning-at-risk, while other reaches were rated as in proper functioning condition (PFC) by CTNF (Maxim 2004e). In 1998, Idaho BURP monitoring listed Crow Creek just downstream from Manning Canyon as being affected by grazing, "other", and recreation but rated 100 percent of the stream bank in the measured reach as stable (IDEQ 2005). In 2002, they added agriculture, mining (exploration), and roads to the affecting activities, and about 4.5 percent of the bank length was rated as unstable.

Baseline studies describe South Fork Sage Creek's channel bed as having shallow alluvium over cobble substrate along much of the studied reach. Although much of the reach apparently is comprised of these permeable materials, conditions are sufficient to support various streamside wetlands with predominantly deep-rooted willows. In spots, the bed is less permeable and forms isolated perennial pools. Studies further described South Fork Sage Creek near its confluence with the unnamed tributary as a Rosgen type G4 and about 1 mile upstream from its mouth as an A4 type (Maxim 2004a). Maxim (2004k) describes the upper channel reach as being in proper functioning condition, but at risk from concentrated sheep grazing and trampling. They report that the lower reach (apparently) is functioning-at-risk due to grazing and noxious weeds, and they note that the 1999 CTNF evaluation indicated that the stream was functioning at risk because of roads and planned mining activities in the drainage.

In 2001, Idaho BURP monitoring listed Sage Creek just downstream from the confluence with South Fork Sage Creek as a Rosgen C stream type, affected by grazing and recreation, with about 20 percent of the stream bank in the measured reach rated unstable (IDEQ 2005).

The channel bed in Deer Creek has a predominantly cobble substrate, though wetland areas and riparian corridors have formed, often associated with beaver activity. Beaver dams were noted to be the primary factor in channel shaping along much of mainstem Deer Creek (Maxim 2004a). However, Deer Creek and its tributaries exhibit a wide variety of channel types, and stability ratings of either stable or degrading. As reported in Maxim (2004e), Deer Creek was rated by Maxim and in the 1999 CTNF PFC analyses, as functioning-at-risk due to noxious weeds, roads, intensive grazing, and/or mining activities. In the headwaters, a degrading meander riffle-pool classification (Rosgen type G6) was identified, while a degrading meander pool-run (type F4) was identified at the confluence with North Fork Deer Creek. In the vicinity of the South Fork Deer Creek confluence and lower Deer Creek, the channel has a meander riffle-pool or riffle run pattern (type C3). A site on lower Deer Creek was typed as Rosgen C in 1998 (IDEQ 2005) with 25 percent of the banks rated as unstable; in 2003 a site on lower Deer Creek about 0.75 miles downstream from the 1998 site was considered a B stream with about 9 percent of the banks in that reach unstable (IDEQ 2005). Upper North Fork Deer Creek is identified as a degrading high-grade riffle (Rosgen type A4), while the lower reach exhibits a degrading riffle pool pattern (type G4). In 1998 and 2003, Idaho BURP monitoring listed North Fork Deer Creek near its mouth as a Rosgen B stream type, with about 30 percent of the stream bank in the measured reach rated unstable in 1998 and about 14 percent unstable in 2003 (IDEQ 2005). South Fork Deer Creek is a stable riffle-pool-run pattern of Rosgen type E6 according to Maxim; its upper reaches were classed by IDEQ (2005) in 1998 as a stable Rosgen type C.

Baseline studies also report that "intensive" livestock use is evident along North Fork Deer Creek and along the intermittent reach of the South Fork Deer Creek, where grazing and trampling have affected stream bank conditions (Maxim 2004e). Further, the South Fork of Deer Creek has been impacted by an adjacent USFS road. The IDEQ (2005) BURP data indicates the various reaches of Deer Creek are affected by beaver, grazing, mining, recreation, "other", and/or roads, depending upon the reach and the year (1998 or 2003).

Maxim (2004c) notes that lower Wells Canyon, near its mouth, is a riffle-run channel of Rosgen type G6. Rosgen type G6 streams are unstable with grade control problems (Rosgen 1996, table 4-1). They are generally considered to be highly degradational (Rosgen 1996, pg 5-186), highly sensitive to disturbance, and have poor recovery potential (Rosgen 1996, table 8-1, pg 8-9). Idaho BURP data (IDEQ 2005) indicates that this same area was a Rosgen type B stream in 1998 and mostly stable (98.5 percent of the banks). An unpaved road alongside the channel has confined the Wells Canyon drainage, filled portions of it, and contributed sediments. Campsites and livestock grazing are also noted as contributing to the stream's instability and at-risk condition. Maxim (2004e) reports their assessment of Wells Canyon Creek as non-functional and degraded by sedimentation and road influences; they note that the 1999 CTNF assessment was functioning-at-risk due to roads, grazing, and recreational activities. Additional Idaho BURP data were apparently collected on Wells Canyon in 2004; however, these data are not yet publicly available. Upper Diamond Creek is a moderately sinuous Rosgen B channel confined within a v-shaped valley (IDEQ 2001). Its overall stability was rated as fair (using the Phankuch methodology) 20 or more years ago, but in 1990, aquatic habitat was apparently in good condition above the forest boundary (IDEQ 2001). In 2002, Idaho BURP monitoring measured 96 percent of the banks in the reach as stable. Diamond Creek was rated as functioning-at-risk in 1999 and is on the EPA approved (1998) 303(d) list of impaired waters, with sediment listed as the pollutant. Diamond Creek is under the governance of a TMDL approved by the EPA in April of 2002. Monitoring of the percent of streambed fines is being conducted by the Forest Service at a location just above the Forest boundary.

Streambed sediment

Streambed sediment can be directly measured as surface or subsurface sediments. The measures are not directly comparable, nor are they directly linked to TSS or suspended sediments as measured in the water column. As mentioned under the regulatory information subsection above, the Diamond Creek TMDL established loads based upon subsurface (depth) fines as determined by core samples taken in bed substrate (IDEQ 2001). Higher percentages of depth fines are related to impacts to salmonid spawning, anadromous habitat, invertebrate habitat, and redd conditions (IDEQ 2003a).

At selected sites in the Study Area, Maxim (2004c) performed pebble counts to characterize in-situ stream bottom grain size distribution (surface sediments). Results of the pebble counts showed that most sites were comprised of predominately gravel-sized sediment, followed by sand and cobbles.

As an alternate means of characterizing substrate, TRC Mariah (2004) has been rating the streambed embeddedness at two South Fork Sage Creek sites on a biannual basis since 1992. Embeddedness is related to, but not directly comparable with, surface fines (IDEQ 2003a). The rating system describes the amount of gravel and larger particles that have their surfaces covered by fine sediment. By its nature, use of the measure of embeddedness indicates that the original streambed substrate is comprised of a matrix of coarse grained particles (gravel and larger); embeddedness ratings cannot be done on beds that are comprised predominately of fines. Values can range from 1 to 5. Implied in a lower embeddedness value is the assumption that fine sediments have been eroded from up-channel or in the watershed and deposited over the surface of "cleaner" substrate that is more suitable for aquatic habitat. A value of 5 would indicate particles that have not been covered over by fines and are therefore of potentially greater habitat value. Between 1992 and 2001, embeddedness values (taken only when flow occurred) ranged between 1 and 4 at the upstream South Fork Sage Creek site and between 3 and 5 at the downstream site, indicating somewhat better conditions downstream (TRC Mariah 2002). Embeddedness is of dubious relevance in intermittent or ephemeral stream reaches, so these data should be treated accordingly.

Subsurface fines data for the area streams are limited to core samples taken at four of the stream sites: South Fork Sage Creek, Deer Creek, South Fork Deer Creek, and Wells Canyon (Maxim 2004c). It is not known whether these samples were taken with the same protocol as would be used to assess impairment-related targets such as were developed for the Diamond Fork TMDL (IDEQ 2001) in regard to core diameter, depth, placement in the riffle, etc. These samples appear to be single unit samples, rather than a set of randomly collected samples within a larger grid, which better characterizes the inherent spatial variability of particle sizes in a small area. The available data are presented in **Table 3.3-2** in a manner that allows them to be compared with the Diamond Fork TMDL allocations. As seen in the table, based upon the single sample analysis at each site, three out of the four streams sampled would not meet the depth fines targets if they were applicable to these reaches.

TABLE 3.3-2 SUBSURFACE FINES DATA FOR AREA STREAMS (FROM MAXIM 2004C)

LOCATION (SITE NUMBER)	PERCENTAGE OF PARTICLES IN SAMPLE LESS THAN		DEPTH FINES – FIVE YEAR AVERAGE ALLOWABLE UNDER DIAMOND CREEK TMDL (FOR COMPARISON PURPOSES ONLY)	
	<6.25 MM	<0.85 MM	<6.25 MM	<0.85 MM
South Fork Sage Creek (SW-SFSC-800)	21	5	25%	10%
Deer Creek (SW-DC-800)	35	18		
South Fork Deer Creek (SW-SFDC-300)	26	11		
Wells Canyon (SW-WC-800)	66	55		

In addition to their physical characteristics, the chemical makeup of streambed sediments can also be important to aquatic and riparian resources. The Area Wide Human Health and Ecological Risk Assessment for the Southeast Idaho Phosphate Mining Resource Area (IDEQ 2002c) summarized conservative benchmarks for freshwater sediments for selected COPCs, as shown in **Table 3.3-3** below. Most of these benchmarks are based on a Threshold Effect

Concentration (TEC). Subsequent to the risk assessment, IDEQ published a risk management plan (IDEQ 2004b), which established removal action levels for sediment (and other media) at phosphate mine-impacted sites under CERCLA consideration; these are also shown in the table. With the exception of selenium, the removal action levels are set at a higher concentration than the benchmark levels used in the 2002 report. In cases where the regional background levels exceeded what would otherwise be the removal action level, the maximum background level was substituted as the action level for a given constituent (IDEQ 2004b).

In August 2003, Maxim (2004c) sampled streambed sediment at 10 Study Area sites to characterize baseline metals concentrations. These data are included in **Appendix 3A**. Concentrations of selenium in sediment ranged from less than 0.4 to 1.3 mg/Kg, which are less than both the 4.0 and 2.6 mg/Kg benchmark and removal action levels in **Table 3.3-3**. In most of the samples analyzed, concentrations of cadmium, chromium, nickel, and zinc were greater than the benchmark levels, and in some cases greater than the removal action levels; only copper and selenium concentrations remained below these levels. The reason for the apparently high concentration for some COPCs in these stream sediments is not clear; there has not yet been mining related disturbances in the watersheds that contribute flow to these sample sites. Further, while the background levels from the IDEQ (2004b) dataset were limited, they were obtained from areas with similar general geology as the watersheds contributing to these sample sites. In addition, the results generally echo streambed sediment samples taken by Montgomery Watson (1999) at the two established monitoring sites above and below mining disturbances in South Fork Sage Creek.

TABLE 3.3-3 SEDIMENT BENCHMARK LEVELS USED BY IDEQ (2002B)

PARAMETER	SEDIMENT BENCHMARK (MG/KG)*	REMOVAL ACTION LEVELS (MG/KG)*
Cadmium	0.99	5.1
Chromium	43.4	100
Copper	31.6	197
Nickel	22.7	44
Selenium	4.0	2.6
Vanadium	none	72
Zinc	123.1	315

* See above paragraphs and IDEQ (2002b) for derivation of these numbers and their source.

3.3.4 Surface Water Uses

Water use in the State of Idaho is managed through the adjudication of water rights, and the adjudication process is managed by the Idaho Department of Water Resources. Water rights information for the Study Area was obtained from their website online computer database (Idaho Department of Water Resources 2004). Water rights for the use of stream flow for various uses are summarized in **Appendix 3A, Summary of Water Rights Points of Diversion** and in Maxim (2004c). The majority of these rights are seasonal, for stockwatering and irrigation uses. In addition, there are surface water rights for stockwatering and irrigation in lower Crow Creek downstream of the reaches described in the Appendix and continuing into Wyoming.

3.3.5 Groundwater Resources

This section describes groundwater resources in the Study Area, including a description of hydrostratigraphy, recharge/discharge, hydraulic characteristics, and water quality, primarily utilizing information from the Water Resources Baseline Technical Reports for the Study Area (Maxim 2004c and 2004d). Other applicable information on groundwater includes memos and reports on the Study Area relating to water balance estimates of the Crow Creek area (JBR 2004b), isotopic data from samples collected in the Study Area (Mayo 2004), groundwater modeling (JBR 2005a), and similar work conducted previously at the Smoky Canyon Mine (MFG 2003 and 2004b, and JBR 2001b). In addition to the physical description of the groundwater resources in the Study Area, the connection between groundwater and surface water is described as well as the beneficial uses of groundwater in the Study Area.

Hydrostratigraphy

Groundwater in the Study Area occurs primarily in sedimentary rock units, although some areas of alluvium and colluvium contain local groundwater flow systems. The general geology, structure, and description of hydrostratigraphic units are described in the Geology, Minerals, and Topography section of this document (**Section 3.1**). The primary regional aquifer in the Study Area is the Wells formation, consisting of over 1,000 feet of sandstone and limestone. The 100-foot thick Grandeur Limestone overlies the Wells formation and is mapped locally as part of the Wells formation. Underlying the Wells formation is the Brazer Limestone, which has similar hydrostratigraphic characteristics (i.e., limestone and interbedded sandstone). Therefore, the Grandeur Limestone, Wells formation, and Brazer Limestone are considered to function as a single hydrostratigraphic unit with respect to groundwater movement.

Immediately overlying the Wells formation is the Meade Peak member of the Phosphoria formation, which generally consists of 75 to 120 feet of shale and mudstone. These rocks have low permeability and do not transmit water, except where faulted and fractured. The Meade Peak member is considered to be a barrier (aquitard) to downward groundwater movement between units above (Rex Chert and Dinwoody) and below (Wells formation) (Ralston 1979, Mayo et al. 1985).

The Rex Chert member of the Phosphoria formation is water bearing in some locations and forms local groundwater flow systems.

The highest bedrock unit stratigraphically in the Study Area that contains groundwater is the Dinwoody formation, which is composed of interbedded siltstone, limestone, and shale. This unit is part of local groundwater flow systems. Presence and movement of groundwater in the Rex Chert member and Dinwoody formation are most predominant where these rocks are faulted and fractured.

The stratigraphy and structure for the Study Area is shown on **Figures 3.1-1** through **3.1-3** and is discussed in **Section 3.1**. The mine panels are located along the east limb of the Webster Syncline and the west limb of the Boulder Creek Anticline. These folds plunge slightly to the north. **Figures 3.3-4** through **3.3-7** focus on hydrostratigraphy and groundwater conditions in the immediate vicinity of Panels F and G and these are discussed later in this section. Locations of all cross-sections are shown on **Figure 3.1-1** in **Section 3.1**.

Groundwater Movement

Geologic cross-sections in **Section 3.1** (**Figures 3.1-2** and **3.1-3**) show areas of groundwater recharge and discharge in the Study Area. In general, groundwater recharge occurs to the Wells formation and Brazer Limestone along the high-elevation Freeman Ridge and Snowdrift Mountain on the west side of the Study Area and flows generally eastward downhill toward discharges located in Sage Valley and Crow Creek Valley. Additional recharge occurs along this flow path where outcrop of the Wells formation and Brazer Limestone occur between the eastward edge of the Phosphoria formation and the discharge locations. Evidence for this eastward flow includes the difference in ground surface elevation between the recharge and discharge areas that have been measured for the water table in the Wells formation. The Wells formation aquifer water table elevation was determined to be 6902 feet at the monitoring well DC-MW-5 northwest of the Panel G, 6780 feet at Stewart Ranch Spring, 6590 feet at Books Spring, and 6630 feet at South Fork Sage Creek Spring (**Figure 3.3-8**). In addition, water balance studies conducted in 2003 and 2004 in Crow Creek below its confluence with Lamb Canyon indicate that Crow Creek gains flow due to groundwater discharge from the Wells formation and Brazer Limestone between about Lamb Canyon to just downstream of Deer Creek (Maxim 2004a).

The Webster Range highland is located within the Webster Syncline and contains the Thaynes, Dinwoody, and Woodside formations in the upper elevations, which locally may be highly permeable. Ralston et al. (1977) estimated that the recharge rate of these formations is dependent on locally intense fracturing where snow accumulation occurs. These conditions were thought to result in net recharge rates of 2 to 4 inches in Little Long Valley. This is at a lower elevation than the Webster Range, and minimum recharge rates are expected to be higher in the Webster Range where precipitation amounts are greater. These are recharge areas for what Ralston et al. (1977) called the upper flow system that is contained on top of the Phosphoria formation. Groundwater moves along bedding and fractures within these upper flow system rocks, flowing down dip in the more permeable beds to locations where the beds outcrop in canyons and/or where geologic structure provides secondary permeability.

Ralston conducted a number of site-specific hydrogeology studies in the Smoky Canyon Mine area (Ralston 1979, 1980, 1981, 1983, and 1987). He concluded that there are two major zones of groundwater flow in the Smoky Canyon area, the Triassic beds above the Phosphoria shale and the carbonate rocks below it. He described the same pattern of stream gains and losses in the Triassic beds (Dinwoody and Thaynes formations) and Wells formation, respectively, that has been noted throughout the southeast Idaho area. Gaining perennial flows were noted for the upper reaches of Smoky, Pole, Sage, and South Fork Sage creeks where they flow over the Triassic beds. Flows were noted to be stable where these streams flow across the Phosphoria and then decrease dramatically where they flow over the Wells formation. Winter (1980) described similar patterns of stream channels gaining flow from groundwater discharges in the Dinwoody formation and then losing flow over the Wells formation in Wells Canyon and the Deer Creek drainage.

The Idaho Water Resources Research Institute (1980) studied the general hydrogeology of the region between the Aspen Range to the Smoky Canyon area. They summarized hydraulic conductivity data for the Meade Peak member of the Phosphoria from multiple test locations in the area and concluded that it was an aquitard that "virtually prevented" groundwater flow between the overlying Dinwoody and Thaynes formation aquifers and the underlying Wells formation aquifer. They also characterized the upper aquifers as being "intermediate flow systems" dominating local conditions, while the Wells formation was postulated to be a regional flow system.

Figure 3.3-4 Panel F East-West Cross Section

Figure 3.3-5 Panel F North-South Cross Section

Figure 3.3-6 Panel G East-West Cross Section

Figure 3.3-7 Panel G North-South Cross Section

Figure 3.3-8 Monitoring Well Locations

Mayo et al. (1985) described the regional hydrogeology of the Meade Thrust Plate throughout southeastern Idaho. They determined that groundwater contained in the strata above the base of the Phosphoria formation did not circulate through that aquitard to strata below the Phosphoria, and groundwater below the Phosphoria in the Wells formation and Brazer Limestone did not circulate to rocks above the aquitard. They also determined that groundwater in the Webster Range did not pass through the Meade Thrust Fault zone to the Salt Lake formation and other rocks on the east side of the fault. Isotopic values for groundwater discharges along the Meade Thrust Fault suggested to them that groundwater discharging along the fault could be deeper (older) groundwater from the Brazer Limestone mixed with shallower groundwater in the Wells formation. Groundwater studies done in the Smoky Canyon Mine area within the last few years also indicated that mixed age groundwater was apparently discharging along the Meade Thrust Fault in that area (JBR 2001b).

The separation of the bedrock groundwater above and below the Meade Peak member is an important feature in the Study Area because groundwater in the Dinwoody formation is stratigraphically above the proposed pit backfills and external overburden fills. Therefore, the overburden fills from the proposed mining are downgradient of the Dinwoody aquifer. The Wells formation and Brazer Limestone are stratigraphically below the proposed mining operations and groundwater in these units is downgradient of the proposed mine pits, pit backfills, and external overburden fills. Groundwater in the Wells formation and Brazer Limestone west of the Meade Thrust Fault zone discharges upward to surface streams and springs located along the fault zone or locations west of it.

In the Study Area, the major eastward groundwater flow component in the Wells formation and Brazer Limestone appears to discharge as major springs (e.g., Hoopes Spring, South Fork Sage Creek Springs, and Books Spring) at or near the surface expression of the thrust faults in Sage Valley and in the bottom of Crow Creek Valley (**Figure 3.3-8**). The thrust faults are considered to be barriers to eastward groundwater flow, resulting in the discharge of groundwater at the low elevations along this linear feature. Mayo et al. (1985) indicated that the thrust faults east of and below the Boulder Creek Anticline were barriers to groundwater flow transverse to the plane of the faults, while also providing potential flow pathways parallel to the faults in the shatter or damage zone of the faults. Ralston (1979) concluded that the flow from Hoopes Spring and South Fork Sage Creek Springs occurred from the Wells formation along the West Sage Valley Branch fault where the trace of the fault and adjacent Wells formation outcrop is at an elevation below the water table in the Wells formation, estimated at approximately 6,700 feet (Ralston 1979).

Flow monitoring of streams and springs in the Study Area during 2003 and 2004 baseline studies resulted in an understanding of the approximate amount of groundwater being discharged from the Wells formation and Brazer Limestone to the surface environment (Maxim 2004c). In addition to discrete springs, monitoring of stream flow in Crow Creek and lower Deer Creek indicate the approximate amount of groundwater that is thought to move from the ground into the stream channels within the Study Area (JBR 2005a). **Table 3.3-4** shows the estimates of the discharges from the Wells formation and Brazer Limestone aquifers in the Study Area.

TABLE 3.3-4 GROUNDWATER DISCHARGE FROM WELLS FORMATION AND BRAZER LIMESTONE IN THE STUDY AREA

LOCATION	ANNUAL FLOW (CFS)
Stewart Ranch Springs	6.0
Wells Canyon Spring	0.2
Books Spring	2.9
Lower Deer Creek	0.9
Crow Creek Channel Gain	1.8
South Fork Sage Creek Spring	4.5
Total	16.3

Localized groundwater flow systems occur in the Dinwoody and Phosphoria formations. These rocks receive recharge locally from precipitation in the mountain areas where they outcrop. Smaller springs and seeps in and near the Panel F and G lease areas are likely from local, shallow groundwater systems in the Dinwoody and Phosphoria formations that are structurally and/or stratigraphically controlled. Relatively small flows from these springs discharge where these rocks outcrop due to topography, bedding, or faults/fractures.

A review of drill logs provided by Simplot (2003) for Panel F show that groundwater was encountered in the Rex Chert and Meade Peak members of the Phosphoria formation only in the vicinity of upper Manning Creek where several normal faults have been identified. Other exploration drill holes completed in Panel F to the top of the Wells formation encountered no groundwater. Drill holes in Panel G show that water was encountered in the Rex Chert and Meade Peak members, primarily on the west side of the proposed mine pit. **Figures 3.3-4** through **3.3-7** show locations of groundwater encountered in monitoring wells completed in the vicinity of Panels F and G. Locations of all cross sections are shown on **Figure 3.1-1**.

Figure 3.3-4 is a section across the southern portion of Panel F showing how the mine development would remove the Meade Peak and part of the overlying Rex Chert down dip to the economic stripping ratio. Standing groundwater was encountered in the Rex Chert and in fractured Meade Peak. Both of these groundwater observations are above the regional water table in the Wells Formation, which is more than 800 feet below the bottom of the Panel F pit at this location.

Figure 3.3-5 is a section roughly running along the axis of Panel F and also shows the elevation of the groundwater in the monitoring wells installed within the Meade Peak and Rex Chert. The projection of the deepest portion of the Panel F pit is shown and portrays the fact that the proposed pit bottom throughout Panel F is estimated to be at least 200 feet higher than the regional water table in the Wells formation.

Figure 3.3-6 is a section roughly east-west through Panel G and shows the planned open pit removing the Meade Peak and the Rex Chert that is present on west side of the unnamed hill down dip to the economic stripping ratio. This also shows that a groundwater body exists in the Rex Chert in this location but the regional Wells formation water table is estimated to be approximately 100 feet below the deepest portion of the pit bottom. This is also shown in **Figure 3.3-7**, which is a section roughly parallel to the long dimension of Panel G, which shows groundwater in the Rex Chert and that the bottom of Panel G is estimated to be from 100 to 200 feet above the Wells formation aquifer.

Influence of the Deer Creek and Wells Canyon faults (**Figure 3.3-8**) on groundwater movement in the Study Area is uncertain. A small spring, Wells Canyon Spring, is located about a third of the way up Wells Canyon and may be influenced by the Wells Canyon Fault located in this canyon. Books Spring is located along the Deer Creek Fault and likely discharges from the Wells formation and/or Brazer Limestone. Downstream of where the Deer Creek Fault crosses Deer Creek (**Figure 3.3-8**), the stream gains flow from groundwater from the Wells formation and Brazer Limestone.

Groundwater flow in the Wells formation north of the Deer Creek Fault (under Panel F) flows primarily to the east toward the Meade Thrust Fault and then along the fault toward the north. South of the Wells Canyon Fault, groundwater in the Wells formation and Brazer Limestone appears to discharge at Stewart Spring (**Figure 3.3-8**). Additionally, some groundwater from these formations also appears to discharge into alluvium in the Crow Creek Valley in the general reach between Lambs Canyon and Deer Creek, as evidenced by water balance measurements made in this area in 2003 and 2004 (Maxim 2004c).

Unconsolidated Quaternary colluvium and alluvium deposits occur along the bottoms of South Fork Sage, Deer, and other creeks flowing east from the Webster Range in the Study Area. Alluvial deposits, consisting of well- to poorly-sorted gravel, sand, silt and clay, are narrow and thin in the bottoms of these creeks where they flow through their respective canyons and become thicker at the mouths of the canyons (Cressman 1964). Permeability of the alluvium is high to moderate, depending on the amount of fines in the sediments.

Aquifer Hydraulic Characteristics

During summer 2003, several monitoring wells were constructed in the Project Area to evaluate groundwater conditions (**Figure 3.3-8**). Well completion information is summarized in **Table 3.3-5**. A total of 11 monitoring wells were drilled and completed in the following hydrostratigraphic units: alluvium, Rex Chert, Meade Peak, and Wells formation.

TABLE 3.3-5 MONITORING WELL COMPLETION DATA
SMOKY CANYON MINE - PANELS F & G

WELL NO.	DEPTH TO WATER (FEET)	WATER ELEVATION (FEET)	WELL DEPTH (FEET)	SCREEN INTERVAL (FEET)	MONITORED LITHOLOGY
MC-MW-1	148.1	6632	210	160 - 210	Upper Wells formation
MC-MW-2	60.0	7763	85	55 - 85	Rex Chert Member
MC-MW-3	dry	dry	25	5 - 25	Alluvium
MC-MW-4	45.5	7846	96	66 - 96	Rex Chert Member
MC-MW-5	88.4	7786	121	81 - 121	Meade Peak Member
DC-MW-1	7.5	7381	7.5	2.5 – 7.5	Alluvium
DC-MW-2	62.6	7203	117	87 - 117	Meade Peak & Upper Grandeur Fm.
DC-MW-3	94.9	7300	193	163 - 193	Rex Chert Member
DC-MW-4	105.0	7314	136	106 - 136	Meade Peak Member
DC-MW-5	303.0	6902	494	380 – 483	Upper Wells formation
DC-MW-6	4.3	7260	7.5	2.5 – 7.5	Alluvium

Note: Elevations surveyed October 29, 2003 as feet above mean sea level. Based on NAD 83 datum.

Regional aquifer test data show the following mean, horizontal hydraulic conductivity values for the various hydrostratigraphic units over a wide geographic area: Rex Chert (unfractured) = 2.8 feet/day; Rex Chert (fractured) = 52 feet/day; Meade Peak (unfractured) = 2.4 feet/day; Meade Peak (fractured) = 25 feet/day; and Wells formation = 1.8 feet/day (Whetstone Associates 2003). Hydraulic conductivity of the Wells formation where locally fractured would be expected to be higher.

Aquifer testing conducted in the bedrock monitoring wells indicated hydraulic conductivities that were lower than the ranges of regional values (Maxim 2004c). Tests of three monitoring wells in the Rex Chert yielded hydraulic conductivities ranging from 0.05 to 0.57 feet/day. A test of the Meade Peak Member away from known faulting yielded a hydraulic conductivity of 0.4 to 0.6 feet/day. Where the Meade Peak was faulted in two monitoring wells, the hydraulic conductivity ranged from 0.4 to 2.9 feet/day. The one test of the Wells formation (DC-MW-5) produced a hydraulic conductivity of less than 0.04 feet/day, which is much lower than expected, but this well was difficult to develop, so the measured hydraulic conductivity is suspect. A recent pump test conducted in the Smoky Canyon Industrial Well by NewFields (2004) indicated a hydraulic conductivity for the Wells formation of 3.7 feet/day.

3.3.6 Groundwater Model

To better understand the flow of groundwater in the Wells formation and Brazer Limestone, a numerical groundwater model using the USGS computer code MODFLOW 2000, was developed for the Study Area (JBR 2005a). The boundaries of the modeled area were South Fork Sage Creek on the north, Freeman Ridge/Snowdrift Mountain on the west, Lamb Canyon on the South, and Crow Creek or the Meade Thrust Fault on the east (**Figure 3.3-9**).

An estimate of the groundwater recharge to the Wells formation and Brazer Limestone was made for the model area using empirical data from previous hydrogeology studies (JBR 2005a). The recharge to these units comes from: 1) distributed infiltration of precipitation directly into the outcrop areas of the units within the Study Area, 2) percolation from stream channels where they cross the units and lose flow, and 3) underflow from adjacent portions of these units outside the model area. The estimate of these recharge amounts is shown in **Table 3.3-6**.

TABLE 3.3-6 RECHARGE INTO THE WELLS FORMATION AND BRAZER LIMESTONE IN THE STUDY AREA

TYPE OF RECHARGE	ANNUAL AMOUNT (ACRE-FEET/YEAR)
Distributed Precipitation Infiltration	4,800
Percolation from Stream Losses	1,900
Groundwater Underflow from Adjacent Areas	4,400

Distributed recharge occurs from infiltration of rain and snowmelt over the recharge area of the Wells formation and Brazer Limestone within the model area boundary. It was assumed there would be no such recharge in the area underlain by the Meade Peak member aquitard. Streams that cross the outcrop areas of the Wells formation and Brazer Limestone are known to lose flow through percolation into the units under the stream channels (Ralston 1979, Winter 1980). Estimates of the annual recharge to these formations through stream losses were made using gain/loss survey data measured on the streams in the Smoky Canyon Mine area (JBR 2005a). Groundwater that flows into the model area originates from recharge of precipitation and snowmelt in outcrop areas of the Wells formation to the south and west of the model area. A large, high-elevation recharge area is in the area of Meade Peak immediately south and southwest of the model area boundary.

Figure 3.3-9 Modeled Potentiometric Surface and Groundwater Flow Direction

The groundwater model used a water budget consisting of the measured groundwater discharges listed in **Table 3.3-4** and the groundwater recharge estimates listed in **Table 3.3-6**. The hydraulic conductivity within the model area was adjusted until the model discharges calibrated with the measured flows listed in **Table 3.3-4**, and the elevation of the water table at the discharge points calibrated with the known elevations at these points and the measured water table elevations at monitoring wells DC-MW-5 and MC-MW-1. Based on previous studies in the area, the hydraulic conductivity along the Meade Thrust Fault plane was set at a high level (Mayo et al. 1985). Outside of the thrust fault and the immediate vicinities of Stewart Ranch and Books springs, the majority of the calculated hydraulic conductivities within the model area ranged from about 1.4 to 3.8 feet/day, which is consistent with the recently measured hydraulic conductivity at the Smoky Canyon Mine Industrial Well.

The model was then used to generate the water table contours shown in **Figure 3.3-9**. These show a general pattern of eastward groundwater flow for the Wells formation /Brazer Limestone regional aquifer within the model area. They also show the influence of the large amount of groundwater recharge that occurs in the high-elevation area south and southwest of the model area. Finally, hypothetical particles were placed in the top of the modeled aquifer at specified locations along the east margin of the Meade Peak member and allowed to move downgradient under the influence of groundwater flow. These "particle tracks" are shown in **Figure 3.3-9**.

The particle tracks indicate that groundwater in the Wells formation and Brazer Limestone generally moves toward the east boundary of the model area. They also indicate that the groundwater under Panel F moves toward the trace of the Meade Thrust Fault and then northward along the fault toward South Fork Sage Creek Spring. Groundwater under Panel G appears to flow eastward toward discharge locations along lower Deer Creek or at Books Spring.

3.3.7 Chemical Characteristics of Groundwater

Water samples were collected in 2003 and 2004 from all monitoring wells in the Study Area, with the exception of alluvial well MC-MW-3 (Panel F) because it was dry. Samples were analyzed for the water quality parameters listed in **Appendix 3A, Summary of Groundwater Data**. Some parameters were also measured in the field during sample collection including: temperature, pH, conductivity (SC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. Metals were analyzed as both total and dissolved. Tables including complete groundwater quality data are contained in the baseline technical reports (Maxim 2004c and 2004d) and are reproduced in **Appendix 3A, Summary of Groundwater Data**. The groundwater quality standards listed in this same table are obtained from IDAPA 58.01.11.200. For Idaho, groundwater standards for metals are based on the total fraction. Groundwater samples were obtained and analyzed for both total and dissolved metals to identify the potential effect of turbidity on the reported water chemistry. Some groundwater standards (e.g., pH, TDS, chloride, sulfate, aluminum, iron, manganese, silver, and zinc) are "secondary", which are generally based on aesthetic qualities (IDAPA 58.01.11.200.01.b). If the natural background level of a constituent in groundwater exceeds its standard, the natural background level shall be used as the standard (IDAPA 58.01.11.200.03).

Comparison of the baseline monitoring results from the monitoring wells to applicable standards show that, in general, groundwater in the Study Area meets the groundwater quality standards with some exceptions that exceeded the standards. These exceedances are highlighted in **Appendix 3A, Summary of Groundwater Data** with shading. Many of the exceedances of the metals standards were measured in total metals samples with fewer exceedances noted in dissolved metals samples. The total metal samples are not filtered in the field and represent water quality in the well itself, including any suspended sediment in the well. The dissolved metals samples are filtered in the field to exclude any suspended sediment and represent water quality in the aquifer outside the well casing.

The pH was typically in a range of about 7 to 8.5. Values in the lower range from 5.4 to 6 were measured in the field in four samples from monitoring wells completed in Rex Chert, Meade Peak shale, and alluvium (MC-MW-2, MC-MW-5, and DC-MW-1). Laboratory pH measurements for all four samples were about 7 or above. One well (DC-MW-3) had field and lab pH values over 8 and 10, respectively for the 2003 and 2004 samples. This water was obtained from the Rex Chert west of Panel G.

One groundwater sample (DC-MW-1) had a nitrate value (25 mg/L) over the standard (10 mg/L). This was from a shallow (7.5-foot deep) well developed in alluvium west of Panel G.

The manganese standard (0.05 mg/L) was exceeded in four groundwater samples from the Rex Chert (MC-MW-2, MC-MW-4, and DC-MW-3), two samples from alluvium (DC-MW-1 and DC-MW-6), and three samples from the Meade Peak member (MC-MW-5, DC-MW-2, and DC-MAW-4). The manganese standard is a secondary one intended to reduce discoloration of materials that come in contact with the water.

The dissolved selenium concentration (0.507 mg/L) in the 2003 sample from the Meade Peak member in MC-MW-5 exceeded the selenium standard (0.05 mg/L) by an order of magnitude. The selenium concentration in this well dropped to half the groundwater standard in June 2004 but then increased to 0.325 mg/L in October 2004. Other monitoring well samples collected from the Meade Peak (DC-MW-2 and DC-MW-4) had dissolved selenium values that were below the groundwater standard.

Well DC-MW-5, completed in the upper Wells formation at Panel G, also had selenium concentrations that were anomalous. The dissolved selenium concentration was 0.0143 mg/L in 2003, dropping to 0.0105 mg/L in June 2004 and 0.0079 mg/L in October 2004. These concentrations are below the groundwater standard of 0.05 mg/L, but above the surface water standard of 0.005 mg/L. The significant drop in manganese and iron concentrations between 2003 and 2004 in the samples from this well, combined with the extreme depth (>300 feet) and low pumping rate (1.5 gpm), indicate that this well was not adequately developed to obtain representative groundwater samples, and the selenium concentrations are likely not indicative of baseline conditions.

Concentrations of several metals are elevated for the total fraction (e.g., aluminum, cadmium, chromium, iron, and manganese). Dissolved metal concentrations, however, are lower and show the effect of insufficient development of this well on measured water chemistry.

Graphical plots (Piper and Stiff diagrams) of common ions for the surface water and groundwater samples are included in **Appendix 3A, Figures H-1 – H-9**. The Piper diagrams titled "Median Groundwater Quality" and "Median Spring Water Quality" (**Appendix 3A, Figures H-3 and H-6**) graphically show that ion concentrations are generally similar for all groundwater samples, and the water samples are of the calcium-magnesium bicarbonate type. Stiff diagrams graphically show the concentrations of the major cations and anions in a way that allows comparison of the water chemistries of the different samples. The Stiff diagrams for the median water quality for springs from the Wells formation (**Appendix 3A, Figure H-7**) show the close chemical similarity of these samples, consistent with them all discharging from the same aquifer.

The higher sodium and chloride concentrations in SP-Books (Books Spring) suggest the water in this spring discharge has contacted saline rocks in the Pruess formation, which is known to contain bedded salt deposits in the area. The Pruess formation is present to the east of the Meade Thrust Fault in this area, suggesting the water discharging from this spring has flowed along the fault zone and contacted salt bearing rock.

The major ion values of the water in the two Wells formation monitoring wells (DC-MW-5 and MC-MW-1) on **Figure H-4, Appendix 3A**, are similar to the Wells formation springs shown on **Figure H-7**, again demonstrating a common aquifer for these samples. Note that the concentration scales for **Figure H-4** are different than **Figure H-7**, which is the reason the shapes are different between these two figures even though the chemistries are similar. The stiff diagrams for the other monitoring wells on **Figures H-4 and H-5, Appendix 3A,** demonstrate different water chemistry than the samples from the Wells formation aquifer and show highly variable chemistries when compared to each other.

The stiff diagrams for the Rex Chert monitoring wells (**Figure H-5, Appendix 3A**) typically show low concentrations of all major ions. This pattern is similar to the spring waters shown on **Figure H-9, Appendix 3A,** that discharge on the Rex Chert outcrop (SP-UTNFDC-400, SP-DC-350, SP-UTDC-700, SP-WC-400).

The chemistries shown in **Figures H-5, H-8 and H-9 (Appendix 3A)** for waters sampled from monitoring wells and springs contained in shales (DC-MW-2, SP-SFSC-100, SP-UTSFSC-100, SP-MC-300, SP-UTNFDC-600, SP-NFDC-700, and SP-UTDC-800) all have higher concentrations of calcium and bicarbonate than the samples from the Rex Chert.

Comparisons of water chemistry data for springs in the Study Area to applicable water standards are shown in **Appendix 3A, Summary of Surface Water Data.**

The field pH of the springs was typically in a range of about 7 to 8.5 for the 2002 and 2003 samples. Lower pH values in the range from 6.2 to 6.5 were measured in the field in 2004 regardless of the spring location in the Study Area. Laboratory pHs for all samples in all years were in the range of 7.4 to 8.6. Questions related to field pH measurements in May 2004 resulted in them being declared invalid (Maxim 2004b). There are no obvious geographic or geologic trends in pH between the various springs in the Study Area.

Spring water in the Study Area is generally good quality with total dissolved solids (TDS) values ranging from 22 to 308 mg/L. The lowest TDS values were from SP-UTWC-300 (22 mg/L) and SP-UTSFDC-500 (54 mg/L), which discharge from colluvium west of Panel G. The higher TDS springs included Books Spring (264 mg/L), Hoopes Spring (276 mg/L), which discharge Wells/Brazer groundwater, and two springs located on the south end of Panel F and the north end of Panel G, respectively (SP-UTNFDC-600 = 308 mg/L and SP-UTDC-800 = 285 mg/L), which likely discharge groundwater from the Rex Chert or alluvium/colluvium.

Electrical conductivity is an indirect measurement of the salinity of water and the readings from the springs in the Study Area ranged from 26 to 629 umhos/cm. The lowest conductivity reading was for SP-UTWC-300 (26 umhos/cm). The highest conductivity value for spring water was obtained from SP-CC-500, the small saline spring near the narrows along Crow Creek downstream of Deer Creek (629 umhos/cm). The other high values were from SP-UTNFDC-600 (573 umhos/cm), Books Spring, (498 umhos/cm) SP-UTNFDC-540 (498 umhos/cm) and SP-UTDC-800 (488 umhos/cm).

Springs in the Study Area typically had dissolved cadmium concentrations that were below the surface water standard of 0.001 mg/L (dissolved basis, hardness adjusted). There was one dissolved cadmium concentration (0.0019 mg/L) that exceeded the standard at SP-UTNFDC-540. This spring is located in an area downhill of Meade Peak Shale outcrop.

The mercury surface water standard (0.000012 mg/L total basis) was exceeded in a few springs in the Study Area as shown in **Table 3.3-7**. All of these springs discharge from the Rex Chert or Meade Peak members of the Phosphoria formation. These were all total metals analyses, and the dissolved metals analyses for all these springs were below the surface water standard, indicating the groundwater mercury concentration prior to discharge at these springs was below the standard.

TABLE 3.3-7 SPRINGS EXCEEDING THE MERCURY SURFACE WATER STANDARD

SPRING	DATE	CONCENTRATION (MG/L)
SP-MC-300	8/25/04	0.00013
SP-UTDC-700	8/26/04	0.00027
SP-UTNFDC-400	5/20/03	0.0002
SP-UTSFDC-500	5/22/02	0.0003D, 0.0004T
SP-UTWC-300	5/23/02	0.0003D, 0.0004T
SP-WC-400	8/25/04	0.0001T

The selenium concentrations in a number of springs exceeded the surface water standard of 0.005 mg/L (total basis) (**Table 3.3-8**). All of these springs except SP-UTSC-850 discharge water from the Rex Chert or Meade Peak members of the Phosphoria formation. SP-UTSC-850 is a small spring located approximately along the West Sage Valley Branch thrust fault and could potentially be discharging groundwater from the Wells/Brazer aquifer. The reported selenium values for 5/16/04 are anomalous because later sampling (9/28/04) indicated a total selenium concentration of 0.00073 mg/L.

TABLE 3.3-8 SPRINGS EXCEEDING THE SELENIUM SURFACE WATER STANDARD

SPRING	DATE	CONCENTRATION (MG/L)
SP-DC-350	8/08/02	0.006 D & T
SP-UTDC-700	5/19/03	0.01 D*
SP-UTDC-700	10/28/03	0.0068 T
SP-UTDC-700	5/17/04	0.0073 D, 0.0075 T
SP-UTDC-800	5/19/03	0.015 D*
SP-UTDC-800	5/17/04	0.0065 D, 0.0069 T
SP-UTNFDC-540	10/28/03	0.0054 D & T
SP-UTNFDC-540	5/17/04	0.0105 D, 0.0104 T
SP-UTNFDC-600	10/29/03	0.0122 D*
SP-WC-400	8/08/02	0.006 D & T
SP-UTSC-850	5/18/04	0.008 D, 0.0084 T

*There was no total metals sample for this date or quality assurance requires use of dissolved data.

The only other metal that exceeded surface water standards in the springs water quality monitoring was zinc with a standard of 0.105 mg/L. The standard was exceeded in the samples from SP-UTDC-700 (0.225 mg/L) and SP-UTSFDC-500 (0.21 mg/L). Both these springs are located in the Phosphoria formation outcrop area.

In general the groundwater discharges to the surface at springs in the Study Area indicate good quality groundwater with the exception of certain springs that discharge within the outcrop area of the Phosphoria formation where groundwater flow can contact mineralized rock units. These springs are not hydrologically connected to the regional Wells/Brazer aquifer. Spring discharges from the regional Wells/Brazer aquifer indicate good water quality meeting all surface and groundwater quality standards.

3.3.8 Environmental Isotopes

Analyses were conducted of isotopes (deuterium, oxygen-18, tritium, carbon-14) in selected water samples from the Study Area (Mayo 2004). The stable isotopes (deuterium and oxygen-18) were used to discriminate between different waters and to interpret their origins. All of the springs that appear to discharge from the Wells formation or Brazer Limestone (Hoopes, Wells Canyon, Books, South Fork Sage, Lower Deer Creek, Lower Clear Creek, and Stewart Ranch) all had similar, depleted stable isotopic characteristics indicating they belong to a common aquifer. The more negative values of the stable isotopes for these samples indicate the water precipitated in relatively low temperature conditions, consistent with precipitation occurring at high elevations and as snow, or during colder climatic conditions (old water).

The sample from the deep, Wells formation monitoring well upgradient (west) of Panel G, DC-MW-5, had the most depleted stable isotope ratios, indicating it formed at the coldest temperatures of any of the samples. This is consistent with the fact that only high elevation recharge areas are upgradient of this sample site. On the other hand, the sample from the shallower monitoring well in the mouth of South Fork Sage Creek Canyon, MC-MW-1, had a rather positive stable isotope value, indicating it is in the flow path of recharge from surface water flow in the adjacent South Fork Sage Creek (Mayo 2004).

The stable isotope results for the groundwater samples are consistent with water that was recharged at higher elevations and then flowed eastward to lower elevation discharge locations. The more negative isotope values are also consistent with mixed shallow and deeper origin groundwaters along the Meade Thrust Fault where the deeper waters would be older and have more negative isotopic values.

Stable isotope characteristics for surface water samples obtained in the Study Area during summer 2003 tended to be similar to each other and were more positive in value than the groundwater samples, indicating the water precipitated at warmer temperatures (lower elevations) and possibly was affected by evaporation.

Stable isotope values for Crow Creek samples in the Study Area taken during summer and winter indicated that the winter base flow of the creek upstream from the area of the confluence with Deer Creek was supported by the same aquifer as the other Wells formation/Brazer Limestone springs. This is consistent with water balance studies conducted along Crow Creek during summer 2003 and winter 2004, which indicated that groundwater is discharged into the Crow Creek channel from somewhere below the mouth of Lamb Canyon to just downstream of Deer Creek Canyon (Maxim 2004c).

The radioisotopes (carbon-14 and tritium) were utilized to evaluate mean residence times (age) of the groundwater in the aquifers. Carbon-14 provides information regarding the number of years that have elapsed since the groundwater became isolated from soil-zone gases and near-surface waters. Tritium is a qualitative tool that indicates if groundwater was recharged since about 1954 when man-made tritium was released to the atmosphere through thermonuclear testing. Groundwater ages determined from carbon-14 and tritium were listed as modern, mixed old/modern, or old, depending on whether the samples contained anthropogenic carbon-14 and tritium.

The elevated tritium content of all samples, typically greater than 4 tritium units, indicated that all samples from the Wells formation and Brazer Limestone contained appreciable modern recharge. Most samples also contained carbon-14 concentrations greater than 50 percent modern carbon, indicating anthropogenic (human-induced) carbon associated with atmospheric nuclear weapons testing. Hoopes and Books springs had the lowest carbon-14 contents which, when combined with their lower tritium contents, indicate the flows discharging from these springs are mixtures of old and younger waters with mean residence times of 200 and 300 years, respectively. This is consistent with the mixed-age that was determined for Hoopes Spring water in 2000 (JBR 2001b) and in 1980 (Muller and Mayo 1983).

The modern tritium and radiocarbon ages determined for MC-MW-1 indicated that this well is located in recharge flow paths for modern surface waters in the adjacent South Fork Sage Creek.

Unlike Hoopes Spring and Books Spring, South Fork Sage Creek Spring and Stewart Spring both have appreciable carbon-14 contents indicating they have more modern mean residence times than either Hoopes or Books springs.

The mixed-age mean residence times for samples from Books and Hoopes Spring indicate flows from these sources are likely mixtures of relatively young groundwater in the upper Wells formation and Brazer Limestone aquifer, with relatively old groundwater rising along the Meade Thrust Fault. This is consistent with the theory proposed by previous workers that the trace of the thrust fault acts as a barrier to flow perpendicular to it but also as a zone of preferential flow in the damage zone parallel to the fault trace (Mayo et al. 1985, JBR 2001b).

3.3.9 Groundwater – Surface Water Interconnection

Groundwater in the Dinwoody and Thaynes formations supports springs and seeps located in the map area for these units. Perennial and seasonal seeps, springs and streams in the Study Area are supported by Dinwoody groundwater discharges in the following watersheds: Diamond Creek, Upper Deer Creek (above SW-DC-300), Upper South Fork Deer Creek (above SW-SFDC-200), North Fork Deer Creek (above SW-DC-500), Upper Manning Creek (SP-MC-300), Upper South Fork Sage Creek (SP-SFSC-100), and the upper portion of the unnamed tributary to South Fork Sage Creek that drains the northern portion of Panel F (SP-UTSFSC-100 and –200) (**Figure 3.3-3**).

Groundwater in the Rex Chert apparently does not support any of the major mapped streams in the Study Area, but does provide flow to isolated seeps and springs in the following areas: Upper Wells Canyon (SP-WC-400, SP-UTWC-300), Panel G (SP-UTDC-800, SP-UTDC-700, SP-UTSFDC-500 and -600, Panel F (SP-UTNFDC-400 and –600) (**Figure 3.3-3**).

All of the groundwater supporting the seeps, springs and streams in the Dinwoody and Rex Chert areas is stratigraphically isolated above the Meade Peak member and is not connected to the groundwater in the Wells formation and Brazer Limestone underlying the Meade Peak.

Groundwater contained in the Wells formation and Brazer Limestone supports the following springs and streams located along the eastern slope of the Webster Range: Hoopes Spring (SP-Hoopes), South Fork Sage Creek Spring (SP-SFSC-750), Unnamed spring south of SF Sage Creek (SP-UTSC-850), Lower Deer Creek (above SW-DC-800), Books Spring (SP-Books), Wells Canyon (SP-WC-750), Stewart Ranch (SP-ST-100, -200, and –500), Crow Creek (above SW-CC-500), and Clear Creek (SW-CL-800) (**Figure 3.3-3**). All of the discharges described above that apparently flow from the Wells formation or Brazer Limestone combine for a total flow in the range of 15 to 20 cfs, which provide perennial base flow to Sage Creek, Crow Creek, and certain tributaries to these creeks including Lower South Fork Sage Creek, Lower Deer Creek, and lower Clear Creek.

Groundwater in the Rex Chert member and Dinwoody formation does not recharge the aquifer in the Wells formation to a significant degree. The exception to this is where perennial streams flowing across the Dinwoody are supported by Dinwoody groundwater, and these stream flows are lost to the Wells formation outcrop where the channels cross the outcrop.

Groundwater from the Wells formation and Brazer Limestone does not flow up through the Meade Peak member, so it does not connect with seeps, springs and streams within the outcrop areas of the Rex Chert member or Dinwoody formation.

Based on the above, it is apparent that there are two separate groundwater systems in the Study Area: 1) the Rex Chert and Dinwoody groundwater system located stratigraphically above the Meade Peak member and 2) the Wells formation and Brazer Limestone groundwater system below the Meade Peak.

3.3.10 Beneficial Use of Groundwater

A listing of water rights associated with both surface water and springs (considered a groundwater right) in the Study Area obtained from IDWR (2004) is presented in **Appendix 3A, Summary of Water Rights Points of Diversion**. Also included in the appendix is a map showing locations of water rights (points of diversion) in the Study Area. According to this information, springs closest to Panels F and G that have water rights coincide with:

> SP-UTSFSC-100 and -200 along the west side of Panel F in a tributary to South Fork Sage Creek (No. 4054, USFS, stock water);
>
> SP-MC-300 on the west side of Panel F in upper Manning Creek (No. 4053, USFS, stock water); and,
>
> SP-WC-400 on the southwest side of Panel G in upper Wells Canyon (No. 4056 and 10505, USFS, stock water).

In addition to these springs closest to the Panels F and G, the following spring discharges in the Study Area also have water rights: Books Spring (SP-Books; No. 4069, Nate, irrigation-stock water); Stewart Springs (SP-ST-100 and -200; No. 2020 and 4010, Alleman and Stewart, domestic-irrigation-stock water); South Fork Sage Creek Springs (SP-SFSC-750; No. 10034, Hoopes, stock water); and Hoopes Spring (SP-Hoopes; No. 4081 and 10033, Peterson and Hoopes, domestic-irrigation-stock water). There are also springs with water rights that occur within or very near the proposed haul/access road corridors throughout the Study Area. The majority of these springs have been included in the baseline studies for this EIS and are shown on **Figure 3.3-3**.

There is one listed groundwater right for the Study Area: No. 10024; owner – Reide; domestic use. This matches the “SP-Reide” monitoring site shown on **Figure 3.3-3**, which is a spring that has been developed into a shallow well.

3.4 Soils

Regional Setting

The Project Area is located in the middle Rocky Mountain Physiographic Province of southeastern Idaho. Much of the province is made up of interior basins. Mountains rise steeply from the semiarid sagebrush-covered plains or agricultural valleys. The mountains are generally well covered with vegetation, and the higher elevations support conifer forests on the north and east facing slopes (USDA 1990).

Panels F and G are located in the Webster and Preuss Ranges, and the average annual runoff in these ranges is estimated at 1.07 acre-feet of water per acre of land (USDA 1990). This rate of runoff is more than twice the average runoff of the Blackfoot River watershed, slightly higher than the average for the Salt River, and more than seven times the average annual runoff of the Bear River at Soda Springs, Idaho. Runoff rate statistics indicate that this area is in an important water source area for all three drainages (USDA 1990).

The annual water losses through evaporation exceed the annual water gains from precipitation at lower elevations and in the western portion of the Forest (USDA 1990). Vegetation distribution is controlled mostly by altitude, latitude, direction of prevailing winds, and slope exposure.

Existing soils in the Study Area are largely undisturbed. Past mineral exploration and timber harvesting have disturbed parts of the area. All these areas have been reclaimed and the soil stabilized with vegetation. Forest Routes open to motorized access in the area present an ongoing ground disturbance. Soils in the area can also be affected by grazing and recreational activities (USFS 2003b).

3.4.1 Soil Survey

The Baseline Technical Report for Soil Resources (Maxim 2004f) is a 2nd Order soil inventory conducted from June through August 2003 and is the main reference for determining onsite soil characteristics. Procedures and interpretations were adapted primarily from the *Soil Survey Manual* (USDA 1993), *National Soil Survey Handbook* (USDA 2003b), and *Keys to Soil Taxonomy* (USDA 2003c). Soil resources outside the 2nd Order soil inventory area have been evaluated at the 3rd Order level using the *Soil Survey of the Caribou National Forest, Idaho (*USDA 1990) and the *Soil Survey of Star Valley Area, Wyoming-Idaho* (USDA 1976).

Twenty-two soil map units were identified and mapped, including seven consociations and 15 complexes (Maxim 2004f). Soil profile characteristics obtained in the field were utilized in coordination with laboratory analyses to determine suitable depths of salvage for each soil type. Field procedures and detailed data from the 2nd Order soil inventory are presented in the baseline technical report (Maxim 2004f).

A reconnaissance level field survey was conducted on natural soils within the portions of the proposed and alternative haul road and conveyor corridors, based on the existing 3rd Order *Soil Survey of the Caribou National Forest, Idaho* (USDA 1990). The field survey review included evaluation of exposed soil profiles, depths, coarse fragment content, color, and vegetation-soil relationships, and concluded that soil resources within these proposed disturbance areas have been accurately characterized in the existing survey (Maxim 2004f).

3.4.2 Mapped Soil Unit Characteristics

Soil map units determined in the baseline technical report (Maxim 2004f) for proposed disturbance in Panel F and Panel G are shown on **Figure 3.4-1** and **Figure 3.4-2**, respectively. Soil resources for the proposed haul road, conveyor corridors, and alternatives are shown at a 3rd Order level on **Figure 3.4-3**.

Profile descriptions, laboratory analysis results, and complete soil map unit data for each sample site are presented in the baseline report. **Table 3.4-1** provides a summary of the soil map units, identifying the classification, properties, and characteristics of the soils, and their total composition within the Project Area. Soils in the baseline Study Area are classified to the soil family level in accordance with *Keys to Soil Taxonomy* (USDA 2003c).

TABLE 3.4-1 SOIL MAP UNIT DESCRIPTIONS

MAP UNIT NUMBER[1]/ NAME	TAXONOMIC CLASSIFICATION	PERCENTAGE OF MAP UNIT	LANDSCAPE POSITION/ SLOPE	PARENT MATERIAL	TEXTURE	APPROXIMATE SOIL DEPTH (INCHES)	ERODIBILITY WIND WATER	PERCENT COARSE FRAGMENTS	WATER HOLDING CAPACITY
1/ Ericson-Rock River Complex	Fine-loamy, mixed, superactive Xeric Haplocryalf	50	Valley bottom/ 15-22%	Alluvium and colluvium	Loam	28	Moderate Moderate	20	Moderate
	Rock River	35			Rock outcrop	0	Low Moderate	+90	Low
2/ Ketchum Loam	Loamy-skeletal, mixed, superactive Xeric Eutrocryept	80	Ridgetop and canyon slopes/ 7–40 %	Limestone	Loam	24	Low Moderate	40	Low-Moderate
3/ Cloud Peak-Ketchum Complex	Loamy-skeletal, mixed, superactive Inceptic Haplocryalf	40	Steep slopes/ 45-55%	Shale and chert	Loam	24	Low Moderate	40	Very High
	Loamy-skeletal, mixed, Superactive Xeric Eutrocryept	40							
4/ Dranyon-Fluvents/Aquolls Complex	Fine-loamy, mixed, superactive Pachic Argicryoll	50	Drainage bottoms and side slopes/ 5-15%	Alluvium	Loam	30	Moderate Moderate	15	Moderate-High
		30							
5/ Blaine-Farlow Complex	Loamy-skeletal, mixed, superactive Xeric Argicryoll	45	Ridgetop and steep side slopes/ 15-50%	Chert, limestone, siltstone	Loam	24	Moderate Moderate	35-60	Moderate-High
	Loamy-skeletal, mixed, superactive Xeric Haplocryoll	40				18			
6/ Ericson-Blaine Complex	Fine-loamy, mixed, superactive Xeric Haplocryalf	50	Hilltops and side slopes/ 15-40%	Old limestone, alluvium and colluvium	Sandy loam	24	Moderate Moderate	40	Moderate-High
	Loamy-skeletal, mixed, superactive Xeric Argicryoll	35	Hilltops and side slopes/ 15-50%					20	
7/ Dranyon-Parkay Complex	Fine-loamy, mixed, superactive Pachic Argicryoll	40	Drainage bottoms and side slopes/ 5-30%	Alluvium and colluvium	Silt loam	30	Moderate High	30	High-Very High
	Loamy-skeletal, mixed, superactive Pachic Argicryoll	40						35	

MAP UNIT NUMBER[1]/ NAME	TAXONOMIC CLASSIFICATION	PERCENTAGE OF MAP UNIT	LANDSCAPE POSITION/ SLOPE	PARENT MATERIAL	TEXTURE	APPROXIMATE SOIL DEPTH (INCHES)	ERODIBILITY WIND WATER	PERCENT COARSE FRAGMENTS	WATER HOLDING CAPACITY
8/ Farlow-Ketchum Complex	Loamy-skeletal, mixed, superactive Xeric Haplocryoll	50	Ridgetop and steep side slopes/ 20-50%	Cherty shale and Rex Chert, Mixed colluvium	Sandy loam	18	Low Moderate	40	Low
	Loamy-skeletal, mixed, superactive Xeric Eutrocryept	35						50	
9/ Swede-Blaine Complex	Fine-loamy, mixed, superactive Xeric Argicryoll	45	Gentle slopes and swales/ 10-15%	Alluvium and colluvium limestone derived	Loam	36	Moderate Moderate	35	Moderate
	Loamy-skeletal, mixed, superactive Xeric Argicryoll	40						20	
10/ Ericson Loam	Fine-loamy, mixed, superactive Xeric Haplocryalf	80	Hilltops and side slopes/ 10-20%	Shale and sandstone	Loam	20	Moderate Moderate	20	High
13/ Blaine-Dranyon Complex	Loamy-skeletal, mixed, superactive Xeric Argicryoll	60	Steep south facing slopes and benches/ 10-20%	Shale and limestone derived colluvium	Silt loam	24	Moderate Moderate	40	Very High
	Fine-loamy, mixed, superactive Pachic Argicryoll	25				30		20	
14/ Blaine-Jughandle Complex	Loamy-skeletal, mixed, superactive Xeric Argicryoll	60	Ridgetops and steep slopes/ 35-45%	Limestone colluvium	Loam	24	Moderate Moderate	40	Moderate
	Coarse-loamy, mixed, superactive Xeric Eutrocryept	25				18		20	
16/ Cloud Peak Loam	Loamy-skeletal, mixed, superactive Inceptic Haplocryalf	70	Swales and gentle sideslopes/10-15%	Limestone residuum and colluvium	Loam	24	Moderate Moderate	40	Moderate
17/ Farlow-Blaine Complex	Loamy-skeletal, mixed, superactive Xeric Haplocryoll	65	Steep canyon sideslopes/ 40-55%	Limestone colluvium	Silt Loam	18	Moderate Moderate	45	Moderate-High
	Loamy-skeletal, mixed, superactive Xeric Argicryoll	20				24		40	
18/ Starman-Rock Outcrop Complex	Loamy-skeletal, mixed, superactive Lithic Cryorthent	40	Ridgetops and steep slopes/ 20-75%	Chert and limestone residuum	Loam	6	Low Moderate	50+	Very Low
	Rock Outcrop	40			Rock Outcrop	0		90+	

MAP UNIT NUMBER[1]/ NAME	TAXONOMIC CLASSIFICATION	PERCENTAGE OF MAP UNIT	LANDSCAPE POSITION/ SLOPE	PARENT MATERIAL	TEXTURE	APPROXIMATE SOIL DEPTH (INCHES)	ERODIBILITY WIND WATER	PERCENT COARSE FRAGMENTS	WATER HOLDING CAPACITY
19/ Judkins-Blaine Complex	Loamy-skeletal, mixed, superactive Xerollic Haplocryalf	45	Mountain sideslopes, north aspect/ 25-50%	Cherty shale and Rex Chert, Mixed colluvium	Gravelly loam	24	Moderate Moderate	50	Moderate
	Loamy-skeletal, mixed, superactive Xeric Argicryoll	40							
20/ Karlan-Dranyon Complex	Fine-loamy, mixed, superactive Pachic Haplocryoll	50	Mountain sideslopes, south and west aspects/ 35-50%	Siltstone and shale	Silt loam	30	Low Moderate	10	Very High
	Fine-loamy, mixed, superactive Pachic Argicryoll	30							
21/ Dranyon-Ericson Complex	Fine-loamy, mixed, superactive Pachic Argicryoll	60	Valley bottom and swale/ 5-10%	Alluvium	Sandy loam	24	Moderate Moderate	25	High- Very High
	Fine-loamy, mixed, superactive Xeric Haplocryalf	20							
22/ Judkins Silt Loams	Loamy-skeletal, mixed, superactive Xerollic Haplocryalf	75	Ridgetop and sideslopes/ 15-30%	Dolomite, limestone, shale	Silt loam	24	Moderate Moderate	70	Moderate
24/ Cloud Peak Silt Loams	Loamy-skeletal, mixed, superactive Inceptic Haplocryalf	75	Sideslopes and ridgecrests/ 20-30%	Shale and chert colluvium and residuum	Silt loam	24	Moderate Moderate	50	Moderate
25/ Jughandle Silt Loams	Coarse-loamy, mixed, superactive Xeric Eutrocryept	75	Steep sideslopes/ 40-50%	Sandstone, limestone	Silt loam	24	Moderate Moderate	15	Moderate
26/ Starley Silt Loams	Loamy-skeletal, mixed, superactive Lithic Haplocryoll	90	Ridge crest/ 10-50%	Limestone, dolomite	Silt loam	6	Low Moderate	50	Very Low

Source: Maxim 2004f

[1] Map units are identified on **Figures 3.4-1** and **3.4-2**.

Figure 3.4-1 Soil Mapping Units of Panel F

Figure 3.4-2 Soil Mapping Units of Panel G

Figure 3.4-3 Order 3 General Soils of Transportation Areas

The majority of soils in the Project Area are classified as moderately deep to very deep, well drained to somewhat excessively well drained, loamy-skeletal or fine-loamy, mixed, superactive, Xeric Argicryolls, Haplocryolls and Haplocryalfs. Soil textures are generally loamy with a high percentage of coarse fragments. Slope steepness ranges from five to 75 percent and varies depending on the profile location. Laboratory analytical data indicate that soils pH values range from 5.1 to 8.2 (strongly acid to moderately alkaline), but the majority of soils are neutral to moderately acid. Soil organic matter content ranges from 0.48 to 10.5 percent, with an average of between one and three percent organic matter. Soil depths in the Project Area ranged from rock outcrop areas with no measurable soil to profiles greater than five feet thick.

The map units are mapped as land types and cover a wide range of topography from valley and drainage bottoms to canyon slopes, sideslopes, and ridgetops. Soils found in the Project Area are classified taxonomically as Argicryolls, Cryorthents, Eutrocryepts, Haplocryolls, and Haplocryalfs.

Parent materials for soils within the Project Area include sandstone, shale, siltstone, limestone, chert, colluvium, alluvium and residuum (Maxim 2004f). Soil in drainages and swales developed primarily from alluvial materials, and colluvium is the parent material for development of soil on most slopes.

Depth to water table was determined to be greater than six feet for all map units in the Project Area (Maxim 2004f).

Seven soil consociations and 15 soil complexes were identified as map units within the Project Area. Rock outcrops are not suitable for recovery and use as growth medium. Maxim (2004f) provides further details regarding the specific soil characteristics for each of the individual sample sites. The soil complexes and consociations identified within the Project Area are shown on **Figures 3.4-1** and **3.4-2**.

Soil inclusions that exist to a limited extent within the composition of the soil complexes and consociations identified in the 2nd Order inventory area, but are not a significant portion of the map unit, include the following soil types: Cluff, Mikesell, Moonlight, Nisula, Povey, Redfeather, Starley, Starman, and Thayne. Maxim (2004f) provides further details regarding soil characteristics for these inclusion soil types.

Soil map units described at the 3rd Order level that have been identified in the vicinity of the Study Area are shown on **Figure 3.4-3**. These mapping units are further described in the *Soil Survey of the Caribou National Forest, Idaho* (USDA 1990).

3.4.3 Topsoil/Growth Medium Suitability

Mountainous terrain does not favor optimal soil development. Soils on mountain slopes are susceptible to increased erosion rates that constantly remove the fine particles from the surface and deposit them on the surfaces of soils occupying the alluvial or valley slopes. Mountain soils also tend to have high concentrations of coarse fragments that are transported to the alluvial slopes during landslide events over time. Shallow, stony soils provide a minimal amount of quality topsoil/growth medium material for reclamation. The rate of soil formation is slow in any environmental condition and location, even beneath grassland vegetation. Rates of soil formation from consolidated parent material under grasslands have been calculated at 0.33 tons per acre per year or less (DeBano and Wood 1992).

The estimated average depth of topsoil currently existing in the Project Area is more than 22 inches, as described in the baseline report (Maxim 2004f). Steep slopes are the main limitation that would preclude salvage of topsoil resources in disturbance areas. An estimated 12 acres of soil resources would not be suitable for recovery as growth medium for reclamation due to limiting factors such as rock outcrop, excessive coarse fragments or slope. These areas of unrecoverable soil are scattered throughout the Project Area.

The suitable topsoil/growth medium depths determined for each soil type were based on the amount of salvageable unconsolidated material available in the surface soil or within the subsoil. The percentage of coarse fragments, organic matter, and selenium concentrations were additional, locally important limitations considered in determining topsoil/growth medium suitability. Criteria utilized by Maxim (2004f) to initially determine topsoil/growth medium suitability were developed and outlined by CNF resource specialists and are detailed in **Table 3.4-2**.

TABLE 3.4-2 CRITERIA USED TO DETERMINE TOPSOIL/GROWTH MEDIUM SUITABILITY

PROPERTY	TOPSOIL/GROWTH MEDIUM SUITABILITY				RESTRICTIVE FEATURE[1]
	GOOD	FAIR	POOR	UNSUITABLE	
Texture	textures finer than sands and coarser than sandy clay and silty clay, with less than 35% clay	loamy textures	sand textures and clayey textures with <60% clay	>60% clay content	excessive sands or clays
Organic Matter Content	>3%	<3% but greater than 1%[1]	0.5 to 1.0%[1]	<0.5%[1]	low fertility
Coarse Fragments (0-40 inches)	<15% by volume	15-25% by volume	25-35% by volume	>35%	equipment restrictions and low fertility
Depth to High Water Table	--	--	<1 foot to high water	perennial wetness	equipment restrictions
Soil Reaction – pH[2] (0-40 inches)	6.0 to 8.0	5.0 to 6.0 8.0 to 8.5	4.5 to 5.0 8.5 to 9.0	<4.5 or >9.0	excessive acidity or alkalinity
Slope Steepness	<8% slope	8 to 25% slope	25 to 40% slope	>40% slope	equipment restrictions

Source: Maxim 2004f
Notes:
1. As defined in the Soil Survey Manual (USDA 1993) and National Soil Survey Handbook (USDA 2003a).
2. pH in standard units.
< Less than
> Greater than

Based on field reviews of the soils mapped in the Project Area, the majority of soil family classifications were determined to be potentially suitable for topsoil or growth medium recovery. Samples of each soil horizon were collected and submitted for laboratory analysis to further determine the characteristics and limitations for each soil type. **Table 3.4-3** identifies the topsoil/growth medium suitability parameters and limitations for each soil family that comprise the 2nd Order map units found within the Project Area.

Table 3.4-4 identifies the extent of suitable and marginally suitable soils for topsoil/growth medium salvage found within mapped soil units covered by the 2nd Order soil inventory, including the total volume of useable topsoil/growth medium. The reclamation potential for soils recoverable within the Project Area is based on production and fertility parameters identified in **Table 3.4-2** such as soil texture, organic matter, slope steepness, coarse fragment content, and pH. Soils in the Project Area have pH values of 5.1 to 8.2 that fall within the suitability limit range (Maxim 2004f). Individual soil sample sites may not be representative of the surrounding soil in the major map unit. These minor inclusions represent a small percentage of the map unit and would be incorporated into the majority soil during salvage and reclamation. Excessive coarse fragment content and steep slopes are the two limitations that have the most potential to negatively influence fertility and production of reclaimed areas within the Project Area. Mixing of soil map units during salvage operations would dilute excessive coarse fragment content and selenium concentration in some soils, resulting in maximum recovery volumes.

Prime Farmland

Prime farmland is classified as available land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (USDA 1993). Due to high elevations, there are no prime farmlands located within Caribou County. The growing season in areas of high elevation in this portion of southeastern Idaho often is less than 60 days and frost may occur anytime during the year at elevations above 6,500 feet (USDA 1990), which renders the soil unsuitable for classification as prime farmland.

TABLE 3.4-3 TOPSOIL/GROWTH MEDIUM SUITABILITY PARAMETERS FOR SOILS IN THE PROJECT AREA

SOIL FAMILY	PHYSICAL CONSIDERATIONS			ANALYTICAL CONSIDERATIONS[3]				TOPSOIL/ GROWTH MEDIUM SUITABILITY LIMITATION(S) [5]
	SOIL TEXTURE[1]	COARSE FRAGMENT CONTENT PERCENT [2]	SLOPE PERCENT	ORGANIC MATTER PERCENT[4]	REACTION (PH) [4]	TOTAL SELENIUM[4] (SE)	EXTRACTABLE SELENIUM[4] (SE) (MG/KG)	
Blaine	Silty clay loam/ Clay loam	35-60	10-70	2.59-10.2	5.9-6.0	Not Detected (ND)	0.09-0.15	Extractable Se greater than 0.10 mg/Kg[6] Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Cloud Peak	Sandy loam/ Silt loam/ Loam	40-50	15-60	0.48-3.5	5.0-7.6	ND	ND to 0.13	Extractable Se greater than 0.10 mg/Kg[7] Low organic matter content below 39 inches. Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Ericson	Loam/ Silt loam/ Clay loam	20-25	2-60	0.52-3.38	5.4-6.6	ND	ND to 0.26	Extractable Se greater than 0.10 mg/Kg[6] Equipment restrictions in areas with >40% slope
Farlow	Silt loam	35-60	0-70	1.22-6.71	5.5-7.1	ND	ND to 0.10	Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Judkins	Loam	50-70	2-65	0.88-10.5	6.3-7.3	ND to 6 mg/Kg	ND to 0.14	Extractable Se greater than 0.10 mg/Kg[6] Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope.
Jughandle	Silt loam/ Loam/ Sandy loam	15-20	30-50	0.47-6.09	5.1-6.6	ND	ND to 0.07	Low organic matter content below 17 inches. Equipment restrictions in areas with >40% slope
Jughandle (variant)	Silty clay loam	15-20	30-50	1.67-4.07	5.8-6.0	ND	0.11-0.12	Extractable Se greater than 0.10 mg/Kg[6] Equipment restrictions in areas with >40% slope.

SOIL FAMILY	PHYSICAL CONSIDERATIONS			ANALYTICAL CONSIDERATIONS[3]				TOPSOIL/ GROWTH MEDIUM SUITABILITY LIMITATION(S) [5]
	SOIL TEXTURE[1]	COARSE FRAGMENT CONTENT PERCENT [2]	SLOPE PERCENT	ORGANIC MATTER PERCENT[4]	REACTION (PH) [4]	TOTAL SELENIUM[4] (SE)	EXTRACTABLE SELENIUM[4] (SE) (MG/KG)	
Karlan	Loam/ Silt loam/ Silty clay loam	10-15	10-60	0.71-4.93	5.6-8.2	ND to 24 mg/Kg	0.03-0.14[7]	Total Se greater than 13 mg/Kg[6] and extractable Se greater than 0.10 mg/Kg[7] Equipment restrictions in areas with >40% slope.
Ketchum	Sandy loam/ Silt loam/ Loam/ Silty clay loam	40-50	10-70	0.33-5.26	5.3-7.4	ND to 8 mg/Kg	ND to 0.06	Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Moonlight	Loam	Not Applicable (NA)	15-35	0.69-3.88	5.7-6.0	ND	ND to 0.07	NA
Parkay	Silt loam	35	10-70	1.31-5.26	6.4-7.1	ND	0.07-0.10	Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Povey	Loam	NA	0-60	2.45-4.9	6.9-7.4	ND	ND to 0.08	Equipment restrictions in areas with >40% slope
Starley	Silt loam	50	10-70	NA	6.3-7.2	Not Analyzed	Not Analyzed	Equipment restrictions in areas with >40% slope. Equipment restrictions and low fertility in areas with high coarse fragment content.
Starman	Silt loam/ Loam	+50	15-70	0.88-7.02	5.8-6.0	ND	0.04	Equipment restrictions and low fertility in areas with high coarse fragment content. Equipment restrictions in areas with >40% slope
Swede	Silt loam/ Silty clay loam	20	5-65	0.78-8.48	5.5-6.3	ND	0.07-0.14	Extractable Se greater than 0.10 mg/Kg[7] Equipment restrictions in areas with >40% slope.

Source: Maxim 2004f

1. Majority soil texture(s) (by percent weight) occurring throughout the depth of the profile.
2. Range of estimated percent volume of coarse material through the top 40 inches of the profile. Coarse fragment content is dominated by gravels in most soils.
3. Production potential.
4. Range of values through soil profile. The pH values represent the top 40 inches of the soil profile.
5. Based, in part, on Guidelines for the Salvage of Topsoil and Shale used to Reclaim and Provide a Seed Bed for Phosphate Mine Reclamation (USDA 2003c), in addition to suitability parameters identified in **Table 3.4-2**.
6. At one sample site.
7. At more than one sample site.

ND = Not detected.

TABLE 3.4-4 SUITABLE AND MARGINALLY SUITABLE RECLAMATION SOILS IN THE PANEL F AND G PROJECT AREA

MAP UNIT[1]	SOIL FAMILY	SUITABLE TOPSOIL/GROWTH MEDIUM		MARGINALLY SUITABLE TOPSOIL/GROWTH MEDIUM		ACRES WITHIN PANELS F & G (INCLUDES PROPOSED LEASE MODIFICATIONS)	TOPSOIL/GROWTH MEDIUM VOLUME (BCY)
		SOIL DEPTH (INCHES)[2]	CONSTRAINTS	SOIL DEPTH (INCHES)[2] AND HORIZON DEPTHS	CONSTRAINTS		
1/ Ericson-Rock River Complex	Ericson	15	--	11 (15-26)	Selenium[4]	5.86*	12,309
	Rock River	0	Rock outcrop	0	Rock outcrop		
2/ Ketchum Loam	Ketchum	22	Slope[3]	44 (22-66+)	Excessive coarse fragment content	1.0	8,906
3/ Cloud Peak-Ketchum Complex	Cloud Peak	5	Excessive coarse fragment content or Slope[3]	58 (5-55+)	Excessive coarse fragment content or selenium[4]	8.87	75,129
	Ketchum						
4/ Dranyan-Fluvents/Aquolls Complex	Dranyon[5]	30	--	0	--	1.68	6,776
	Fluvents/ Aquolls						
5/ Blaine-Farlow Complex	Blaine	0	Excessive coarse fragment content or Slope[3]	21 (0-21+)	Excessive coarse fragment content or Slope[3]	85.56	241,564
	Farlow						
6/ Ericson-Blaine Complex	Ericson	0	Selenium[4]	24 (0-24)	Excessive coarse fragment content, selenium[4] or slope[3]	45.21	145,878
	Blaine	0	Excessive coarse fragment content				
7/ Dranyon-Parkay Complex	Dranyon[5]	16	--	13 (16-29)	Selenium[4]	17.42	67,731
	Parkay						
8/ Farlow-Ketchum Complex	Farlow	0	Excessive coarse fragment content or Slope[3]	18 (0-18)	Excessive coarse fragment content	84.3	204,006
	Ketchum						
9/ Swede-Blaine Complex	Swede	36	Excessive coarse fragment content	0	Excessive coarse fragment content	45.5	220,220
	Blaine						
10/ Erickson	Ericson	20	--	0	--	23.39	63,019
13/ Blaine-Dranyon Complex	Blaine	0	Excessive coarse fragment content	24 (0-24)	Excessive coarse fragment content	60.06	193,794
	Dranyon[5]						
14/ Blaine-Jughandle Complex	Blaine	0	Slope[3]	17 (0-17)	Excessive coarse fragment content and low organic matter below 17 inches	7.18	16,449
	Jughandle						

MAP UNIT[1]	SOIL FAMILY	SUITABLE TOPSOIL/GROWTH MEDIUM		MARGINALLY SUITABLE TOPSOIL/GROWTH MEDIUM		ACRES WITHIN PANELS F & G (INCLUDES PROPOSED LEASE MODIFICATIONS)	TOPSOIL/GROWTH MEDIUM VOLUME (BCY)
		SOIL DEPTH (INCHES)[2]	CONSTRAINTS	SOIL DEPTH (INCHES)[2] AND HORIZON DEPTHS	CONSTRAINTS		
16/ Cloud Peak	Cloud Peak	0	Excessive coarse fragment content	24 (0-24)	Excessive coarse fragment content	0.16	516
17/ Farlow-Blaine Complex	Farlow	0	Slope[3]	24 (0-24)	Excessive coarse fragment content	151.71	489,518
	Blaine						
18/ Starman-Rock Outcrop Complex	Starman	0	Excessive coarse fragment content and Slope[3]	6 (0-6)	Excessive coarse fragment content	24.21*	23,435
	Rock outcrop	0	Rock outcrop	0	Rock outcrop		
19/ Judkins-Blaine Complex	Judkins	7	Excessive coarse fragment content or Slope[3]	17 (7-24+)	Excessive coarse fragment content or Selenium[4]	197.48	637,202
	Blaine						
20/ Karlan-Dranyan Complex	Karlan	0	Selenium[4]	28 (0-28)	Selenium[4]	62.89	250,955
	Dranyon[5]						
21/ Dranyon-Ericson Complex	Dranyon[5]	28	--	0	--	26.3	98,863
	Ericson						
22/ Judkins Silt Loams	Judkins	22 (7-29)	Excessive coarse fragment content	7 (0-7)	Excessive coarse fragment content and Selenium[4]	42.37	164,740
24/ Cloud Peak Silt Loams	Cloud Peak	0	Excessive coarse fragment content	24	Excessive coarse fragment content	65.95	212,799
25/ Jughandle Silt Loam	Jughandle	0	Slope[3]	17 (0-17)	Low organic matter below 17 inches and Slope[3]	35.66	81,695
26/ Starley	Starley	0	Excessive coarse fragment content	6 (0-6)	Excessive coarse fragment content	0.68	549
TOTAL						992.83	3,216,053

Source: Maxim 2004f

1. Map units are identified on **Figures 3.4-1** and **3.4-2**.
2. Soil depth is the average recoverable depth, generally to the bottom of the B horizon or to a depth where more than 35% of the profile contains coarse fragments greater than 3 inches in size. Materials below this depth may be suitable at some individual sites.
3. Equipment restrictions exist in areas with >40% slope.
4. Total Selenium >13 mg/Kg or Extractable Se >0.10 mg/Kg
5. Laboratory analyses for selenium, organic matter, and coarse fragment content were not conducted for Dranyon soils.

* Rock outcrop comprises between 35-40% of these map units, therefore acreage has been reduced for the cubic yard calculations.

3.4.4 Erosion Potential

The overall hazard of erosion for soils has previously been determined by soil surveys conducted within the watershed area (USDA 1990; USDA 1976). Soil erosion, combined with other impacts from forest disturbances, such as soil compaction, can reduce forest sustainability and soil productivity (Elliot et al. 1996). In general, upland areas are more susceptible to erosion than lowland sites, and areas with higher coarse fragment content and lower slope angle have lower potential for water erosion hazard.

Elliot et al. (1996) determined that soil erosion in an undisturbed forest is extremely low, generally under 0.5 tons per acre per year (tons/acre/yr). Disturbances can dramatically increase soil erosion to levels exceeding 50 tons/acre/yr (Elliot et al 1996). These disturbances may include natural events such as wildfires and mass movements, as well as human induced disturbances such as road construction and timber harvesting (Elliot et al 1996).

Soil loss tolerance (T-factor) is defined as the maximum rate of annual soil erosion at which the quality of a soil as a medium for plant growth can be maintained (USDA 2003b). The T-factor is represented by integer values ranging from 1 to 5 tons per acre per year (USDA 1993). The factor of 1 ton per acre per year is for shallow or otherwise fragile soils, and 5 tons per acre per year is for deep soils that are least subject to damage by erosion (USDA 1993). A T-factor rating is assigned to soils without respect to land use or cover and represents the soil loss from wind and water erosion (USDA 2003b). Select published data on rates of soil formation and plant productivity responses to erosion indicate that tolerable soil losses vary widely for croplands (DeBano and Wood 1992). Data for rangelands are essentially nonexistent, although values of 4.5 tons per acre per year have been estimated for shallow soils on rangeland sites (DeBano and Wood 1992).

The soil suitability assessment identifies limitations and suggests that certain areas disturbed by the Project would experience increased erosion potential by water due to the steep slopes in the Project Area. **Table 3.4-5** identifies the erosion potential and hydrologic characteristics of soils in the Project Area. These soil erodibility characteristics are described in the *Soil Survey Manual* (USDA 1993) and summarized below.

Wind Erodibility Group (WEG)

The WEG for each soil was determined based on soil texture using the *National Soil Survey Handbook* (USDA 2003b) and soil information presented in Maxim (2004f). WEGs are based on the compositional properties of the surface horizon that are considered to affect susceptibility to wind erosion. These properties include texture, presence of carbonate, and the degree of decomposition of organic soils. The wind erodibility index of each WEG is the theoretical, long-term amount of soil lost per year through wind erosion (USDA 1993). Significant proportions of clay content, organic matter, and coarse fragment content decrease the wind erosion potential. Silt loam is the soil texture that is most susceptible to wind erosion. Wind erosion potential has been rated as moderate for the majority of soils within the Project Area, with the exception of the Karlan, Ketchum, Starley, and Starman soils, which have low wind erodibility ratings. There are no soil types in the Project Area categorized as highly susceptible to wind erosion (Maxim 2004f).

Course Fragment Content
Typical soils within the Project Area have been determined to have a surface coarse fragment content from three to 20 percent. The Farlow, Judkins, Ketchum, Povey, Starley, and Starman soil types characteristically have 20 to 43 percent surface coarse fragments, with some profile layers containing as much as 70 percent coarse fragments. The majority of soils contain a range of 1.6 to 10.5 percent organic matter in the top few inches of the soil profile, with an average of approximately 4.4 percent.

K-Factor
The K-factor is a relative index of the susceptibility of bare, cultivated soil to particle detachment and transport by rainfall (USDA 1993). A high K-factor value indicates greater susceptibility of the soil to erosion by water and provides a quantification of the hazard. The K-factor may be computed from the composition of the soil texture and structure, and may be influenced by organic matter and surface coarse fragment content. The fine sand and silt fractions of soil are most susceptible to erosion, while organic matter and coarse fragments reduce susceptibility to erosion (Maxim 2004f). Water erosion hazard for soils within the Project Area has been determined to be moderate for all map units except the Cluff, Harkness, and Parkay soils with high water erodibility, and the Povey and Moonlight soils with low water erodibility. Soils with greater than 25 percent coarse fragments by volume would have dramatically reduced susceptibility to water erosion (Maxim 2004f). When adjusted for the generally excessive coarse fragment content of the native soils, the Blaine, Cloud Peak, Farlow, Judkins, Ketchum, Starley and Starman soil types would be classified as having a low hazard for water erosion, rather than a moderate hazard as shown in **Table 3.4-5**. The overall erosion hazard rating is based on the combination of the WEG and K-factor values and has been adjusted for coarse fragment content.

Available Water Capacity (AWC)
AWC is the volume of water that should be available to plants if the soil, inclusive of coarse fragments, were at field capacity (USDA 1993; 2003b). It is commonly estimated as the amount of water held between field capacity and wilting point, with corrections for salinity, fragments, and rooting depth. This is an important soil property in developing water budgets, predicting droughtiness, designing and operating irrigation systems, designing drainage systems, protecting water resources, and predicting yields (USDA 2003b). Depending on their abundance and porosity, rock and pararock fragments reduce AWC. Soils high in organic matter have higher AWC than soils low in organic matter if the other properties are the same.

Drainage Class
Drainage class identifies the natural drainage condition of the soil. It refers to the frequency and duration of wet periods (USDA 2003b). Soils in the Project Area are generally well drained to somewhat excessively drained, which indicates that water is removed from the soil readily and sometimes rapidly. None of the soils in the Project Area have been classified as poorly drained. Therefore, drainage is not a factor that would inhibit growth of roots for significant periods during most growing seasons.

Soil Permeability
Soil permeability is the quality of the soil that enables water or air to move through it. Historically, soil surveys have used permeability coefficient or permeability as a term for saturated hydraulic conductivity (USDA 2003b). The soil properties that affect permeability are distribution of pore sizes and pore shapes. Texture, structure, pore size, and density are properties used to estimate permeability since the pore geometry of a soil is not readily observable or measurable (USDA 2003b).

TABLE 3.4-5 EROSION POTENTIAL AND HYDROLOGIC CHARACTERISTICS OF SOILS IN THE PROJECT AREA

SOIL FAMILY	SLOPE (PERCENT)	DRAINAGE	PERMEABILITY	AVAILABLE WATER HOLDING CAPACITY	WATER ERODIBILITY[1] (K-FACTOR)	WIND ERODIBILITY[2] (WEG)	SURFACE COARSE FRAGMENTS[3]	OVERALL EROSION HAZARD [4]
Blaine	10-70	Well drained	Moderate to moderately slow	Moderate	Moderate (0.26)	Moderately erodible (5)	18	Low to moderate
Cloud Peak	15-60	Very well drained	Moderate to moderately slow	Moderate	Moderate (0.39)	Moderately erodible (5)	16	Low to moderate
Cluff	40-55	Well drained	Moderately slow	High	High (0.47)	Moderately erodible (5)	15	Moderate to high
Dranyon	0-70	Well drained	Moderate to moderately slow	Very high	Moderate (0.29)	Moderately erodible (5)	9	Moderate
Ericson	2-60	Well drained	Moderately slow	High	Moderate (0.33)	Moderately erodible (5)	10	Moderate
Farlow	0-70	Somewhat excessively drained	Moderately rapid	High	Moderate (0.27)	Moderately erodible (5)	23	Low to moderate
Harkness	10-50	Well drained	Slow	High	High (0.48)	Moderately erodible (5)	0	Moderate to high
Judkins	2-65	Well drained	Moderately slow	Moderate	Moderate (0.36)	Moderately erodible (5)	23	Low to moderate
Jughandle	30-50	Somewhat excessively drained	Moderate to moderately rapid	Moderate	Moderate (0.28)	Moderately erodible (3)	3	Moderate
Karlan	10-60	Well drained	Moderate to moderately rapid	Very high	Moderate (0.35)	Low erodibility (6)	7	Low to moderate
Ketchum	10-70	Somewhat excessively drained	Moderately rapid	Low	Moderate (0.33)	Low erodibility (8)	29	Low
Nisula	10-70	Well drained	Moderately slow to slow	High	Moderate (0.37)	Moderately erodible (5)	18	Moderate
Parkay	10-70	Well drained	Moderate to moderately slow	High	High (0.44)	Moderately erodible (5)	17	Moderate to high

SOIL FAMILY	SLOPE (PERCENT)	DRAINAGE	PERMEABILITY	AVAILABLE WATER HOLDING CAPACITY	WATER ERODIBILITY[1] (K-FACTOR)	WIND ERODIBILITY[2] (WEG)	SURFACE COARSE FRAGMENTS[3]	OVERALL EROSION HAZARD [4]
Povey	0-60	Well drained	Moderately rapid to moderately slow	High	Low (0.20)	Moderately erodible (5)	43	Low to moderate
Redfeather	40-70	Somewhat excessively drained	Moderate	Very low	Moderate (0.37)	Moderately erodible (5)	0	Moderate
Starley	10-70	Somewhat excessively drained	Moderate to moderately rapid	Very low	Moderate (0.34)	Low erodibility (8)	30	Low
Starman	15-70	Somewhat excessively drained	Moderate to moderately rapid	Very low	Moderate (0.31)	Low erodibility (8)	30	Low
Swede	5-65	Well drained	Moderate to moderately slow	Moderate	Moderate (0.28)	Moderately erodible (5)	11	Moderate
Thayne	2-40	Well drained	Moderate to moderately slow	High	Moderate (0.34)	Moderately erodible (5)	0	Moderate

Source: Maxim 2004f, USDA 1993.
[1] Relative index of susceptibility to water erosion (0.25=low, 0.25 to 0.40=moderate, >0.40=high).
[2] Wind Erodibility Group (WEG) rating (1-2 = highly erodible, 3-5 = moderately erodible, 6-8 = low erodibility).
[3] Values based on field estimates (Maxim 2004f).
[4] Hazard rating for a disturbed, unvegetated soil. Erodibility rating has been adjusted for coarse fragment content of native soils.
Maxim (2004f) notes that soils with more than 25% coarse fragments by volume would have reduced susceptibility to water erosion.

3.4.5 Roads and Development

Areas of potential disturbance (mainly proposed haul/access road corridors) outside the 2nd Order soil inventory area have been described at the 3rd Order level (USDA 1990), and these soil land types are shown on **Figure 3.4-3**. **Table 3.4-6** identifies the suitability ratings of these soils for roads and development. Land types that are not within potential disturbance corridors are not further described in the table, although they are identified in **Figure 3.4-3**. Ratings are given for trafficability on unsurfaced roads, cut and fill erosion hazard, cut and fill revegetation limitations, cut slope stability hazard, and suitability for topsoil (USDA 1990).

Ratings for trafficability on unsurfaced roads assume use of native materials for the road running surface (USDA 1990). Ratings are based on characteristics such as soil texture, drainage, and coarse fragments. Soils containing large percentages of coarse fragments are not rated as suitable for unsurfaced roads. A rating of good indicates that the roadbed would be stable and require only occasional maintenance. A rating of fair indicates that the roadbed would yield limited volumes of sediment and require seasonal repair to maintain trafficability. A rating of poor indicates that roadbeds would yield high volumes of sediment and require frequent maintenance. Soils within the Study Area have been rated as poor to good for trafficability on unsurfaced roads.

Cut and fill erosion hazard ratings are for the period prior to revegetation and assume cut and fill slopes of 1h:1v (USDA 1990). The ratings are based on properties which affect soil movement caused by overland flow, including slope, coarse fragments, and surface erosion hazard. A rating of low indicates that resistance to erosion is sufficient to permit prolonged exposure of bare soil. A rating of moderate indicates that resistance to erosion is sufficient to permit temporary exposure of bare soil, necessitating standard revegetation practices. A rating of high indicates that unprotected cuts and fills would yield high volumes of sediments, requiring special protective measures. Within the Study Area, soils have a low to high rating for cut and fill erosion hazard, with the majority of soils in the moderate range.

Cut and fill revegetation limitation ratings assume uniform slopes with 1h:1v slope and seeding completed during the first growing season following construction (USDA 1990). The ratings are based on properties affecting the establishment of grasses, including mass stability, drainage, coarse fragments, soil texture, depth to bedrock, and slope. Soils that are shallow, rocky, unstable, or are located on steep slopes have severe limitations for establishing vegetation. A rating of slight indicates an acceptable revegetation response rate; moderate indicates a limited response, and severe indicates that a slow revegetation response can be expected. Soils within the Study Area have been rated as slight to severe for cut and fill revegetation suitability.

Cutslope stability hazard ratings assume construction on uniform slopes with cuts greater than five feet high, a 1h:1v final slope, and revegetation following construction (USDA 1990). These ratings are based on soil properties affecting stability of mechanically disturbed slopes including mass stability, texture, drainage, and slope. Wet soils with uniform particle size on steep, naturally unstable slopes have the highest hazard. A rating of low indicates that no appreciable hazard of mass failure on cut and fill slopes exists. A rating of moderate indicates that seasonal repair of roads would be needed because of potential mass failures, and a rating of high indicates that cut and fills may yield excessively high volumes of material from mass failures, necessitating constant repairs. Within the Study Area, soils have a low to high rating for cut slope stability hazard, with the majority of soils in the moderate range.

TABLE 3.4-6 ROADS AND DEVELOPMENT SUITABILITY

LAND TYPE[1] & SOIL FAMILIES	UNSURFACED ROAD TRAFFICABILITY	CUT & FILL EROSION HAZARD	CUT & FILL REVEGETATION LIMITATION	CUT SLOPE STABILITY HAZARD	TOPSOIL SUITABILITY
061 Venable-Argic Cryaquolls-Coski	Poor to Good	Low to Moderate	Slight to Moderate	Low	Poor to Good
082 Rooset-Beaverdam-Toone	Poor to Fair	Moderate to High	Moderate	Low to Moderate	Fair to Good
201 Farlow-Judkins-Starley	Poor	Moderate to High	Moderate to Severe	Low	Poor
300 Ericson-Cloud Peak-Ketchum	Poor to Good	Low to Moderate	Slight to Moderate	Low to Moderate	Poor
301 Blaine-Dranyon	Good	Moderate	Moderate	Low	Fair to Good
380 Povey-Alpon-Ketchum	Fair to Good	Low to Moderate	Slight to Severe	Low to Moderate	Poor to Good
381 Parkay-Judkins-Farlow	Fair to Good	Low to Moderate	Slight to Severe	Low	Poor to Good
404 Judkins-Farlow-Swede	Fair to Good	Moderate to High	Moderate to Severe	Low to Moderate	Poor
405 Starley-Povey-Farlow	Fair to Good	Moderate to High	Moderate to Severe	Moderate	Poor
451 Beaverdam-Swede-Dranyon	Poor to Fair	Low to Moderate	Slight	Moderate to High	Fair to Good
473 Dranyon-Judkins-Povey	Poor to Fair	Moderate to High	Moderate to Severe	Low to Moderate	Poor to Fair
553 Blaine-Nisula-Calcic Cryoborolls	Poor to Good	Moderate to High	Moderate to Severe	Low to Moderate	Poor
653 Judkins-Nisula-Farlow	Poor to Fair	Moderate to High	Moderate to Severe	Low to Moderate	Poor
656 Cloud Peak-Jughandle-Swede	Fair	Low to Moderate	Moderate to Severe	Low to Moderate	Poor
755 Ketchum-Nisula-Farlow	Poor to Good	Moderate to High	Moderate to Severe	Low to Moderate	Poor
912 Calcic Cryoborolls-Starley-Judkins	Fair to Good	Moderate to High	Severe	Low to Moderate	Poor

Source: USDA 1990
[1]Map units described in this table are identified on **Figure 3.4-3**

Ratings for suitability for topsoil assume stripping of surface layers for storage and later use as a growth medium for revegetation (USDA 1990). Growth medium recovered from road surfaces typically remains adjacent to the road for use during reclamation. The suitability ratings are based on properties which affect reclamation of the borrow area as well as ease of excavation, loading and spreading. These properties include depth to bedrock, soil texture, coarse fragments, layer thickness, slope, and depth to a high water table. A rating of poor indicates that the material is an improbable source of growth for revegetation; a rating of fair indicates the material is a probable source with some limitations, and a rating of good indicates that the material is a probable source of growth medium. Within the Study Area, soils have a low to high rating for topsoil suitability, with the majority of soils in the poor range. It should be noted that the topsoil suitability criteria for roads and development are based on suitability criteria identified in the 3rd Order Soil Survey (USDA 1990). Topsoil suitability ratings identified in **Table 3.4-6** do not include laboratory analyses from the 2nd Order analysis (Maxim 2004f) and are not determined using criteria identified in **Table 3.4-2**.

3.4.6 Selenium and Trace Elements in Soils

Selenium

As documented elsewhere in this EIS, selenium has been identified as a concern in southeastern Idaho where phosphate mining activities have caused surface disturbance with mine overburden. Because selenium in growth medium and water resulting from certain phosphate overburden can bio-accumulate in plants, animals consuming a constant diet of contaminated plants can be exposed to elevated levels of selenium. These selenium levels have the potential to exceed concentrations considered hazardous to livestock. Both deficient and toxic levels of selenium cause similar effects, including reproductive depression, anemia, weight loss, and immune disfunction (Koller and Exon 1986 as cited in Skorupa 1998). Similar toxic effects could occur in terrestrial wildlife, although the pathology is not as well understood.

The range of naturally occurring selenium concentrations in soils of the western United States is <0.1 to 4.3 mg/Kg, and the mean concentration is 0.23 mg/Kg (Shacklette and Boerngen 1984). Selenium is considered a metalloid, possessing both metallic and non-metallic properties, and can exist in an amorphous state or in any of three crystalline forms (Haws and Möller 1997). It exists in four oxidation states including selenate (Se^{+6}), selenite (Se^{+4}), elemental selenium (Se^{0}), and selenide (Se^{-2}). Elemental selenium is present in minute amounts, and selenides are typically associated with sulfides and are largely insoluble (Haws and Möller 1997).

Selenium enters the soil profile through the weathering of selenium-rich rocks. Water and wind erosion and sedimentation processes distribute these particles and deposit them into topsoil. Selenium moves through the soil until adsorbed on metal hydroxides, or organic particles.

Selenite and selenate are produced by chemical oxidation and soil microorganisms from less soluble forms of selenium. These forms are highly soluble in alkaline soils, thus facilitating uptake of selenium by certain plants. Selenate is generally the more toxic form in soils, since selenite is adsorbed to hydrous metal oxides and is generally unavailable for plant uptake (Mayland et al. 1991). The major form of selenium found in well-aerated alkaline soils is selenate, whereas selenite predominates in acid and neutral soils (Mayland et al. 1991).

Selenium mobility in soils is favored by alkaline pH, high selenium concentrations, oxidizing conditions, and high concentrations of other strongly adsorbed anions. Selenates are significantly more stable and soluble than selenites, especially in alkaline environments (Haws and Möller 1997). Adsorption of selenite is influenced positively by low pH, organic carbon, hydrous oxides, calcium carbonate, and cation exchange capacity, and negatively influenced by high salt, alkalinity, and high pH. Sorption of both selenite and selenate decreases with increasing pH (Munkers 2000). Studies conducted by Mayland et al. (1991) indicate that sorption of selenite by soil shows some analogies to the sorption of phosphate, whereas the sorption of selenate is closer to that of sulfate. Some soil anions, such as phosphate, increase plant selenium uptake because increased soil-solution anion concentrations compete with selenium anions for adsorption sites on soil particles. Other anions, such as sulfate, actually inhibit uptake by affecting plant metabolism. The antagonistic effect of selenium and sulfate can reduce selenium availability. For example, Mayland et al. (1991) shows that the addition of lime to soils containing sulfur often mobilizes selenium by precipitating the sulfate ion. This results in greater selenium uptake by vegetation. Mayland et al. (1991) cited Ylaranta (1983) who found selenate was reduced by added organic matter (peat) and subsequently rendered immobile by adsorption onto clay. Munkers (2000) reviewed literature showing that selenium-reducing bacteria can reduce soluble, oxidized forms to insoluble forms.

Skorupa (1998) indicates that the presence of selenium in geologic formations does not mean it is present in toxic amounts in the soils derived from these strata. Herring (1990) states that an important consideration of selenium behavior in soils is of assimilation and availability. The most important observation is that neither assimilation or availability of the element necessarily correspond to its soil concentration. An example cited in Herring (1990) indicated that in the case of acidic soils that contain an abundance of iron, iron selenite compounds or complexes form, and these are sufficiently insoluble to reduce the bioavailability of the selenium. Thus, acid soils favor the more reduced, complexed forms of selenium, such as ferric selenite, which are not readily available to plants. Oxidation by chemical and bacterial processes in alkaline soils favors the existence of selenate compounds of complexes, and these are soluble and readily assimilable by plants (Herring 1990).

Selenium has been identified as a parameter affecting soil management. USFS developed guidelines for phosphate mine reclamation have been developed for topsoil/growth medium salvage relative to this element (USDA 2003a). This document provides guidance and does not impose legally binding requirements or imply policy. The guideline states that soil with less than 13 milligrams per kilogram (mg/Kg) total selenium or less than 0.10 mg/Kg extractable selenium are known to be suitable for reclamation. Implementation of these guidelines for soil salvage and use as growth medium could reduce the amount of selenium available for uptake by plants. Soils, weathered in place on the landscape appear to have been depleted of most of their bioavailable selenium (USDA 2003a). Salvage soil materials with total selenium values up to 13 mg/Kg are considered suitable for use as a planting medium when used in combination with other preventative BMPs designed for the long-term protection of reclamation plantings (USDA 2003a). Under the guidelines, soils with selenium values above 13 mg/Kg may also be acceptable for reclamation with additional testwork. The guideline of 13 mg/Kg was established because soils with concentrations above 13 mg/Kg were not available for testing.

Concentrations of selenium in topsoil/growth medium samples collected within the Project Area are below detection limits in most soil samples. Only one sample site from the Project Area exhibited elevated total selenium levels, and this occurred in Panel G at depths greater than 54 inches.

Naturally occurring selenium concentrations in soil vary greatly depending on the profile location. When soils are salvaged for proposed mining operations, soil from different areas can become mixed, reducing selenium concentrations in the soil mixture. The total concentration of selenium in soils does not directly determine the concentration of available selenium in the plants growing on those soils (Lakin 1972 as cited in Bauer 1997; Fisher 1991). **Table 3.4-7** shows the maximum selenium and trace element concentrations for sampled soils within the Project Area. Laboratory analyses indicate the total selenium concentrations were generally less than analytical detection limits at all sample locations (Maxim 2004f), with the following exceptions:

- The Judkins soil type at sample site G-TP-5 contained 3 mg/Kg of selenium in the top seven inches of the profile and 6 mg/Kg in the 7 to 27-inch interval depth of the profile.
- Karlan soil at sample site G-TP-33 showed total selenium levels of 24 mg/Kg in soils greater than 54 inches deep, with 7-12 mg/Kg total selenium levels throughout the upper layers of the profile.
- Two profile layers of the Ketchum soil at sample site F-TP-48 showed total selenium values of 6 to 8 mg/Kg. These profile layers were separated by 20 inches of soil with non-detectable selenium levels.

The above values for total selenium are not elevated and are considered suitable for topsoil/growth medium recovery and use in reclamation (USDA 2003a), with the exception of the Karlan soil occurring deeper than 54 inches at site G-TP-33, which by itself would not be suitable for reclamation due to elevated selenium content.

TABLE 3.4-7 MAXIMUM SELENIUM AND TRACE ELEMENT CONCENTRATIONS FOR SAMPLED SOILS WITHIN THE PROJECT AREA

ANALYTICAL RESULTS – EXTRACTABLE (MG/KG)[1]					ANALYTICAL RESULTS – TOTAL (MG/KG)[1]			
SOIL TYPE	CADMIUM	NICKEL	SELENIUM	ZINC	CADMIUM	NICKEL	SELENIUM	ZINC
Blaine	1.1	1	0.15	7.7	2	36	ND	156
Cloud Peak	2.9	0.8	0.13	9.4	8	33	ND	280
Ericson	1.1	36	0.26	5	2	49	ND	207
Farlow	0.5	1.4	0.10	3.3	ND	40	ND	209
Judkins	30	217	0.14	67.2	12	244	6	944
Jughandle	3.5	1.4	0.07	6.4	16	56	ND	348
Jughandle (variant)	0.1	0.9	0.12	1.2	ND	13	ND	52
Karlan	9.8	41.7	0.14	70.5	24	125	24	520
Ketchum	0.7	0.6	0.06	3.5	1	33	8	121
Moonlight	16	6.9	0.07	65.3	59	71	ND	906
Parkay	0.6	1.8	0.10	--	ND	32	ND	245
Povey	5.3	5.5	0.08	47.7	13	86	ND	512
Starman	0.4	0.3	0.04	2.3	ND	22	ND	75
Swede	0.2	0.6	0.14	2.4	ND	15	ND	61

Source: Maxim 2004f
[1] Maximum value reported at any sample site, in any single soil horizon.
ND = Not Detected (Indicates nonspecific value below detection limit).
- - = Not noted or analysis not requested.

Extractable selenium concentrations were generally less than 0.1 mg/Kg, indicating that the hazard for excessive selenium uptake in vegetation in undisturbed soil is low, with the following exceptions:

- Judkins soil type at sample site F-TP-9 contained 0.14 mg/Kg of extractable selenium in the top seven inches of the profile. The remainder of the profile (7-29 inches) showed extractable selenium of less than 0.10 mg/Kg.
- The Farlow soil at sample site F-TP-10 had extractable selenium content of 0.10 mg/Kg in profile layers below 28 inches (28-40 inches).
- At sample site F-TP-22, the Blaine soil had extractable selenium levels of 0.12 to 0.15 mg/Kg in the soil profile layers below six inches (6-19 inches).
- The Ericson soil had extractable selenium of 0.12 mg/Kg in the soil layer between 15-21 inches and 0.26 mg/Kg in soil below 21 inches (21-26 inches) at sample site F-TP-27.
- The Karlan soil at sample site G-TP-33 showed extractable selenium levels ranging from 0.10 to 0.13 mg/Kg in three of the six soil profile layers. This site also had total selenium of 24 mg/Kg below 54 inches. At sample site F-TP-58, Karlan soil showed extractable selenium levels ranging from 0.11 to 0.14 mg/Kg throughout the soil profile (0-44 inches).
- Cloud Peak soil at sample site F-TP-45 showed extractable selenium of 0.12 mg/Kg in the 16-23 inch layer. The remainder of the profile (23-55 inches) showed extractable selenium of less than 0.10 mg/Kg. At sample site F-TP-67, the Cloud Peak soil had extractable selenium of 0.13 mg/Kg in soils greater than 20 inches deep.
- At sample site F-TP-46, the Swede soil had one layer (20-33 inches) that showed extractable Se of 0.13 mg/Kg. The remaining portions of the profile (0-20 and 33-45 inches) showed extractable selenium of less than 0.10 mg/Kg. At sample site F-TP-55, the Swede soil showed extractable selenium levels ranging from 0.11 to 0.14 mg/Kg throughout the soil profile (0-28 inches).
- The Parkay soil at site F-TP-59 showed extractable selenium at 0.1 mg/Kg below 16 inches deep.
- Jughandle soil variant at sample site F-TP-63 showed extractable selenium levels ranging from 0.11 to 0.12 mg/Kg throughout the soil profile (0-28 inches).

It should be noted that individual soil sample sites may not be representative of the surrounding soil in the major map unit. The Swede soil sample taken at site F-TP-46 indicated elevated extractable selenium, but this does not represent the majority of soil types within the Judkins-Blaine Complex that have selenium levels below the 0.10 mg/Kg guideline. In comparison, three samples were taken within the Karlan-Dranyon Complex (Map Unit #20), including samples of the Karlan soil, the Swede inclusion and the Jughandle (variant) inclusion. All three of these sample sites showed elevated extractable selenium levels throughout the entire soil profile. This map unit is composed of approximately 50 percent Karlan soil, 30 percent Dranyan soil, and the remaining 20 percent is represented by inclusions.

Cadmium

All soils and rocks have some cadmium in them. It is generally found at low concentrations in the environment and typical background concentration of cadmium in western United States soils is less than 1.5 mg/Kg (EPA 2003a). The Soil Screening Level (SSL) for cadmium in plants is 32 mg/Kg (dry weight in soil) and the soil invertebrate SSL for cadmium is 140 mg/Kg (EPA 2003a). The cadmium SSL for avian wildlife is 1.0 mg/Kg and the SSL for mammalian wildlife is 0.38 mg/Kg (EPA 2003a). With the exception of the mammalian value, these concentrations are higher than the 50^{th} percentile of reported background soil concentrations in eastern and western U.S. soils (0.23 and 0.40 mg/Kg dry weight, respectively). Cadmium is adsorbed in soil to a much lesser extent than most other metals (EPA 2003a). The most important soil properties influencing adsorption are pH and organic content. Adsorption increases with pH and organic content, therefore, leaching is more apt to occur under acid conditions in sandy soil (EPA 2003a). Plant uptake of cadmium decreases as soil pH increases. In soil, cadmium is expected to convert to more insoluble forms, such as cadmium carbonate in aerobic environments and cadmium sulfide in anaerobic ones (EPA 2003a).

Nickel

The normal range of nickel concentration in soil is between 4 and 80 mg/Kg. Shacklette and Boerngen (1984) calculated the mean concentration of nickel in western United States soils to be 15 mg/Kg. Nickel attaches to soil particles that contain iron or manganese, which are often present in soil and sediments (ATSDR 2003). It is usually attached so strongly onto the soil and rock particles that it is not readily taken up by plants and animals, although under acidic conditions nickel is more mobile in soil. Nickel does not appear to collect in fish, plants, or animals used for food (ATSDR 2003). The International Agency for Research on Cancer (IARC) has determined that nickel metal may possibly be carcinogenic to humans, and that some nickel compounds are carcinogenic to humans (ATSDR 2003).

Zinc

Zinc (Zn) is the 23rd most abundant element in the earth's crust and is an essential element for proper growth and development of humans, animals, and plants (USGS 2004c). It is the second most common trace metal, after iron, naturally found in the human body (USGS 2004c). Zinc is bioaccumulated by all organisms, even in areas of low zinc concentrations, and both deficient and excessive amounts cause adverse effects in all species (Skorupa 1998). It is highly reactive and is present as both soluble and insoluble compounds. Typical background concentrations of zinc in western United States soils are less than 150 mg/Kg and Shacklette and Boerngen (1984) calculated the mean concentration to be 55 mg/Kg. Skorupa (1998) identified the level of concern for zinc in sediment to be 150-410 mg/Kg; however, sulfides in sediment may reduce zinc toxicity. Zinc toxicity in water is affected by water hardness, pH, temperature, dissolved oxygen, and alkalinity. In most of the West, water hardness of more than 200 mg/L is common, and zinc would be less toxic under those conditions (Skorupa 1998). Skorupa (1998) also notes that most of the zinc introduced into the aquatic environment is eventually deposited in sediments.

3.5 Vegetation

3.5.1 Introduction

The CNF, its uses, and resources are managed with the guidance of the RFP (USFS 2003a). The Desired Future Conditions (DFC) and objectives for forest and non-forest vegetation are achieved by using the forest-wide standards and guidelines and the standards and guidelines for the Biological Elements section as set forth in the Management Prescriptions of the RFP. Maxim conducted a baseline assessment of vegetation resources within the Study Area during 2003. These studies provided baseline data on vegetation resources that might be influenced by any of the action alternatives. A baseline technical report was prepared and provides details on Maxim's methodologies, results, and conclusions (see Maxim 2004e). The following is largely summarized from this report. Additional pertinent information is also included and cited appropriately.

3.5.2 Cover Type Descriptions

The Study Area ranges in elevation from about 6,500 feet in the lower end of the South Fork Sage Creek, Manning Creek, and Deer Creek drainages, to about 8,500 feet along Freeman Ridge west of Panels F and G. Vegetation within the Study Area is common to this portion of the CNF with both forested and non-forested cover types. Maxim (2004e) assessed, described, and mapped ten vegetation cover types in the Study Area (**Figure 3.5-1**). **Table 3.5-1** shows the acres and relative occurrence of each type.

TABLE 3.5-1 VEGETATION COVER TYPES, ACRES, RELATIVE OCCURRENCE, AND PRINCIPAL PLANT SPECIES IN THE STUDY AREA

COVER TYPE (ACRES/OCCURRENCE1)	PRINCIPAL PLANT SPECIES	
	SCIENTIFIC NAME	COMMON NAME
Aspen (6,702 / 32.8%)	*Populus tremuloides*	Quaking aspen
Mountain Big Sagebrush (5,479 / 26.8%)	*Artemisia tridentata* ssp. *Vaseyana* *Purshia tridentata* *Symphoricarpos oreophilus*	Mountain big sagebrush Antelope bitterbrush Mountain snowberry
Subalpine Fir (3,056/14.9%)	*Abies lasiocarpa* *Pinus contorta* *Populus tremuloides*	Subalpine fir Lodgepole pine Quaking aspen
Aspen/Conifer (1,593 / 7.8%)	*Populus tremuloides* *Pseudotsuga menziesii* *Pinus contorta*	Quaking aspen Douglas-fir Lodgepole pine
Riparian Shrub/Wet Meadow (1,546 / 7.5%)	*Carex nebrascensis* *Deschampsia caespitosa* *Salix boothii* *Salix drummondii* *Lonicera utahensis*	Nebraska sedge Tufted hairgrass Booth's willow Drummond's willow Utah honeysuckle
Mountain Snowberry/Sagebrush (932 / 4.5%)	*Symphoricarpos oreophilus* *Artemisia tridentata* ssp. *Vaseyana* *Prunus virginiana* *Amelanchier alnifolia* *Rosa* spp. *Ceanothus velutinus*	Mountain snowberry Mountain big sage Chokecherry Serviceberry Rose Snowbrush
Douglas-Fir (456 / 2.2%)	*Pinus contorta* *Abies lasiocarpa* *Pseudotsuga menziesii*	Lodgepole pine Subalpine fir Douglas-fir
Forb/Graminoid (341 / 1.7%)	*Delphinium bicolor* *Geranium viscosissimum* *Veratrum californicum*	Little larkspur Sticky geranium California false hellebore
Mountain Big/Silver Sagebrush (187 / 0.9%)	*Artemisia tridentata* ssp. *vaseyana* *Artemisia cana*	Mountain big sage Silver sage
Mountain Mahogany (180 / 0.9%)	*Cercocarpus ledifolius*	Mountain mahogany

[1] Occurrence expressed as % of total Study Area (20,462 acres)

Aspen
Aspen (*Populus tremuloides)* is the most abundant (32.8 percent) cover type in the Study Area. Aspen stands are primarily located on east- and southeast-facing slopes. This cover type is an early-seral (i.e., pioneer) stage on nearly every moist Douglas-fir (*Pseudotsuga menziesii*) site, and many mixed conifer and subalpine fir/Engelmann spruce (*Abies lasiocarpa*/*Picea engelmannii*) sites on the CNF (USFS 2003a). Aspen communities within the Project Area are typically closed canopy stands of aspen with a few conifers, usually Douglas–fir. The understory consists mainly of mountain snowberry (*Symphoricarpos oreophilus*), sweet cicely (*Osmorhiza chilensis*), sticky geranium (*Geranium viscosissimum)*, meadowrue (*Thalictrum occidentalis*), and silvery lupine (*Lupinus argenteus var. parviflorus*). Intermediate and older aspen stands are located at higher elevations, while younger stands are common at the lower elevations, usually in drainages. Below the elevation range of conifers, aspen stands may indicate a late-seral (i.e., climax) condition.

Mountain Big Sagebrush
Mountain big sagebrush is the second most abundant (26.8 percent) cover type in the Study Area, found at lower elevations and on dry south-facing slopes. Mountain big sagebrush (*Artemisia tridentata* ssp*. vaseyana*) is the dominant plant species, with mountain snowberry and antelope bitterbrush (*Purshia tridentata)* found occasionally. Forb and grass species found in this cover type include arrowleaf balsamroot (*Balsamorhiza sagittata*), silky lupine (*Lupinus sericeus*), bluebunch wheatgrass (*Agropyron spicatum*), Kentucky bluegrass *(Poa pratensis*), and western needlegrass (*Stipa occidentalis*).

Mountain Big/Silver Sagebrush
The mountain big/silver sagebrush cover type is co-dominated by both species and is found on more mesic (moderately moist habitat) sites at lower elevations. This cover type accounts for 0.9 percent of the Study Area. Associated forbs include death camas (Zigadenus paniculatus) and monument plant (Frasera speciosa).

Douglas-Fir
The Douglas-fir cover type, 2.2 percent of the Study Area, is found on the east-facing slopes from Deer Creek north to Sage Creek. Two habitat types are associated with Douglas-fir.

- The Douglas-fir/mountain sweet-cicely (*Osmorhiza chilensis*) habitat type is a predominant habitat type in southern Idaho and northern Utah (Steele et al. 1983) and occupies slopes with relatively moist soils. Douglas-fir is the dominant overstory species, with 45-65 percent canopy cover. Aspen and lodgepole pine are often interspersed. The understory usually contains high shrub cover, including mountain snowberry, chokecherry (*Prunus virginiana*), and serviceberry (*Amelanchier alnifolia*). Herbaceous species include mountain sweet-cicely, sticky geranium (*Geranium viscosissimum*), wild strawberry (*Fragaria vesca*), pinegrass, and elk sedge (*Carex geyeri*).
- The Douglas-fir/pinegrass (*Calamagrostis rubescens*) habitat type occurs on drier and cooler sites, usually on gentler slopes (5-25 percent). Overstory species consist of Douglas-fir, lodgepole pine, and occasionally subalpine fir. Small pockets of large Douglas-fir, some over 30 inches in diameter, were observed in the Study Area. The Douglas-fir/pinegrass habitat understory consists of sparse shrub cover, including Utah honeysuckle (*Lonicera utahensis*), Oregon grape (*Berberis repens*), and wild rose (*Rosa* spp.). Herbaceous species include pinegrass, elk sedge, wild strawberry, and heart-leaf arnica (*Arnica cordifolia*).

Figure 3.5-1 Vegetation Cover Types in Project Area

Subalpine Fir

The Subalpine fir cover type occurs on 14.9 percent of the Study Area and is found on north-facing, cool slopes at relatively low elevations, and on all aspects at high elevations. The north-facing slopes of Deer Creek, Manning Creek, and Sage Creek drainages are inhabited by large stands of subalpine fir, dominated by an overstory of lodgepole pine. Aspen is often interspersed on east- and south-facing slopes in subalpine fir habitats. Three habitat types are associated with subalpine fir:

- The subalpine fir/pinegrass habitat type occupies cooler sites than the Douglas-fir/mountain sweet-cicely. The subalpine fir/pine grass habitat type understory is dominated with pinegrass and elk sedge, often exceeding 60 percent cover. Other associates include heart-leaf arnica, Oregon grape (edible), and mountain snowberry.
- The subalpine fir/mountain sweet-cicely habitat type occupies cooler sites than the Douglas-fir/pinegrass habitat type and is dominated by aspen and a small number of Douglas-fir. Understory shrubs include mountain snowberry, serviceberry, and wild rose. Herbaceous species include mountain sweet-cicely, sticky geranium, wild strawberry, pinegrass, and Kentucky bluegrass (*Poa pratensis*).
- The subalpine fir/grouse whortleberry (*Vaccinium scoparium*) habitat type occupies the coldest sites in the Study Area. The overstory is dominated by lodgepole pine with sapling and pole-sized subalpine fir. The shrub understory is dominated by grouse whortleberry mixed with globe huckleberry (*Vaccinium globulare*), russet buffaloberry (*Shepherdia canadensis*), Utah honey suckle, and mountain lover (*Pachistima myrsinites*). Herbaceous species are sparse in this habitat type but include heart-leaf arnica, pinegrass, pipsissewa (*Chimaphila umbellata*), one-sided wintergreen (*Pyrola secunda*), and various species of hawkweed (*Hieracium* spp.).

Aspen/Conifer

The mixed aspen/conifer cover type comprises 7.8 percent of the Study Area and is interspersed among pure aspen and conifer stands. Trees in the aspen/conifer type are intermediate to mature in age, and many stands are potentially seral, succeeding from aspen to conifer. Dominant canopy species are quaking aspen, Douglas-fir, subalpine fir, and lodgepole pine. The understory consists mainly of mountain snowberry, meadowrue, sticky geranium, and pinegrass.

Riparian Shrub/Wet Meadow

The riparian shrub/wet meadow cover type makes up 7.5 percent of the Study Area and includes two separate vegetation communities: wet/sedge meadows and riparian shrub. These communities are associated with the high moisture levels found in the broad floodplain of Crow Creek and areas along Deer Creek. Wet/sedge meadows are dominated by Nebraska sedge (*Carex nebrascensis*) and tufted hairgrass (*Deschampsia caespitosa)*. The riparian shrub community is dominated by Booth's willow (*Salix boothii)*, Drummond's willow (*Salix drumondii)*, and Utah honeysuckle. **Section 3.6** provides a more detailed description and identification of delineated wetlands.

Riparian areas in the Study Area were evaluated for Proper Functioning Condition (PFC) in accordance with the procedures described in BLM (1993). Riparian areas associated with Crow Creek, Deer Creek, Wells Canyon drainage, South Fork Sage Creek, and Manning Creek were evaluated and compared to the CNF rating of functional capacity determined by CNF personnel in January 1999. The evaluations and comparisons of the riparian areas are as follows:

Crow Creek

Maxim (2004e) evaluated Crow Creek from the confluence of the Wells Canyon drainage to approximately five miles downstream to the confluence of Sage Creek. Crow Creek is a low-gradient stream with a broad floodplain up to 0.5 mile wide. Approximately 25-30 percent of the stream in the Study Area has been affected by grazing and the clearing of natural vegetation. Riparian areas have unstable banks that show signs of accelerated erosion; some areas have been stabilized with riprap. Approximately 50 percent of the riparian area evaluated had vegetation densities in sufficient amounts to resist erosion along the banks of Crow Creek. The functional capacity is reduced by the scarcity of large woody debris in and adjacent to Crow Creek, and recruitment of tree and shrub species that generate woody debris is nearly non-existent. Crow Creek was rated as functioning-at-risk due to loss of woody vegetation, accelerated bank erosion on some reaches, placement of riprap, constriction of the stream channel by the Crow Creek Road, proposed expansion alternative of the road within the floodplain, and increased sediment loading from Crow Creek Road.

Deer Creek and Tributaries

Deer Creek and its tributaries drain the steep, mountainous terrain near the headwaters of Crow Creek. A floodplain has developed where the valleys in this drainage area become wider. Wetland and riparian vegetation covers most of these floodplains. Willows, with small patches of sedge meadows interspersed within, are found along the perennial and intermittent reaches of Deer Creek. Willows, native grasses, and sedges have been reduced in density and replaced by silver sagebrush, Kentucky bluegrass, and other invasive species including nemophila (*Nemophila breviflora*), bilobed speedwell (*Veronica biloba*), Canada thistle (*Cirsium arvense*), and Dyer's woad (*Isatis tinctoria*), a noxious weed. The perennial reach of upper South Fork Deer Creek is constrained by a Forest road located along the creek. The road is adding sediment to the creek from surface water runoff. Deer Creek was found to be functioning-at-risk (Maxim 2004e).

Wells Canyon Drainage

The Wells Canyon drainage was evaluated from its source at the upper most spring down to the confluence with Crow Creek. This relatively high gradient drainage, which is mostly intermittent and confined by steep banks in a canyon, has a narrow strip of riparian vegetation that is primarily willows and sedges. The riparian vegetation in the upper drainage is not effective in withstanding high stream flows. There is little or no channel migration during high flows because of the presence of the Forest road in the canyon bottom and confining canyon slopes. Several camping sites and the road have been constructed adjacent to the drainage, reducing the riparian area. The unpaved Forest road constrains the intermittent channel over most of the length. The road has added sediment to the stream, and in some areas the stream flows over the road. The Wells Canyon drainage was rated as non-functional due to high sediment loads caused by the road (Maxim 2004e). CNF had previously rated the drainage as functioning-at-risk (Maxim 2004e).

South Fork Sage Creek

South Fork Sage Creek was evaluated from the east boundary of the Study Area to its origin at a spring in Sage Meadows. Riparian vegetation consists of dense stands of willows interspersed with sedge meadows on some of the broader stream terraces. Invasive plant species have increased in density on disturbed soils. Invasive species found included tarweed (*Madia glomerata*), California false-hellebore (*Veratrum californicum)*, nemophila, and bilobed speedwell. South Fork Sage Creek was rated as properly functioning.(Maxim 2004e). The CNF evaluated the creek as functioning-at-risk.

Manning Creek

Manning Creek, an intermittent stream, is a tributary to Crow Creek with a short upper reach of perennial flow due to a spring discharge. The entire channel receives seasonal flow from snowmelt and precipitation. Manning Creek was determined to be functioning-at-risk due (Maxim 2004e).

Mountain Snowberry/Sagebrush

The mountain snowberry/sagebrush cover type is found primarily at higher elevations, where soil moisture is higher than in low-elevation sagebrush stands. The mountain snowberry/sagebrush cover type occurs on 4.5 percent of the Study Area and is dominated by mountain snowberry and big sagebrush. In certain areas, big sagebrush is absent and young aspen trees are found, indicating that these areas may succeed to forest cover in the absence of disturbance. Other associated shrub species include chokecherry, serviceberry, rose, and snowbrush (*Ceanothus velutinus*, USFS 2003b). Associated grasses and forbs include buckwheat (*Eriogonum* spp.), arrowleaf balsamroot, mules ear (*Wyethia amplexicaulis*), and oniongrass (*Melica bulbosa*).

Forb/Graminoid

The forb/graminoid cover type is present throughout the Study Area, accounting for 1.7 percent of the vegetation. This cover type, dominated by forbs with some grasses and sedges, is found on steep, "shaley" slopes most frequently, but can also be found in more mesic conditions and appear as montane meadows. The common associates include: little larkspur (*Delphinium bicolor*), paintbrush (*Castilleja pilosa var. longispicata*), western wallflower (*Erysimum asperum*), hawksbeard (*Crepis* spp.), lupine (*Lupinus* spp.), mutton grass (*Poa fendleriana*), buckwheat, mules ear, arrowleaf balsamroot, horse-mint (*Agastache urticifolia*), sticky geranium, and California false hellebore.

Mountain Mahogany

The Mountain mahogany cover type occurs on 0.9 percent of the Study Area on south-facing slopes above Deer Creek with dry, rocky, shallow, limestone soils. Curlleaf mountain mahogany (*Cercocarpus ledifolius*) dominates, forming an open canopy. Other associates include: bluebunch wheatgrass, mountain snowberry, serviceberry, arrowleaf balsamroot, and Oregon grape.

3.5.3 Special Status Plant Species

The US Fish and Wildlife Service (USFWS) does not identify any Threatened, Endangered, Proposed, or Candidate (TEPC) species that are known or expected to occur on the CNF (Species List #1-4-05-SP-0354). In addition to TEPC species, the Regional Forester identifies Sensitive (S) species as those for which population viability is a concern, as evidenced by significant current and predicted downward trends in population numbers, density, and/or habitat capability that would reduce a species' existing distribution. Sensitive species receive special management emphasis from the USFS to ensure their viability and to preclude trends toward endangerment that could result in the need for federal listing (FSM 2672.1). Sensitive species potentially occurring in the Study Area are listed in **Table 3.5-2**. Background information on each species follows the table. Additional information can be found in the RFP EIS (USFS 2003b:Appendix D) and the vegetation baseline report (Maxim 2004e).

TABLE 3.5-2 SENSITIVE SPECIES KNOWN OR SUSPECTED TO OCCUR ON THE CNF

COMMON NAME	SPECIFIC NAME	USFS STATUS
Starveling Milkvetch	*Astragalus jejunus* var. *jejunus*	Sensitive
Payson's Bladderpod	*Lesquerella paysonii*	Sensitive
Cache Penstemon	*Penstemon compactus*	Sensitive

<u>Starveling Milkvetch</u>
In Idaho, starveling milkvetch occurs on knolls, ridges, and other exposures of raw, loose, sparsely vegetated, light-colored shale. It appears to be restricted to bright outcrops of calcareous shale, having a fine to stone-size texture. Starveling milkvetch is found on all aspects, usually on gentle to moderately steep slopes. Idaho populations are found in the southeastern corner of the State, in the southern Preuss Range, Sheep Creek Hills, and Bear Lake Plateau, all in Bear Lake County, all at least 15 miles from the Project Area. While no individuals of this species were observed, suitable habitat for this species may be present on road cuts along the South Fork of Deer Creek or on ridge tops along the west side of the Crow Creek Valley. Approximately 1,340 acres of potential habitat for starveling milkvetch occur in the Study Area; however, this species appears to be restricted to more exposed shale sites than those observed in the Project Area (Maxim 2004e).

<u>Payson's Bladderpod</u>
Payson's bladderpod occurs most often above 8,000 feet elevation, on ridge tops or south-facing slopes of limestone with gravelly soils and sparse vegetation. The species is endemic to west-central Wyoming and adjacent Idaho, with disjunct populations in southwestern Montana (USFS 2003b:D-186). While Payson's bladderpod was not observed during field investigations, the range of the species includes areas near the Project Area (Maxim 2004e). The nearest occurrence is the nearby Salt River Range in Wyoming, approximately 15 miles southeast of the Project Area.

<u>Cache Penstemon</u>
Cache penstemon is considered endemic to the Bear River Range, located at least 15 miles west-southwest of the Project Area. This species occurs in open, rocky limestone areas in the subalpine zone at 8,800 – 9,300 feet elevation. Idaho populations are reported to occur on carbonate substrates (USFS 2003b:D-188). While this species was not observed during field investigations, some habitat exists in the Project Area (Maxim 2004e).

3.5.4 Noxious Weeds

Noxious weed species, as defined in Executive Order 13112 (64 CFR 6183, Invasive Species, February 1999), are those plants of foreign origin, not widely prevalent in the United States, that can injure crops, ecosystems, interests of agriculture, or fish and wildlife resources. They generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, and a carrier or host to insect pests or disease. The State of Idaho is responsible for listing noxious weeds in the State. The State's most current list, created in 2001, lists 36 species of noxious weeds. Six of these species were recorded in the Study Area.

In 1996, the CNF adopted Integrated Pest Management (IPM) guidelines to treat uncontrolled noxious weeds. IPM emphasizes the best management strategies for weed control and uses the best control techniques available for the targeted species. In February 2001, the CTNF completed a forest strategy for noxious weeds developed from direction found in the following documents: National Administration's *Pulling Together – National Strategy of Invasive Plant Management*, Forest Service's *Stemming the Invasive Tide – A Forest Service Strategy for Noxious and Nonnative Invasive Plant Management*, and *Idaho's Strategic Plan for Managing Noxious Weeds*. The RFP (USFS 2003a:3-21) outlines the goal of minimizing the establishment and spread of noxious weeds through the application of Forest direction, IPM, and BMP's. The RFP also established standards and guidelines to be used for controlling and eliminating noxious weeds and other invasive plant species (USFS 2003a:3-22). The Smoky Canyon Mine's weed control program follows guidelines established by the USFS. The mine is inspected on a monthly basis, and Simplot is notified by the USFS of any problems noted, including weed infestations. Simplot responds to these reports by treating weed-infested areas with USFS-approved chemicals.

As reported from CTNF survey results in 2001, noxious weeds infest over 85,000 acres throughout the CTNF. Based on GIS data provided by the CNF, a number of noxious weed infestations occur within the Study Area. **Figure 3.5-2** shows infestations of black henbane (*Hyoscyamus niger*), Canada thistle, Dyer's woad, field bindweed (*Convolvulus arvensis*), musk thistle (*Carduus nutans*), and yellow toadflax (*Linaria vulgaris*). The vegetation baseline studies found three noxious weed species during surveys in 2003 (Maxim 2004e). Black henbane was observed along Crow Creek Road and scattered along the lower portions of Deer Creek and the Manning Creek Road. Canada thistle was found along the riparian corridors of Crow, Deer, and Manning Creeks. Dyer's woad was observed along sections of lower Deer Creek, Crow Creek Road, and along the Manning Creek Road.

3.5.5 Suitable Timber for Harvest

Management prescriptions in the RFP are a set of practices applied to a specific area to attain multiple-use and to provide a basis for consistently displaying management direction on land administered by the CNF. Management Prescription 5.2 (USFS 2003a:4-71, Forest Vegetation Management) pertains to scheduled wood-fiber production, timber growth, and yield while maintaining or restoring forested ecosystem processes and functions to more closely resemble historical ranges of variability with consideration for long-term forest resilience. All forms of timber harvest are permitted, including salvage, to achieve stated goals and objectives. Livestock grazing may be allowed on transitory forage produced following timber harvest where and when that use would not conflict with regeneration and restoration efforts. Motorized use is prevalent for timber management activities and recreation. Land in this prescription is included in the suitable timber base and contributes to the Allowable Sale Quantity.

Tentatively Suitable Forest land is land which is producing or is capable of producing crops of industrial wood and: 1) has not been withdrawn by Congress, the Secretary, or Chief; 2) existing technology and knowledge is available to ensure timber production without irreversible damage to soil, productivity, or watershed conditions; and 3) existing technology and knowledge provides reasonable assurance that adequate restocking can be attained within five years after final harvesting (USFS 2003a). The Panel F and G lease areas, including the lease modification areas of Panel F, encompass a total of 2,040 acres. The lease areas contain 1,610 acres of tentatively suitable timber. However, only the portion of Panel F that lies within

Prescription 5.2 is included in the Allowable Sale Quantity. This portion of Panel F contains 641 acres of tentatively suitable timber (108 acres aspen, 170 acres aspen/conifer, and 363 acres conifer), which is included in the Allowable Sale Quantity (Maxim 2004g).

Management Prescription 5.2 is replaced by Prescription 8.2.2 (Phosphate Mine Areas) following approval of a Mine and Reclamation Plan. Prescription 8.2.2 allows for the exploration and development of existing mine leases.

3.5.6 Selenium Issues with Vegetation

The uptake of selenium and other trace elements by plants is correlated to the availability of those trace elements in the soil. Several studies have investigated selenium uptake in plants on reclaimed phosphate mining areas in southeast Idaho. NewFields (2005) measured the COPC (including selenium) content of terrestrial vegetation across Smoky Canyon Mine Panels A, D, and E, both within and adjacent to mined areas that have been reclaimed. Reclamation in Panels A, D, and the early parts of Panel E did not include selenium control measures (capping) common to current mining practices. Much of the Panel E overburden fills have been capped with chert and topsoil. Mean selenium accumulation in terrestrial vegetation (including browse and forage species) growing on reclaimed overburden fills was 4.42 mg/Kg dry weight (dw), whereas mean selenium accumulation in terrestrial vegetation growing in native soils adjacent to the reclaimed areas was 0.3 mg/Kg dw. JBR (2001c) sampled reclamation vegetation across the same Smoky Canyon Mine Panels collecting forb and grass samples from six different reclamation sites. They found vegetation rooted in unsorted overburden had the highest selenium values, whereas vegetation rooted in topsoil spread over a chert cap had selenium uptake that was comparable to background levels. Mean dry weight concentration of selenium in all vegetation sampled from the reclaimed areas by JBR was 12.11 mg/Kg dw, relative to background levels of 0.25 mg/Kg dw. Alfalfa sampled on five of the treatment areas showed the highest selenium levels (15.3 - 98.0 mg/Kg dw), with the exception of one sainfoin sample. These values exceed the threshold selenium value for grazing animal forage, established at 5 mg/Kg dw (National Research Council 1980).

At Wooley Valley Mine, approximately 20 miles west of Smoky Canyon Mine, Mackowiak et al. (2004) found that the mean vegetation selenium content from an overburden fill site was 38 mg/Kg dw. Mean selenium values for legume, grass, and tree species growing on the historical Wooley Valley Mine reclamation site were all greater than 5 mg/Kg dw, whereas forb and shrub species growing on the site had lower selenium values. A study where alfalfa was grown in pots showed similar selenium uptake levels as grass species, supporting Stark and Redente's (1990) theory that alfalfa's ability to uptake trace elements from oil-shale deposits was due to its deeper root penetration. Mackowiak et al. (2004) suggested that substituting native shrub and forb species for alfalfa may lessen the risk of selenium toxicosis in livestock and wildlife. Alfalfa and sainfoin are no longer used in reclamation seed mixes for phosphate mines in southeast Idaho on USFS system lands.

When seleniferous overburden material lies beneath topsoil and a layer of low-selenium chert, selenium uptake would largely depend on the ability of roots to penetrate these upper layers and make contact with the overburden. Nobel (1991) compared the root characteristics of various groups of vegetation and found that winter annuals and perennial grasses generally had maximum root depths of less than three feet. Native trees and shrubs, if reestablished through either reclamation or natural colonization, would have greater root penetration. Of the

Figure 3.5-2 Noxious Weeds

common tree species found in the Project Area, reports could be found for subalpine fir, lodgepole pine, Douglas-fir, and quaking aspen (Stone and Kalisz 1991). Douglas-fir maximum root depths were reported from five studies (12.1, >10.5, 4.9, 9.8, and approximately 32.8 feet). Subalpine fir maximum root depths were reported from two studies (4.9 and >13 feet). Lodgepole pine maximum root depths were reported from three studies (>3.3, >6.6, and >10.8 feet), and quaking aspen maximum rooting depths were reported from six studies (4.9, 7.5, >9.8, 4.9, >9.8, and >5.9 feet). In a survey of reported maximum rooting depths of 253 herbaceous and woody plants, Canadell et al. (1996) found that the mean maximum root depths of herbaceous plants, shrubs, and trees were 8.5, 16.7, and 23.0 feet, respectively.

Within the last several years, Simplot has begun using a cap design that includes four feet of chert and one to two feet of topsoil for all seleniferous overburden reclamation activities at the existing Smoky Canyon Mine. Sampling reclamation vegetation growing on these capped areas has demonstrated a lack of selenium accumulation in the vegetation compared to areas where reclamation vegetation is growing directly on top of seleniferous overburden (JBR 2001c, NewFields 2005).

3.6 Wetlands

Wetland resources in the Project Area and along proposed haul/access road and conveyor corridors were surveyed by Maxim Technologies, Inc. (Maxim) in 2003 and 2004. The Maxim surveys identified potentially jurisdictional wetlands and Waters of the U.S. within areas that may be affected by the Proposed Action and alternatives (**Figure 3.6-1**). The results of these surveys are presented in several reports addressing various phases of the Proposed Action and alternatives (Maxim 2003b; 2004h; 2004i). Data from these reports are summarized below.

Waters of the U.S. include channels that show evidence of conveying flowing water on at least an average annual basis and have the presence of a defined bed and banks. Maxim's reports identify Waters of the U.S. by the acronym WUS, or as "non-wetland waters." The acronym WOUS is also used to identify Waters of the U.S. Concerning RFP Standards and Guidelines for wetlands and aquatic resources (USFS 2003a:3-16), direction is provided in Prescription 2.8.3 (USFS 2003a:4-45 to 4-53). This prescription applies to the Aquatic Influence Zone (AIZ) associated with lakes, reservoirs, ponds, streams, and wetlands. Default AIZ widths for wetlands include: 1) for wetlands > 1 acre, the AIZ would consist of an area 150 feet slope distance from the maximum pool elevation of the wetland, and 2) for wetlands < 1 acre, the AIZ would consist of an area 50 feet slope distance from the edges of the wetland. Within the Study Area, there are approximately 1,225 acres of AIZs that are associated with perennial and intermittent streams (fish-bearing and non-fish-bearing) and identified wetlands.

Maxim further identified channels as ephemeral, intermittent, and perennial. Ephemeral channels flow only during periods of snow melt or intense precipitation events. Intermittent channels support surface flow for only a portion of the year. Flow in these channels occurs as a result of snow melt, precipitation events, and in part as a result of seasonal groundwater discharge. Perennial channels flow year round, with flow supported by continuous groundwater discharge.

Some channels may be ephemeral or intermittent in their upper reaches and perennial in some (usually lower) reaches. Channels were examined for evidence of an average annual flow. In particular, channels were examined for evidence of an ordinary high water mark (OHWM). Channels exhibiting evidence of an OHWM and that share a connection to interstate waters or waters used in interstate commerce are generally identified as Waters of the U.S.

Potential wetland areas were evaluated using the methodology specified in the USACE's Wetland Delineation Manual ("Manual") for conducting routine onsite wetland delineations (USACE 1987). The vegetation, soils, and hydrology were examined at potential wetland sites. As described in the Manual, potentially jurisdictional wetlands must meet specific vegetation, soils, and hydrology criteria. Waters of the U.S., including wetlands, that may be used in interstate commerce are identified as jurisdictional waters under the Clean Water Act (CWA).

Dredge and fill activities within jurisdictional areas are regulated by the USCOE. If wetlands are present adjacent to a Waters of the U.S., USCOE jurisdiction extends beyond the ordinary high water mark of the waters to the limit of the adjacent wetlands. Wetlands located along Crow Creek were identified based on National Wetland Inventory (NWI) maps. Maxim did not field-verify the majority of these NWI-mapped wetlands along Crow Creek due to access restrictions. The boundaries of these wetlands as taken from the NWI maps may not be completely accurate.

3.6.1 SWANCC Decision

The USACE regulates dredge and fill activities in Waters of the U.S. (including wetlands) under Section 404 of the Clean Water Act. Waters of the U.S. include navigable waters and their tributaries, including adjacent wetlands; interstate waters and their tributaries, including adjacent wetlands; and all other Waters of the U.S. "such as isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable Waters of the U.S., the degradation or destruction of which could affect interstate commerce" (Federal Register 1982). On January 9, 2001, the U.S. Supreme Court ruled in the Solid Waste Agency of Northern Cook County (SWANCC) case that the USACE cannot invoke migratory bird use as the sole basis under which the USACE may assume jurisdiction over certain isolated Waters of the U.S., including isolated wetlands (Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, No. 99-1178). Prior to this Supreme Court ruling, the USACE considered migratory bird use of isolated wetlands to be a tie to interstate or foreign commerce. As a result of the SWANCC decision, the rationale for USACE's jurisdictional determinations has changed. The USACE may now require the presence of a defined channel/bed and bank connection to known interstate waters or to waters with a clear tie to interstate commerce before taking jurisdiction. Several isolated, non-jurisdictional wetlands were identified within the Project Area.

3.6.2 Wetland Functions and Values

Wetland functions and values were assessed and rated using the methods developed for the Montana Department of Transportation (MDT) (Berglund 1999). Wetland functions include wildlife and fish habitat (including habitat for listed and/or sensitive species and for general wildlife and fish habitat), flood attenuation, long- and short-term water storage, sediment and nutrient retention and removal, sediment and shoreline stabilization, production export and food chain support, and groundwater recharge and discharge. Wetland values include uniqueness and recreational and educational potential. Parameters which include both function and value include habitat for federally listed, proposed and candidate plants and animals and habitat for animals and plants receiving special status from state agencies.

Figure 3.6-1 Wetlands

Wetlands are assessed and assigned a functions and values rating for each of twelve functions and values categories. Functions and values points are then summed and expressed as a function of the possible total. Functions that do not apply are not included in the point total. This percentage is then used to rank the functions and values of the wetland in one of four categories, with Category I the highest ranking and Category IV the lowest. Category I wetlands include rare, unique and/or pristine wetland systems; Category IV wetlands represent severely degraded systems. The wetlands functions and values rating, multiplied by the area of the wetland, also provides a measure of "Wetlands Functional Units." Functions and values for each delineated wetland are available in Maxim 2003b, 2004h, and 2004i.

3.6.3 Wetland Types

The Maxim delineations also classified wetlands found in the area by Hydrogeomorphic (HGM) type (Brinson 1993) and classified wetlands according to the USFWS's Wetland Classification System (Cowardin et al. 1979). The HGM classification categorizes wetlands based on the abiotic features that maintain wetland ecosystem function, such as hydrologic and geomorphic controls (Maxim 2003b). The USFWS Cowardin system categorizes wetlands based on vegetative cover and the role vegetation plays in the structure and function of wetlands. Common Cowardin wetland types in the Project Area include palustrine emergent (PEM) wetlands, which include wetted areas with emergent vegetation and wet meadows; and palustrine scrub-shrub (PSS) wetlands, which include willow stands.

3.6.4 Findings on Extent and Jurisdictional Status of Wetlands

The findings discussed below represent Maxim's evaluation of the extent and jurisdictional status of wetlands and Waters of the U.S. found in the Study Area. As displayed in **Figure 3.6-1**, numerous wetlands were identified throughout the area. No delineation becomes official until it has been verified by the USACE. The USACE conducted a field verification of the Panel F and Panel G delineation, including the areas of the proposed North and South Lease Modifications. With the exception of a single wetland area in the Panel F South Lease Modification Area, the Corps concurred with Maxim's 2003 findings (USACE 2003). The USACE also conducted a field verification for a delineation on potential haul roads and Crow Creek Road (Maxim 2004h) and concurred with the findings, but the USACE has not yet verified the findings in the Maxim (2004i) delineation, an addendum report to Maxim (2004h). Accordingly, the figures for jurisdictional extent of wetlands and Waters of the U.S. found in these portions of the survey area may change. Further, because mining in Panel G may not begin for a number of years, the USACE has determined a verification of the extent of wetlands and Waters of the U.S. in the Panel G area would occur at a later date.

Panel F Lease Area

Maxim (2003b) identified two ephemeral stream reaches within the Panel F lease area (**Figure 3.6-1**). One of these reaches is on Manning Creek, in the southern portion of the proposed lease area. The second is an unnamed ephemeral tributary to the South Fork of Sage Creek located in the northern and central portions of the Panel F lease area. This ephemeral tributary drains the majority of the proposed Panel F lease area north of the Manning Creek watershed. While channel definition in the lower end of this unnamed tributary to the South Fork of Sage Creek is lost, Maxim indicated a groundwater connection exists between this tributary and the South Fork of Sage Creek. Accordingly, Maxim identified both of these channels as potentially jurisdictional features. The delineation also identified three small wetland areas within the Panel

F lease area (**Figure 3.6-1**). One of these wetlands is located at the head of Manning Creek, and the second is adjacent to the unnamed tributary to the South Fork of Sage Creek. Both of these wetlands are considered to share a connection with interstate waters (Manning Creek is directly tributary to Crow Creek, while the unnamed channel is tributary to the South Fork then the main fork of Sage Creek). These sites were identified as potentially jurisdictional wetlands. A third small wetland area is isolated and was identified as a non-jurisdictional site. The two potentially jurisdictional wetlands include a total area of approximately 0.05 acre and a combined Functional Unit score (the functions and values rating multiplied by the acreage of the wetland) of 0.133. Both of these wetlands are developed springs, and are identified as PEM wetlands. The isolated and non-jurisdictional wetland is approximately 0.07 acre in size and was given a Functional Unit score of 0.330. This site is identified as a fen (an area of peat that is fed by groundwater) and as a PEM wetland.

Panel F, North Lease Modification Area

An intermittent reach of the South Fork of Sage Creek passes through the Panel F North Lease Modification Area. Maxim (2003b) identified this intermittent reach of the South Fork of Sage Creek as a potentially jurisdictional channel (**Figure 3.6-1**). Maxim (2003b) also identified a portion of the ephemeral unnamed tributary to the South Fork of Sage Creek as being within the Panel F North Lease Modification Area and a potentially jurisdictional Waters of the U.S. Three wetland areas were identified within or partially within the Panel F North Lease Modification Area. Two of these sites are located on and adjacent to the South Fork of Sage Creek, and both were identified as potentially jurisdictional features. A small isolated wetland area was identified as non-jurisdictional. The two jurisdictional wetlands include a total area of approximately 3 acres and were given a Functional Unit score of approximately 27.6. The isolated and non-jurisdictional wetland is 0.01 acre in size and was given a Functional Unit score of 0.130. All three of these wetlands were identified as riverine/slope/PEM wetlands.

Panel F, South Lease Modification Area

Maxim (2003b) identified two unnamed tributaries to the North Fork of Deer Creek as being within the Panel F South Modification Lease Area. These two tributaries drain southwest from the lease modification area. Both are ephemeral within the lease modification area. Based on evidence of a groundwater connection to the perennial North Fork of Deer Creek, both these channels were identified as potentially jurisdictional Waters of the U.S. (**Figure 3.6-1**). A total of 14 wetland areas within the Panel F South Lease Modification Area were also identified. The Maxim delineation and subsequent USACE verification identified all but one of these wetlands as jurisdictional features. The majority of wetlands present within the Panel F South Modification Lease Area were identified as riverine features on ephemeral channels. Twelve of these wetlands were identified as Palustrine Scrub-Shrub PSS wetland features; one was identified as a fen/PEM wetland. The thirteen jurisdictional wetlands include a total area of approximately 0.84 acre and a combined Functional Unit score of 3.57. The single isolated and non-jurisdictional wetland is approximately 0.02 acre in size and was given a Functional Unit score of 0.090. This site was identified as a fen, and as a PEM wetland.

Panel G Lease Area

Maxim (2003b) identified two ephemeral drainages within the Panel G lease area. These drainages are the South Fork of Deer Creek and an unnamed tributary to this named drainage. The unnamed tributary includes two forks in its upper reaches. Maxim (2003b) identified both of these drainages, including both forks of the unnamed drainage, as potentially jurisdictional Waters of the U.S. (**Figure 3.6-1**).

Maxim (2003b) also identified six wetland areas within the Panel G lease area (**Figure 3.6-1**). Five of these six wetlands were identified as riverine features/PSS wetlands adjacent to the South Fork of Deer Creek or its unnamed tributary. These five features were identified as potentially jurisdictional. The sixth wetland was identified as an isolated, non-jurisdictional feature, located south of the South Fork of Deer Creek. The five jurisdictional wetlands, all identified as riverine systems on ephemeral streams, include approximately 0.4 acre and a combined Functional Unit score of 1.513 for the area of potentially jurisdictional wetlands. The single isolated wetland is approximately 0.3 acre in size and received a Functional Unit score of 1.715. This wetland was identified as a fen/PEM wetland.

3.6.5 Haul/Access Roads and Conveyor Corridors

A delineation of wetlands and Waters of the U.S. that occur within potential haul/access road corridors was also conducted (Maxim 2004h and 2004i). Wetlands and Waters of the U.S. in the area of a potential utility corridor between Panels F and G were identified in the original Deer and Manning Creek Lease Area delineation (Maxim 2003b). A potential conveyor and power line corridor between Panels F and G were located within this Potential Utility Corridor Area. A summary of the findings for the corridors is summarized below.

Panel F Haul/Access Road and Alternate Corridor

This corridor crosses a defined, ephemeral reach of the South Fork of Sage Creek (**Figure 3.6-1**). The Alternate corridor for the haul/access road crosses the defined, but non-perennial reach of the South Fork Sage Creek and crosses one undefined tributary at two locations.

Panel G West Haul/Access Road and Alternate Corridors

The West Haul Road would cross the upper reaches of Deer Creek and the South Fork of Deer Creek, both of which are identified as Waters of the U.S. (**Figure 3.6-1**). Maxim (2004h and 2004i) identified a fen-marsh complex/PEM-PSS wetland in the upper reaches of South Fork Deer Creek at the confluence of two tributaries. A riverine/PSS wetland also occurs along Deer Creek. As the corridor gradually turns toward the northeast, then north, an area of PSS wetland and an unnamed tributary channel located above the upper reaches of Deer Creek occur within the corridor. The corridor would either follow the upper reaches of the South Fork of Sage Creek to the northern end of the Panel F Lease Area (Proposed Action), or, alternately (Transportation Alternative 5), turn south above the upper reaches of the North Fork of Deer Creek and enter the Panel F South Lease Modification Area. A small wetland area was identified at the headwaters of the South Fork of Sage Creek in Sage Meadows. The delineation did not include the majority of the Sage Meadows area, because potential haul road access corridors are outside the area.

Middle Haul Road and Middle Access Road Corridor

The Middle Haul/Access Road corridor crosses a defined, but non-perennial reach of Deer Creek north of Panel G. Maxim (2003b) indicates this reach of stream is just above a large riverine/PSS wetland complex (**Figure 3.6-1**). The Middle Access Road corridor would cross a narrow section of this wetland complex. At its northern end, the corridor crosses a small wetland located at the head of a tributary to the North Fork of Deer Creek. The corridor also crosses five undefined channels (Maxim 2004i) situated between the main channel of Deer Creek and the headwaters of the North Fork of Deer Creek.

East Haul/Access Road

From south to north, this corridor crosses an undefined tributary to Wells Creek east of the southern portion of Panel G and then turns east and crosses an undefined channel in Nate Canyon. This corridor would then cross a large wetland complex (approximately 0.9 acre), identified as a riverine/PSS-PEM wetland, associated with the lower reaches of Deer Creek just west of Crow Creek Road (**Figure 3.6-1**). North of Deer Creek, this corridor would cross six undefined drainages, including the undefined Manning Creek channel. The corridor would also cross a non-perennial channel east of the northern end of Panel F and a defined but non-perennial reach of the South Fork of Sage Creek in the same corridor as the Panel F Haul/Access Road corridor.

A Modified East Haul Road alignment would cross Deer Creek higher in the drainage (above the East Haul/Access Road corridor). This alignment would cross a riverine/PSS-PEM wetlands complex adjacent to the Deer Creek channel at the crossing location (**Figure 3.6-1**).

Crow Creek-Wells Canyon Access Road

The Crow Creek-Wells Canyon access road would generally follow the existing Crow Creek Road. A proposed access road corridor has been identified north of Wells Creek and would access the southern boundary of Panel G.

Maxim (2004h and 2004i) identifies eight Waters of the U.S. crossings and approximately 15 wetland areas along Crow Creek that may occur within the Crow Creek Road corridor (**Figure 3.6-1**). From south to north, the eight Waters of the U.S. (Non-wetland waters) crossings identified in Maxim, 2004h are: a ditch north of Wells Canyon; Deer Creek; Quakie Hollow; Sage Creek; an unnamed tributary to Crow Creek; Herdmane Hollow; a second unnamed tributary to Crow Creek; and possibly a reach of Crow Creek. Wetlands that occur along the potential Crow Creek-Wells Canyon Access Road include primarily riverine/PSS and PEM wetlands along Crow Creek and its tributaries.

3.7 Wildlife Resources

The CNF, its uses, and resources are managed with the guidance of the RFP (USFS 2003a). The Desired Future Conditions (DFC) and objectives for wildlife resources are achieved by using the forest-wide standards and guidelines and the standards and guidelines for the Biological Elements section as set forth in the Management Prescriptions of the RFP. Forest Plans provide for viability of vertebrate communities within multiple use objectives. The CNF uses the planning process and ongoing monitoring, evaluation, and adjustment of fish, wildlife, and rare plant standards to prevent listing of species under the Endangered Species Act and to avoid extirpation of species from its actions (USFS 2003a).

Maxim conducted a baseline assessment of wildlife resources within the Study Area during 2003. These studies provide baseline data on wildlife resources that might be influenced by any of the action alternatives. A baseline technical report was prepared and provides details on Maxim's methodologies, results, and conclusions (see Maxim 2004j). The following is largely summarized from this report. Additional pertinent information is also included and cited appropriately.

The dominant vegetation types in the Study Area are forest, sagebrush, and riparian communities, and are discussed in detail in **Section 3.5** of this document. In summary, the dominant forested habitats are aspen and subalpine fir types. Other forest communities include aspen/conifer, Douglas-fir, and in some cases, mountain mahogany. Aspen is the most productive forest community type on the CNF in terms of wildlife diversity and herbaceous cover (USFS 2003b) as it provides areas for big game calving, browse and foraging areas for a variety of wildlife, nesting areas for arboreal bird species, and security areas. The sagebrush community is dominated by mountain big sagebrush and various forbs and grasses. Rangeland communities, including sagebrush, provide a wide array of habitats for wildlife species found on the CNF. Wetlands and/or riparian habitats occur along Crow Creek, Deer Creek, South Fork Sage Creek, and in Wells Canyon. Of the 334 avian, terrestrial, and amphibian species known or suspected to occur on the CNF, 277 are either directly dependent on riparian areas or use riparian habitats at some time during their lives (USFS 2003b). Other non-forest communities include wet meadow, forb/graminoid, and mountain snowberry/sagebrush.

Wildlife groups are discussed below, including Threatened, Endangered, Proposed, and Candidate (TEPC) species; Management Indicator Species (MIS); Sensitive (S) species; Migratory Land Birds, and other mammals, birds, amphibians, and reptiles. MIS have changed since the original CNF Forest Plan; changes to this list of species can be found in the CNF RFP (USFS 2003a) and are incorporated in the MIS section below (see **Table 3.7-4**).

3.7.1 Threatened, Endangered, Proposed, and Candidate Wildlife Species

The US Fish and Wildlife Service (USFWS) identified four TEPC species that are known or expected to occur on the CNF (Species List #1-4-05-SP-0354). These species are listed in **Table 3.7-1**; background information on each species follows the table. Additional information can be found in USFS (2003b:appendix D) and Maxim (2004j).

TABLE 3.7-1 THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE WILDLIFE SPECIES KNOWN OR SUSPECTED TO OCCUR ON THE CARIBOU NATIONAL FOREST

COMMON NAME	SPECIFIC NAME	USFWS STATUS
Gray Wolf	*Canis lupus*	Endangered[1]
Canada Lynx	*Lynx Canadensis*	Threatened
Bald Eagle	*Haliaeetus leucocephalus*	Threatened
Western Yellow-Billed Cuckoo	*Coccyzus americanus*	Candidate

[1]Population in/near Project Area is considered experimental/nonessential

Gray Wolf

Prior to European colonization, the wolf occupied most habitats in the northern hemisphere. Predator control and other persecution have reduced the wolf's range to Canada, Alaska, and portions of the northern tier of the continental United States. Recently, wolves have been reintroduced into some portions of their former range. In 1995, in an attempt to reintroduce wolves into the Yellowstone area, the USFWS began releasing wolves captured in Canada into Yellowstone National Park. Similar reintroductions were attempted in central Idaho. The reintroduced wolves have increased in numbers, and animals have dispersed into some surrounding areas. The populations established by this release effort are considered experimental, nonessential populations. In Idaho, all wolves south of Highway I-90, which runs through the Idaho Panhandle approximately 400 miles north of the Project Area, are also considered part of an experimental, nonessential population. Wolves east of Interstate 15, which runs through McCammon, Pocatello, and Idaho Falls, and passes approximately 56 miles west of the Project Area, are considered part of the Yellowstone experimental, nonessential population.

Wolves are sociable animals, frequently traveling and hunting in packs. Prey species preferred by wolves include deer, elk, moose, and beaver. Wolves require habitat suitable for denning (i.e., areas with sufficient vegetative cover and isolation from human interests/uses), and "rendezvous sites" for resting and gathering (i.e., meadows adjacent to forested areas). Any habitat in the Study Area could provide movement routes for wolves. Standards associated with wolf habitat (USFS 2003a:3-30) restrict disturbances within one mile of an active den or rendezvous site. Throughout the year, wolves also require accessibility to prey species (i.e., within the ranges of ungulates year-round, and riparian zones for beaver in spring, summer, and fall). Within the ranges of ungulates and their calving grounds, wolves need relatively large spaces in which to hunt.

In recent years, a single wolf was reported in the Caribou County area. In late fall of 2000, a wolf which had been preying on sheep in Caribou County was killed under a taking provision authorized by USFWS (USFWS 2000). Track surveys conducted in the area of sheep kills indicated a single wolf was involved in these predations. This wolf probably dispersed from one of the Yellowstone packs. The closest known wolf pack is located west of Daniels, Wyoming, 50 miles northeast of the Project Area (USFWS et al. 2004). During May 2002, Maxim personnel documented wolf tracks near the confluence of South Fork Deer and Deer Creeks. Wolf tracks were observed in the spring of 2003 approximately ¼ mile west of the confluence of Deer and North Fork Deer Creeks. Though suitable habitat and prey are present, wolves are likely transients in the Study Area, as resident occurrence has not been documented.

Canada Lynx

The Canada lynx is a predator of the northern boreal forests of Canada, Alaska, and the Rocky Mountains and north Cascades. Preferred habitats include boreal forests with openings, bogs, and thickets; old growth taiga; mixed or deciduous forest and wooded step. Early successional stands with high shrub and seedling densities are optimal habitat for snowshoe hare (*Lepus americanus*), the major prey species, and are therefore important to the lynx. Denning occurs in mature forest stands, which also provide important cover and travel corridors (Koehler and Brittell 1990).

It has been determined that suitable lynx habitat on the CNF is too patchy and disjunct to provide suitable resident lynx habitat. Accordingly, it was determined that no Lynx Analysis Units will be identified on the CNF. Habitat on the CNF may however, provide linkage habitat for lynx. Such habitat is used during lynx movement, including dispersal. According to Ruediger et al. (2000), lynx habitats in the Rocky Mountains often occur as "islands of coniferous forest surrounded by shrub-steppe habitats." Lynx movement between these forested habitats is poorly understood, but use of shrub-steppe habitats adjacent to boreal forests has been documented. In the broad sense, connectivity between lynx habitats in Canada and the U.S. may be necessary for the persistence of some southern lynx populations. These southern populations, if isolated, may be too small to maintain themselves over the long term.

Maxim conducted winter track surveys in the Project Area and found no evidence of lynx (Maxim 2004j). Maxim (2000b) notes that a local trapper working in the area for the past 15 years had never seen evidence of lynx. Two unconfirmed lynx were reportedly taken in the area in the 1960s, and an unconfirmed sighting occurred in 1997. A lynx reportedly died a few years ago on the Wyoming Range, 50 miles northeast of the Project Area (USFS 2005a).

Bald Eagle

During the breeding season, bald eagles are closely associated with water and occur along coasts, lakeshores, or riverbanks, where they feed primarily on fish. Bald eagles typically nest in large trees, primarily cottonwoods (*Populus* sp.) and conifers, although they have also been known to nest on projections or ledges of cliff faces. During winter, bald eagles concentrate wherever food is available. Areas of open water, where fish and waterfowl can be taken, are common wintering sites (USFWS 1998).

The CNF mid-winter bald eagle survey results from 1986 to 2005 (USFS 2003c, 2004a, and 2005b) indicate bald eagle use of the Crow Creek drainage in winter. An annual, one-day snowmobile survey is performed in January along Crow Creek Road from the Caribou/Bear County boundary to Poison Creek near the Idaho–Wyoming border (survey route number 48). This route includes the portion of the Study Area encompassing the Crow Creek drainage. During the 2003 survey, an adult bald eagle was observed in the Study Area on a perch near the confluence of Rock and Crow Creeks (Maxim 2004j). Results from the 2004 midwinter survey showed two eagles, one flying north above the creek between Manning Creek and the CNF boundary, the other in an aspen tree at the Sage Creek/Deer Creek confluence (USFS 2004a). During the 2005 midwinter survey, one juvenile bald eagle was observed from Crow Creek Road flying up Sage Creek (USFS 2005b). The nearest confirmed bald eagle nest is located near the Blackfoot River, approximately 20 miles northwest of the Project Area (JBR 2004d). Nests are also known to occur along the Snake River (>60 miles northwest of the Project Area) and around Palisade Reservoir (>30 miles north of the Project Area; USFS et al. 2005).

Standards and Guidelines for occupied nesting zones, primary use areas, and home ranges stated in the RFP (USFS 2003a:3-28 and 3-29) do not apply because there is no nest within 2.5 miles of the Project Area. Guidelines related to minimizing conflicts with bald eagle winter foraging and roosting habitat would apply.

Western Yellow-Billed Cuckoo

Western yellow-billed cuckoos breed in large blocks (>20 acres) of riparian habitat, typically woodlands with cottonwoods and willows. No areas of potential habitat have been identified on the CNF (USFS 2003b:3-212), and the species will not be discussed further in this EIS.

3.7.2 Sensitive Wildlife Species

In addition to TEPC and MIS species, the Regional Forester identifies Sensitive species as those for which population viability is a concern, as evidenced by significant current and predicted downward trends in population numbers, density, and/or habitat capability that would reduce a species' existing distribution. Sensitive species must receive special management emphasis to ensure their viability and to preclude trends toward endangerment that could result in the need for federal listing (FSM 2672.1). Sensitive species potentially occurring in the Study Area are listed in **Table 3.7-2**, followed by background information on each species. Additional information can be found in USFS (2003b:Appendix D) and Maxim (2004j).

TABLE 3.7-2 USFS SENSITIVE WILDLIFE SPECIES KNOWN OR SUSPECTED TO OCCUR ON THE CARIBOU NATIONAL FOREST

COMMON NAME	SPECIFIC NAME
Pygmy Rabbit	*Brachylagus idahoensis*
Spotted Bat	*Euderma maculatum*
Wolverine	*Gulo gulo*
Townsend's Big-Eared Bat	*Corynorhinus townsendii*
Boreal Owl	*Aegolius funereus*
Greater Sage-Grouse	*Centrocercus urophasianus*
Trumpeter Swan	*Cygnus buccinator*
Peregrine Falcon	*Falco peregrinus*
Harlequin Duck	*Histrionicus histrionicus*
Flammulated Owl	*Otus flammeolus*
Northern Three-Toed Woodpecker	*Picoides tridactylus*
Great Gray Owl	*Strix nebulosa*
Columbian Sharp-Tailed Grouse	*Tympanuchus phasianellus columbianus*
Northern Goshawk	*Accipiter gentiles*
Columbia Spotted Frog	*Rana luteiventris*

Pygmy Rabbit

There are no known occurrences of the pygmy rabbit on the CNF (USFS 2003b:D-155) and it is not expected to occur within the Study Area due to the lack of suitable habitat (i.e., dense sagebrush and soft/friable soils). This species will not be discussed further in the EIS.

Spotted Bat

The spotted bat occurs in a variety of habitats from desert to montane coniferous forest, including pinyon-juniper woodlands, ponderosa pine, open pasture, and coniferous forest up to 8,000 feet elevation. These bats roost in deep rock crevices in canyon walls and cliffs and rarely inhabit caves. Forage areas are primarily over dry, open coniferous forest often associated with riparian or wet meadows (Maxim 2004j).

In Idaho, the spotted bat occurs primarily in the southwest corner of the State. The first specimen collected in Idaho was found in Canyon County (IMNH 2001), and the species has only recently been documented in the canyons of Owyhee County (Groves et al. 1997). An unconfirmed report of spotted bat occurrence in the Long Valley Area of Grey's Lake is the only indication that spotted bats may be present in southeast Idaho (USFS 2005c). Populations are also known to occur in the northeast portion of the Greater Yellowstone Area in Montana and Wyoming. Maxim's 2004 and past surveys on the CNF have not documented the presence of spotted bat (USFS 2003b:3-214).

Wolverine
Wolverines inhabit a wide variety of habitats, though they are usually associated with remote montane-forested areas. Hornocker and Hash (1981) reported that wolverines preferred mature forests, followed by ecotones and rocky areas on timbered benches. Wolverines were most often observed in medium to scattered timber, usually subalpine fir. Wolverines appeared to avoid clearcuts, dense young stands of timber, recent burns, and wet meadows. They are vulnerable to trapping and other human activities.

The Predator Conservation Alliance (2003) estimates that up to 300 wolverines persist in Idaho, based on research and sightings in mountainous portions of the state. Records from Wyoming are from the western third of the State, and there is some evidence that their range has expanded into the southwestern part of the State (Banci 1994). The USFS verified two wolverine tracks located within the CNF at the following locations: 1) approximately 25 to 30 miles north-northwest of the Project Area in the vicinity of Caribou Mountain on the north end of the Caribou portion of the Forest and 2) along the divide between Mink Creek and Liberty Creek in the Bear River Range (Maxim 2004j). Unverifiable ("probable") wolverine tracks were located by USFS six miles southwest of the Project Area. The Idaho Conservation Data Center (CDC) lists one wolverine sighting in 1977, approximately 5 miles north of the Project Area. No evidence of wolverines was observed by Maxim in 2004. Wolverine occurrence is unlikely though possible, as potential denning habitat (subalpine fir) and prey base exist within and in the vicinity of the Project Area.

Townsend's Big-Eared Bat
The Townsend's big-eared bat occurs in much of western North America and is rare or uncommon throughout much of its range. Townsend's big-eared bats occur in a variety of habitats from desert shrub to deciduous and coniferous forest over a wide range of elevations. During the summer, these bats roost in abandoned mines, caves, and occasionally in empty or occupied buildings or bridges. Research in California found two females roosting in tree cavities, which may be an important undocumented source of maternity colonies (IMNH 2001). Maternity colonies and winter hibernacula occur in mines and caves where the species hibernates singularly or in small groups. Townsend's big-eared bats forage near the foliage of trees and shrubs, and individuals have a high degree of site fidelity (Maxim 2004j).

In Idaho, hibernacula for Townsend's big-eared bats have been found in 17 counties, and four maternity colonies have been found in Boundary, Bonner, and Butte counties (IMNH 2001). There are known populations of the species in Yellowstone and Grand Teton National Parks, approximately 75 miles northeast of CNF, and at Craters of the Moon National Park approximately 125 miles northwest (Clark et al. 1989). Although the Townsend's big-eared bat was not detected within the Study Area (Maxim 2004j), past surveys on the CNF have found the species in the Bear River Range, Pruess Range, Portneuf Range, and Elkhorn Mountains (USFS 2003b:3-214). Although no caves were observed during Maxim's surveys, a single cave was observed by JBR in the South Fork Deer Creek drainage, and it is possible that other caves exist in the Study Area. However, the possibility of roost and hibernacula sites for the Townsend's big-eared bat is low.

Boreal Owl
Boreal owls are typically found in mature to old-growth spruce-fir forests in the Rocky Mountains. They often nest in abandoned northern flicker and pileated woodpecker cavities in large dead or dying conifers or aspens within mixed conifer forests. Use of lodgepole pine is

infrequent in most areas. Boreal owl roosting and foraging habitat occurs in relatively closed canopy subalpine fir and Engelmann spruce forests. In summer, owls select cool microsites with a high canopy coverage, high basal area, and high tree density. In winter, these owls use a wider variety of habitats due to reduced thermal stress. Foraging occurs year-round primarily in moderately dense stands of subalpine fir and spruce where access to prey is not hindered by thick herbaceous cover or deep-crusted snow (Hayward 1994).

The nearest CDC record of a boreal owl was a 1985 sighting approximately 13 miles northwest of the Project Area. No boreal owls were detected during the February/April 2003 baseline surveys. Douglas-fir and subalpine fir habitat types within the Study Area may provide mature spruce-fir forest for nesting, and subalpine fir and spruce stands for roosting and foraging. Patchy stands of mature Douglas-fir occur in the Manning Creek drainage; however, large stands of closed-canopy spruce-fir forests were not found. Therefore, the absence of good foraging and roosting habitat may deter boreal owls from using the area. The single boreal owl-specific RFP Guideline (USFS 2003a:3-32) is to maintain 40 percent of the forested acres in mature and old age classes within a 3,600-acre area around nest sites.

Greater Sage Grouse

Sagebrush and forb/graminoid habitat types within the Study Area provide cover habitat and potential lek sites for sage grouse. During 2003 field surveys, four sage grouse were flushed in pastureland along Crow Creek (four miles southeast of Panel G), twelve sage grouse were observed near the confluence of Deer and Crow Creeks (three miles southwest of Panel F South Lease), and three sage grouse were observed approximately one mile north of Manning Creek (2-3 miles east of Panel F). No active or historic sage grouse leks, traditional courtship display areas, were identified. Surveys conducted by IDFG located two sage grouse leks within approximately 10 miles of the Study Area (USFS 2005c). The closest lek was located 3.5 miles east of Panel F along Crow Creek basin. The other lek was located 10 miles northwest of the Study Area near the mouth of Stump Creek.

Trumpeter Swan

Trumpeter swans inhabit freshwater marshes, lakes, reservoirs, ponds, and occasionally rivers with wide stream reaches. The species requires a highly irregular shoreline, diverse vegetation, nesting substrate, space for flight take-off, and low levels of human disturbance for breeding (Maxim 2004j). Trumpter swans were trans-located from northern areas into parts adjacent to the CNF, but the species has not been observed on the CNF itself (USFS 2003b:3-219). Neither suitable habitat for trumpeter swans nor evidence of trumpeter swan individuals was found during 2003 surveys (Maxim 2004j). For these reasons, the species will not be discussed further in this EIS.

Peregrine Falcon

Peregrine falcons occupy a wide range of habitats, typically found in open country near rivers, marshes, lakes, and coasts. Foraging habitat includes wetlands and riparian habitats, meadows and parklands, croplands and orchards, gorges, mountain valleys, and lakes that support good populations of small- to medium-sized terrestrial birds, shorebirds, and waterfowl. Cliffs are preferred nesting sites, although reintroduced birds now regularly nest on man-made structures such as towers and high-rise buildings (USFS 2003b:3-216).

There are historical, but currently unoccupied, nesting cliffs, as well as other potentially suitable nesting cliffs on the CNF. As numbers of peregrines increase in Idaho, some of these cliffs may become occupied. The CNF has the potential to contribute to a further increase in peregrine falcon populations in southeastern Idaho. The closest reported nest is located just west of Soda Springs, 20 miles west of the Project Area (USFS 2005c). There is only one known nest site currently on the CNF, near Grays Lake, approximately 30 miles northwest of the Project Area (USFS 2003b:3-217). The Study Area itself contains no suitable habitat for peregrine falcons.

RFP Standards and Guidelines (USFS 2003a:3-30) require that activities or habitat alterations be minimized within two miles of peregrine falcon nest sites, as well as prohibit the use of herbicides or pesticides (which could cause eggshell thinning) within 15 miles of nest sites.

Harlequin Duck

Harlequin ducks inhabit fast flowing mountain streams or rivers with forested banks. Suitable streams are of second- to fifth-order size, have a one to seven percent gradient, and are usually associated with willow, pole-sized lodgepole pine, ponderosa pine, or Douglas-fir. Large streams with faster flow rates, undercut banks, and cobble to boulder-sized substrate are preferred. Reproduction is limited in areas with high human activity, high stream sedimentation, and a low invertebrate supply (Montana Partners In Flight 2000). There is no harlequin duck habitat in the Study Area. The nearest occurrence of a harlequin duck, provided by the Wyoming Natural Diversity Database (WYNDD), is a 1980 record approximately 17 miles east of the Project Area. No incidental observations of harlequin ducks occurred during 2003 data collection activities and the species is not expected to occur on the CNF (USFS 2003b:3-213). The species will not be discussed further in this EIS.

Flammulated Owl

Flammulated owls occur year-round in cool, temperate, semi-arid climates, migrating when necessary to maintain access to their insect prey. Their range is essentially co-extensive with mid-elevation pine forests. Habitat consists primarily of open ponderosa pine or similar dry montane forests (McCallum 1994). Forests used by flammulated owls include an interspersion of dense thickets for roosting within open, mature to old-growth stands of ponderosa pine, Douglas-fir, or aspen. Dense or young pine-fir stands and extensively cutover areas are avoided. Flammulated owls use woodpecker-excavated cavities in pines, aspens, or Douglas-fir, 7 to 25 feet above ground (DeGraaf et al. 1991). Five flammulated owl observations have been documented on the CNF and include: Worm Creek in 1993, Left Fork Fish Haven Canyon in 1992, Smoky Canyon in 1999, head of East Fork Mink Creek in 1989, and Porcelain Pot Gulch in 1998 (USFS 2003b:3-218).

Drier areas of aspen, aspen/conifer, and Douglas-fir habitat types within the Study Area provide potential habitat for the flammulated owl. Dry, open, mature forests are generally absent. However, small, open patches of mature Douglas-fir interspersed with sagebrush and grassland can be found on south facing slopes in the northern portion of the Panel F lease area. Three flammulated owls were detected in the northeast portion of the Study Area (Maxim 2004j) during dedicated surveys in 2003, although no nest sites were identified. RFP Guidelines for flammulated owl habitat (USFS 2003a:3-32) state that no timber activities are allowed within a 30-acre area around nest sites.

Northern Three-Toed Woodpecker

Northern three-toed woodpeckers are primarily associated with dense subalpine fir and Engelmann spruce forests at higher elevations. They also forage in mixed pine, lodgepole pine, and Douglas-fir stands. Mature to old-growth stands are preferred due to an abundance of insect prey in large snags and downed woody debris. Three-toed woodpeckers are often abundant in forests recently disturbed by fire due to ensuing insect epidemics (Koplin 1972). In April 2001, three-toed woodpecker callback surveys conducted within the Panel F Study Area resulted in two responses (JBR 2001d). An observation of a three-toed woodpecker near the headwaters of Manning Creek is also reported in BLM and USFS (2001). During Maxim's surveys, one three-toed woodpecker was observed on the forested north slope of the South Fork Sage Creek drainage. Older/mature stands of the subalpine fir and Douglas-fir habitat types may provide nesting and important foraging habitat (Maxim 2004j). RFP Standards and Guidelines for three-toed woodpeckers are related to maintaining snag habitat (see USFS 2003a:3-27). However, Prescription 8.2.2(g) – Phosphate Mine Areas, which allows for phosphate mining to occur on existing leases, states that snag habitat for woodpeckers shall not be a management consideration.

Great Gray Owl

The great gray owl is widely distributed throughout boreal forests of western North America, where it is associated with coniferous and hardwood forests, primarily Douglas-fir, aspen, and lodgepole pine stands up to 9,600-feet elevation. It forages in open forests, clear cuts, and meadow edges, primarily preying on voles and pocket gophers (Clark et al. 1989).

Open meadows, adjacent to stands of lodgepole pine and Douglas-fir, are common in the Study Area providing adequate nesting and foraging habitat for great gray owls. Two 1992 Conservation Data Center (CDC) records for the great gray owl exist approximately 3 miles north of the Project Area. An additional 1992 record is located approximately 3 miles west of the Project Area. A pair of great gray owls was observed in the Project Area during dedicated surveys in 2003 (map provided in Maxim 2004j). A follow-up survey in 2005 heard multiple responses in the same location, and concluded that a great gray owl territory is located in Panel G (USFS 2005d). RFP Guidelines for great gray owl habitat (USFS 2003a:3-32) state that within a 1,600-acre area around nest sites, maintain over 40 percent of the forested acres in mature and old age classes.

Columbian Sharp-Tailed Grouse

Historically, sharp-tailed grouse occupied native shrub-grasslands interspersed with scattered woodlands, brushy hills and draws, and edges of riparian woodland habitats throughout much of central and northern North America. It is found in relatively open grassland habitats or in areas with low, scattered brush in late summer and autumn. In winter, it uses relatively dense shrub-thickets such as snowberry, willow, sagebrush, and quaking aspen for escape cover, roosting, and feeding. High structural diversity is preferred for high-quality nesting habitat. The Columbian subspecies inhabits sagebrush-grassland and mountain shrub habitats (Connelly et al. 1998).

Based on GIS data provided by the CNF, the nearest known sharp-tailed grouse lek is located approximately nine miles northwest of the Study Area. No incidental observations of sharp-tailed grouse were made during the 2003 surveys (Maxim 2004j). However, suitable habitat, with sagebrush/grassland - deciduous shrub interfaces, occurs along the Deer Creek and Crow Creek drainages.

Northern Goshawk

Northern goshawks inhabit montane coniferous and deciduous woodland in the western U.S., preferring woodland stands of intermediate to high canopy-closure and a thin understory interspersed with small openings, fields, or wetlands. Goshawks generally nest in large trees adjacent to open flight corridors. This species is primarily associated with mature to old growth stands of Douglas-fir, assorted pines, or aspen. In April 2001, JBR biologists identified a single juvenile goshawk within the Study Area (JBR 2001c). During 2003 surveys, Maxim recorded six goshawk detections in four different regions within or near the Study Area (maps provided in Maxim 2004j).

Although attempts were made to locate nests, no active goshawk nests were found in the Study Area, and the presence of nest territories or successful breeding pairs could not be determined. Forested stands within the aspen, aspen/conifer, Douglas-fir, and subalpine fir habitat types with open understory and adjacent small openings provide habitat for the goshawk. However, given suitable habitat and six detections, it is assumed that one or more active nests may occur within, or near, the Study Area. RFP Standards and Guidelines for the goshawk are extensive and are described in USFS (2003a:3-31). One RFP guideline for goshawks states that forest openings larger than 40 acres should not be created in order to preserve foraging and post-fledgling family areas (USFS 2003a:3-31).

Regarding the tree size-class distribution for forested acres guideline, the evaluation area for goshawks has been defined as those portions of the five HUC6 watersheds located north of Crow Creek that contain the Proposed Action footprint. The evaluation area measures 48,893 acres, of which, approximately 31,219 is forested. **Table 3.7-3** shows the size-class distribution for forested acres within this area.

TABLE 3.7-3 TREE SIZE-CLASS DISTRIBUTION FOR FORESTED ACRES WITHIN THE GOSHAWK EVALUATION AREA

SIZE CLASS	ACRES	PERCENT OF FORESTED ACRES	REVISED RFP GUIDELINES
Nonforested (grass, water, rock)	17,674		
Nonstocked/Seedling (<5 years old)	515	2%	<22%
Sapling (5-20 years old)	309	1%	<22%
Pole (20-50 years old)	965	3%	<22%
Mature/Old (>50 years old)	29,430	94%	>33%
TOTAL FORESTED	**31,219**		
GRAND TOTAL	**48,893**		

Columbia Spotted Frog

To date, amphibian surveys on the CNF have not recorded any Columbian spotted frogs, nor has this species been found in southeast Idaho (USFS 2003b:3-223). A segment of the Great Basin population is found in the southwest part of the state, and a segment of the Yellowstone population is found to the north of the CNF. Columbian spotted frogs require still-water habitats, typically laying egg masses just beneath the water's surface on the flooded margins of wetlands, ponds, or lakes (Hallock and McAllister 2002). The species is not expected to occur on the CNF (USFS 2003b:3-213) and will not be discussed further in this EIS.

3.7.3 Management Indicator Species

The CNF designates three bird species as MIS (USFS 2003a:3-224, **Table 3.7-4**). All three species are also USFS Sensitive species and are discussed in **Section 3.7.2**.

TABLE 3.7-4 MANAGEMENT INDICATOR SPECIES AND ASSOCIATED HABITAT FOR THE CARIBOU NATIONAL FOREST

MANAGEMENT INDICATOR SPECIES	HABITAT
Columbian Sharp-Tailed Grouse	Grassland and Open Canopy Sagebrush
Greater Sage Grouse	Sagebrush
Northern goshawk	Mature and Old Forest Structure

3.7.4 Migratory Land Birds

The Study Area provides a diversity of habitats for many species of birds. Riparian, non-riverine wetlands, and sagebrush are three of the four highest priority habitats identified in the Idaho Bird Conservation Plan (Ritter 2000) that are found on the CNF and in the Study Area. The Coordinated Implementation Plan for Bird Conservation in Idaho (IWJV 2005) updated the BCP and included aspen within highest priority habitats. Of the 247 avian species known/suspected to occur on the CNF, 211 are associated with riparian habitats (USFS No Date) found along most perennial streams on the CNF. Of the 108 neotropical landbird species known/suspected to occur on the CNF, 101 are associated with riparian habitats (USFS 1991). Non-riverine wetland areas on the CNF that may be used by migratory birds include seeps, springs, and small beaver ponds. Sagebrush and aspen woodlands are found throughout the Forest (see **Section 3.5.2**).

The needs of birds have been incorporated into the CNF Forest Planning process in several areas: identification of Species at Risk, used to identify species of concern on the CNF; habitat conservation measures for priority habitats (i.e., riparian, non-riverine wetlands, sagebrush, and aspen); individual species (i.e., TECS species) have guidelines to manage habitats and mitigate effects of projects; and cavity nesters are addressed through snag guidelines.

3.7.5 Big Game

Mule Deer (*Odocoileus hemionus*) and Rocky Mountain Elk (*Cervus canadensis*) are the two most visible big game species in the Study Area and can be found there year-round. They are very important species for the local economy and public interest, but are no longer Management Indicator Species (MIS) under the RFP. Moose (*Alces alces*) are also present in the Study Area. USFS (2003b) has identified 18 percent of the CNF as big game winter range habitat. Only 30 percent of the mule deer that summer on the CNF actually use the winter range on the CNF; most move to adjacent private and state owned lands (USFS 2003a).

Regional studies conducted by Kuck (1984) found that most elk in southeast Idaho tend to be nomadic but do not migrate long distances between summer and winter ranges. The mean year-round home range for elk was 26 square miles, with a mean migration distance between summer and winter ranges of 3.6 miles. Mule deer tend to migrate greater distances (mean = 13.7 miles) between summer and winter ranges. Moose tend to use the same high-elevation forested sites year-round; year-round home ranges were small (mean = 10.0 square miles). In general, during winter within the Study Area, deer tend to utilize sagebrush/shrub on southerly and west aspects, elk tend to utilize mountain mahogany on southerly and west aspects, and moose tend to utilize aspen on northerly and east aspects. Based on 2002 GIS data provided by the CNF, approximately 5,400 acres of an 18,230-acre big game winter range polygon occurs within the Study Area (**Figure 3.7-1**). This figure represents 28 percent of the Study Area and 30 percent of the identified winter range polygon. No critical winter range habitat is located within the Study Area.

During field surveys, elk and elk sign were commonly observed in the Study Area on the foothills east and west upslope of Crow Creek, generally on the lower, east-facing slopes of the Webster Mountain Range from South Fork Sage Creek to Wells Canyon during all seasons (Maxim 2004j). The Sage Meadows area was observed being used as a calving area. In winter and fall, herds of elk were observed using aspen and mountain shrub-sagebrush cover types in the lower elevation foothills northwest of Manning Creek and sagebrush-riparian cover types in the Crow Creek bottomlands. Maxim observed mule deer on the foothills upslope of Crow Creek, generally on the lower east slopes of the Webster Range from South Fork Sage Creek to Wells Canyon. Mule deer tracks were common throughout the Study Area during all seasons. Mule deer were observed utilizing sagebrush, aspen-conifer, aspen, and mountain mahogany cover types. Moose sign was most evident in riparian areas. Any habitat type in the Study Area may be utilized by big game individuals during seasonal migrations.

As reported by the Idaho Department of Fish and Game (IDFG), elk populations are near all-time highs, with elk populations doubling in southeast Idaho since 1984 (Compton 2003, as cited in Maxim 2004j). The Idaho portion of the Study Area occurs entirely within IDFG Hunting Unit 76, one of two units comprising the Diamond Creek Elk Management Zone. A population estimate of 3,690 elk, above the 2,100 population objective, in this Zone was estimated from surveys conducted by IDFG in 2002 (USFS 2003b:3-238). The IDFG's objective related to adult bull:cow elk ratios within the Zone is 18 to 24 adult bulls per 100 cows; the current ratio is 19:100. Although elk populations are increasing, mule deer populations are on the decline. Mule deer populations have declined since the 1950s and 1960s. Mule deer have been reduced by approximately 50 percent in southeast Idaho since 1984 (Compton 2003, as cited in Maxim 2004j). The recent decline is a result of severe winters, which resulted in significant winter mortality. For estimating mule deer populations, the IDFG has divided the state into 22 Analysis Areas, which contain groups of Hunting Units. The Study Area occurs within Hunting Unit 76 (889,324 acres), which is part of Analysis Area 22. The current mule deer population estimate for Analysis Area 22 is 6,660 animals; this figure is below the 10,000 minimum population objective (USFS 2003b:3-236). Concerning moose, the most recent estimate in the area was conducted by IDFG in 1999 for Hunting Unit 76. During surveys, 140 moose were observed; population estimates are between 437 - 729 animals (IDFG 2000).

3.7.6 Other Wildlife Species

Predators

In addition to the gray wolf, Canada lynx, and North American wolverine (described above), the American marten (*Martes americana*) and fisher (*Martes pennanti*), also have the potential to exist within and around the Study Area, as potential habitat and prey base are present. No evidence of the American marten or fisher were observed during forest carnivore surveys conducted by Maxim in January and February of 2003 (Maxim 2004j).

During carnivore surveys, and from incidental observations, the following predators were recorded within the Study Area: mountain lion (*Felis concolor*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*), and long-tailed weasel (*Mustela erminea frenata*). Mountain lion tracks were observed on South Fork Sage Creek, near the confluence of Manning and Crow Creeks, and along lower Deer Creek. Coyote and long-tailed weasel tracks were common throughout the Study Area. A red fox den was located along Crow Creek road near the Idaho and Wyoming border. One black bear was sighted at the south end of the Panel F lease area. The remains of a bobcat were found along Deer Creek near the confluence with Crow Creek. The majority of the predators found in the area feed on small mammals and birds and utilize most of the habitat types found in the Study Area. Mountain lions typically occur in areas with high populations of elk and mule deer.

Bats

Bat surveys were conducted by Maxim during the summer of 2003 (Maxim 2004j). Sixteen survey sites were selected within the Study Area based on vegetation types and specific habitat features (e.g., beaver ponds, rock outcrops, small ponds, seeps, and stock ponds). These areas were surveyed using mist nets and a tunable, broadband, ultra-sonic bat detector. Six species were detected: big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), long-eared myotis (*Myotis evotis)*, long-legged myotis (*Myotis volans*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*). No TEPCS bat species were detected. The four most abundant species recorded, the little brown bat, long-legged myotis, long-eared myotis, and silver-haired bat, have habitat requirements mainly associated with forested areas. Roost sites for these species include tree cavities, snags, and under exfoliating bark. Long-legged and long-eared myotis will also roost in cliff and rock crevices and in mine adits (IMNH 2001). In general, sites with high bat activity featured mature aspen, or mixed conifer forest including aspen stands. Small ponds, stock ponds, and beaver ponds were also important components of high bat activity areas.

Raptors

The habitat types in the Study Area provide numerous nesting and foraging opportunities for raptors from early spring (February/March) to late summer (August). Callback surveys were performed for boreal owl (*Aegolius funereus*), great gray owl (*Strix nebulosa*), flammulated owl (*Otus flammeolus*), and northern goshawk (see **Section 3.7.2**). The following raptors were observed or heard during field surveys: great gray owl, flammulated owl, northern goshawk, American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), northern harrier (*Circus cyaneus*), northern pygmy owl (*Glaucidium gnoma*), osprey (*Pandion haliaetus*), prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), sharp-shinned hawk (*Accipiter striatus*), and Swainson's hawk (*Buteo swainsoni*). Many of these species likely nest in the conifer and aspen stands, and/or forage in the diverse vegetation communities in the Study Area. The only nests identified were two red-tailed hawk nests, one along South Fork Sage Creek and one along Deer Creek.

Upland Game Birds

Sharp-tailed grouse and greater sage grouse are discussed above as Sensitive species. Regarding blue grouse (*Dendragapus obscurus*) and ruffed grouse (*Bonasa umbellus*), forest communities within the Study Area provide habitat for these species, and incidental observations of each were recorded during field surveys conducted by Maxim in 2003.

Figure 3.7-1   Big Game Winter Range

Woodpeckers

The major forest types used by woodpeckers are aspen, mixed conifer, Douglas-fir, spruce/fir, and lodgepole pine (USFS 2003b); these forest types are found within the Study Area. Within these habitats, woodpeckers rely on dead and dying trees for nesting and foraging. Seven woodpecker species are found on the CNF (Stephens and Sturts 1998): Lewis' woodpecker (*Melanerpes lewis*), red-naped sapsucker (*Sphyrapicus nuchalis)*, Williamson's sapsucker (*Sphyrapicus thyroideus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), northern three-toed woodpecker (*Picoides tridactylus*), and northern flicker (*Colaptes auratus*). All but the Lewis' woodpecker were observed in the Study Area during 2003 field surveys. The CNF RFP has set standards and guidelines for snag/cavity nesting habitat; however, Prescription 8.2.2(g) – Phosphate Mine Areas, which allows for phosphate mining to occur on existing leases, states that snag habitat for woodpeckers shall not be a management consideration.

Amphibians and Reptiles

Based on an assessment of habitat types within the Study Area and a review of the Northern Intermountain Herpetological Database, six species of amphibians were determined to potentially occur in the Study Area: tiger salamander (*Ambystoma tigrinum*), boreal chorus frog (*Pseudacris maculata*), Columbia spotted frog (*Rana luteiventris*), northern leopard frog, boreal toad, a.k.a. western toad (*Bufo boreas boreas*), and great basin spadefoot toad (*Spea intermontana*). Three of these are considered rare: Columbia spotted frog, northern leopard frog, and boreal toad. The Columbia spotted frog is a sensitive species and is discussed in **Section 3.7-2**; the northern leopard frog and boreal toad are listed as a Species at Risk by the CNF and have special management criteria in the RFP.

Field investigations in 2003 included two survey periods, spring and summer, to evaluate the presence of amphibians and reptiles. Methods used during the spring survey included calling and visual encounter surveys (VES). Field methods used during the summer survey period included VES, road surveys, seine sampling surveys, aquatic funnel trapping, pitfall surveys, and incidental observations. Tiger salamanders were the most abundant species detected within the Study Area, mainly in beaver ponds. Chorus frogs were also found, as well as western terrestrial garter snakes.

Concerning boreal toads, this species uses three different types of habitat: breeding habitats, terrestrial summer range, and winter hibernation sites. Preferred breeding sites are permanent or temporary water bodies that have shallow sandy bottoms. After breeding, adults disperse into terrestrial habitats such as forests and grasslands. They may roam far from standing water, up to approximately 1.5 miles (Keinath and McGee 2005), but prefer damp conditions. Boreal toads spend much of their time underground; though they are capable of digging their own burrows in loose soils, they generally shelter in small mammal burrows, beneath logs and within rock crevices. They hibernate in burrows below the frost line, up to 1.3 meters deep (Frogwatch 2004). The Study Area provides habitat for this species, and five boreal toad tadpoles were observed in small ponds at Sage Meadows. The population discovered in Sage Meadows is the only known population of boreal toads on the Montpelier Ranger District. **Figure 3.7-2** shows the extent of potential boreal toad migration (1.5-mile radius) from Sage Meadows.

The northern leopard frog inhabits sluggish, permanent waters with rooted aquatic vegetation such as ponds, marshes, lakes, and slow streams. They require moderate to high herbaceous cover to avoid predators, preferring tall grasses or sedges near water. They often forage around springs, and in wet or damp meadows and fields. They are very well adapted to cold conditions and can be found at elevations above 8,000 feet (Groves et al. 1997). Although potential suitable habitat exists within the Study Area, the species was not detected during surveys.

3.7.7 Selenium Issues with Wildlife

Selenium is an essential nutrient for animals, and the deficiency and toxicity relationships are fairly well understood for livestock and laboratory animals. Less is known about selenosis and background selenium levels in terrestrial wildlife. A number of studies have been conducted in recent years to determine the effects of selenium on terrestrial wildlife in southeast Idaho. Sampling results in proximity to phosphate mine sites and selenium release areas indicate elevated levels of selenium in every environmental media and species of wildlife tested (Tetra Tech 2003).

As summarized in MWH (2003), selenium toxicity and deficiency can both cause adverse effects in wildlife. Idaho and other areas of the West are typically considered selenium deficient; consequently, the effects of chronic selenium deficiencies on free-ranging wild ungulates dominate the focus of selenium concerns in wild ungulates, not selenium toxicosis. Selenium deficiency lowers reproduction rates primarily through increased neonate and pre-weaning mortality. Relatively small elevations in selenium above optimal nutritional levels can result in potentially toxic forage. Selenium poisoning can affect all animals but is more common in species that directly consume seleniferous vegetation than in carnivores consuming wildlife with elevated selenium levels. Acute selenium poisoning is rare under field conditions and is caused by the short-term consumption of forage that is very high in selenium. Death can follow within a few hours after consumption. Chronic selenium poisoning is recognized in two forms: alkali disease and blind staggers. Alkali disease is associated with prolonged consumption of low levels of seleniferous forage, resulting in general lack of vitality, hair loss, hoof soreness, deformation and shedding, and stiffness and lameness. Blind staggers is associated with consumption of seleniferous forage with moderate levels of selenium, ultimately resulting in death.

In recent years there has been a large increase in the number of reclaimed phosphate mine overburden fills. These overburden fills vary in size from a few acres to hundreds of acres but still only account for less than one percent of the phosphate resource area of southeast Idaho

(MWH 2003). Elk, mule deer, and moose disperse across the entire area and use a variety of habitats. The majority of these animals' home ranges do not encompass overburden fills and their associated seleniferous forage (MWH 2003). However, some elk and deer do have home ranges that encompass areas that contain seleniferous forage, and thus, consumption of this forage does occur. The quantity, frequency, and duration of consumed seleniferous forage would be restricted by the tendency for elk to follow the progression of developing nutritious forage across a variety of terrain and vegetation types (MWH 2003). Moose preference for closed canopy aspen/conifer stands and associated forage types limits the potential use and value of phosphate mine reclaimed areas with potential forage high in selenium levels.

Seleniferous forage is not available or used in the winter, except by some elk, allowing most if not all ingested selenium to be metabolized by each spring.

Figure 3.7-2 Boreal Toad Habitat at Sage Meadows

Currently, elk populations in southeast Idaho are at a historic high with a population increase of 1,500 percent, an average of 30 percent annually over the past 50 years (MWH 2003). This high rate of increase supports a conclusion that the presence of selenium in this elk herd's environment has not had a negative effect on the herd (MWH 2003). Elk surveys conducted by IDFG and Idaho Mining Association in the fall of 1999 and 2000 (Montgomery Watson 2000) showed a significant inverse correlation between elevated selenium levels in elk livers versus the distance of harvested elk from the nearest phosphate mine. Approximately 50 percent of elk harvested within a two-mile radius of historic reclaimed phosphate mining areas showed elevated levels of selenium in their organs, whereas elk harvested 10 miles or more from phosphate mine leases did not have elevated selenium exposure. Eleven elk were sampled from within five miles of the Smoky Canyon Mine. Three of these elk showed signs of elevated selenium levels when compared to the control group. None of the 141 elk livers sampled exceeded thresholds for mammalian livestock toxicity and no muscle tissue concentrations exceeded USDA interim standard for beef of 1.2 mg/Kg dry weight (dw, Wright et al. 2002). The IDFG and Idaho Division of Health concluded that elevated selenium levels in a small percentage of elk livers could result in acute gastrointestinal effects to humans, if consumed in large and persistent portions. Subsequently, the IDFG and Idaho Division of Health posted a human health advisory in the fall of 2000, recommending limited consumption of elk livers by area hunters.

The IDEQ concluded that foraging mammals with smaller home ranges than elk could be experiencing higher doses of selenium and associated risks. Small mammal whole body sample concentrations observed in selected impacted areas ranged from 50-70 mg/Kg dw when typical reported background levels were in the range of 1-4 mg/Kg dw (Tetra Tech 2003). NewFields (2005) measured the COPC (including selenium) content of small mammals across Smoky Canyon Mine Panels A, D, and E, where reclamation did not include selenium control measures of any kind, both within and adjacent to reclaimed areas. In deer mice, mean selenium accumulation outside and within mined/reclaimed areas was 0.72 mg/Kg and 5.83 mg/Kg, respectively. In redback voles, mean selenium accumulation outside and within mined/reclaimed areas was 0.57 mg/Kg and 1.44 mg/Kg, respectively.

Ratti et al. (2002) looked at selenium concentrations in 544 bird eggs, 271 from mining areas and 273 from background areas, in southeast Idaho during 1999 and 2000. Eggs were analyzed from 31 species including waterfowl, shorebirds, raptors, woodpeckers, swallows, and many passerines. Data showed that 16 of the 24 (67 percent) bird species analyzed showed significantly higher levels of selenium in eggs collected from phosphate mine sites than background areas. Eighty-seven percent of eggs collected from the mining sites had selenium levels of 10 mg/Kg or less, 8 percent were between 10 and 16 mg/Kg, and 5 percent were greater than 16 mg/Kg. Recent reports concluded that a selenium effects threshold of 12-14 mg/Kg dw, based on chick mortality and developmental malformations, appears appropriate and conservative (Adams et al. 2002). Ratti et al. (2002) suggest that for the range of selenium levels in bird eggs on both background and mining sites, reproductive success was actually enhanced with elevated levels of selenium; however, additional research would be required to confirm this relationship. Garton et al. (2002a) conducted a population level assessment on metapopulations of red-winged blackbirds and American robins in southeast Idaho. The population-level assessment of the impact of selenium on red-winged black birds and American robins demonstrated no substantial impact from phosphate mining in 2001. Follow-up bird egg samples were conducted in IDEQ-identified impacted zones during 2002 and indicated much higher selenium concentrations than previously recorded, many over 20 mg/Kg (Garton et al. 2002b).

Elevated levels of selenium have also been confirmed in salamanders at a phosphate mine on the Fort Hall Indian Reservation, Idaho and at Smoky Canyon Mine. Concentrations of selenium in some individuals were 10 to 100 times the normal level in animal tissue. There is only limited information about the effects of selenium in amphibians. Viral infections found in salamanders at both sites may be linked to high selenium body burdens (USGS 2001a and 2001b). Eggs and larvae of amphibians may be the most sensitive life stages to direct effects of waterborne selenium. In laboratory exposures, amphibian embryos and tadpoles were about as sensitive as aquatic invertebrates and fish larvae/fry to the effects of waterborne selenium (Rattner et al. 2002).

3.8 Fisheries and Aquatics

3.8.1 Introduction

Maxim conducted a baseline assessment of stream morphology (**Section 3.3**), amphibians and reptiles (**Section 3.7**), benthic invertebrates, and fisheries within the Project Area during the summer of 2003. These studies provided baseline data on biological and physical characteristics of the streams that might be influenced by any of the action alternatives. Baseline technical reports were prepared and provide details on Maxim's methodologies, results, and conclusions. These reports also provide maps indicating the locations of sampling areas (see Maxim 2004c and 2004k). The following is largely summarized from Maxim 2004k (2003 Baseline Technical Report) and Maxim 2005 (Addendum to the 2003 Baseline Technical Report).

RFP Standards and Guidelines for aquatic and fisheries resources (USFS 2003a:3-16) are in Prescription 2.8.3 (USFS 2003a:4-45 to 4-53). This prescription applies to the Aquatic Influence Zone (AIZ) associated with lakes, reservoirs, ponds, streams, and wetlands. AIZ widths are described in the RFP. For this analysis, AIZ widths were defined as the following map distance buffers: 300 feet for perennial streams; 150 feet for ponds, lakes, and wetlands greater than one acre; and 50 feet for seasonally flowing or intermittent streams, and for wetlands less than one acre. The Study Area contains approximately 1,225 acres of AIZs**.** Current disturbances, mainly roads, within these AIZs measure approximately 20 acres.

3.8.2 Benthic Macroinvertebrates

Benthic macroinvertebrates live in the bottom parts of waters, usually on or in the stream or water body substrate. Benthic macroinvertebrates are a good indicator of watershed health. Macroinvertebrate sampling within the Study Area followed Barbour et al. (1999). This procedure involves collecting benthic macroinvertebrates from selected stream locations and assessing stream health based on biological indicators such as the relative abundance of macroinvertebrate taxa sensitive to water quality conditions. Drought conditions during 2003 apparently caused degradation or loss of macroinvertebrate habitat in the Study Area, which subsequently reduced the number of proposed sample locations to only those where suitable habitat conditions existed. Eleven macroinvertebrate sampling locations were established within five different streams in the Study Area. Four locations were created on Deer Creek (DC). Two sampling locations each were created on South Fork Sage Creek (SFSC), North Fork Deer Creek (NFDC), and Crow Creek (CC). One sample was collected from Wells Canyon (WC).

Macroinvertebrate data provided a list of species, relative abundance, and number of taxa, dominant taxa, and percent dominant taxa for each stream location. Further analysis was performed to calculate biotic integrity indices; ratios of functional feeding groups (e.g., predators, scrapers, gatherers); ratios of Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies) taxa, and Chironomidae (midges); and tolerance quotients, tolerance values, and community similarity indices. The Shannon-Weaver Index (H') was also calculated for each stream reach. Shannon-Weaver values range from 0 to 4, values <1.0 indicate severe stress, values >2.5 indicate healthy macroinvertebrate populations (Maxim 2004k). **Table 3.8-1** displays the results of the macroinvertebrate sampling. The Shannon-Weaver diversity index indicates relatively poor environmental conditions or the occurrence of environmental stress factors for most streams.

TABLE 3.8-1 MACROINVERTEBRATE DATA SUMMARY OF STREAM REACHES SAMPLED IN STUDY AREA

REACH	CORRECTED ABUNDANCE (# IND)	DOMINANT COMMUNITY COMPOSITION (% ORDER)	DOMINANT EPT TAXA (% ORDER)	RICHNESS (#SPC.)	SHANNON-WEAVER INDEX (H')	DOMINANT FFG (% FFG)
SFSC-500	1,441	22.9 Diptera	6.38 Ephemeroptera	26	0.87	55.38 Gatherers
SFSC-700	609	79.2 Diptera	8.54 Ephemeroptera	24	0.68	72.91 Gatherers
NFDC-200	1,332	34.53 EPT Taxa	18.62 Ephemeroptera	30	1.11	68.09 Gatherers
NFDC-700	1,357	47.83 EPT Taxa	32.42 Plecoptera	28	0.96	48.64 Gatherers
DC-100	436	41.06 EPT Taxa	30.50 Ephemeroptera	23	0.99	64.45 Gatherers
DC-200	1,098	60.11 EPT Taxa	39.07 Ephemeroptera	25	0.99	50.82 Gatherers
DC-400	954	29.04 EPT Taxa	15.83 Plecoptera	30	0.82	63.73 Predators
DC-600	1,462	54.51 EPT Taxa	26.47 Trichoptera	40	1.12	44.46 Gatherers
CC-100	1,114	33.57 Diptera	14.18 Ephemeroptera	27	1.01	49.82 Gatherers
CC-300	1,597	28.62 Coleoptera	18.85 Trichoptera	46	1.13	35.07 Gatherers
WC-900	737	44.50 EPT Taxa	28.49 Plecoptera	30	0.91	56.72 Gatherers

EPT = Ephemeroptera, Plecoptera, Tricoptera; FFG = Functional Feeding Group.

IDEQ evaluates monitoring data using its Water Body Assessment Guidance (WBAG) to determine if each of Idaho's water bodies meets water quality standards and supports beneficial uses (e.g., recreational activities, ability to support aquatic life). This information is reported to the EPA for 305(b) and 303(d) under the Clean Water Act. The Stream Macroinvertebrate Index (SMI), Stream Fish Index (SFI), and Stream Diatom Index (SDI) are direct biological measures of cold-water aquatic life used by the IDEQ. Both the SMI and SFI are based on condition categories in the 25th percentile of reference conditions (SDI has no minimum threshold established), which is considered adequately conservative to identify a site in good condition. Each condition category is assigned a rating of 1, 2, or 3 (**Table 3.8-2**), which allows the IDEQ to integrate multiple indices into one score that is used to determine use support. This "integrated" metric describes overall stream condition.

TABLE 3.8-2 SMI, SDI, AND SFI SCORING AND RATING CATEGORIES

INDEX	MINIMUM THRESHOLD	1	2	3
SMI	<11	11-13	14-16	>16
SDI	NA*	<22	22-33	>34
SFI	<54	54-69	70-75	>75

*A minimum threshold has not been identified.

The IDEQ has sampled portions of Deer Creek and North Fork Deer Creek for its water body assessments since 1998. In 2003, the SFI ratings for cold water aquatic life and for salmonid spawning in the North Fork were both 3 (SFI = 85.11), indicating high quality habitat for fish. The rating in 2003 for salmonid spawning in Deer Creek was 2 (SFI = 78.76), indicating moderately high quality habitat, where salmonid spawning is likely supported. The SMI scores for Deer Creek and North Fork Deer Creek in 2003 were both 3 (Deer Creek SMI = 62.39; North Fork Deer Creek SMI = 58.39), indicating that macroinvertebrate populations are fully supported.

3.8.3 Fisheries

Based on a review of existing data, the following fish species were determined to potentially inhabit aquatic systems within the Study Area: brown (*Salmo trutta*), brook (*Salvelinus fontinalis*), and cutthroat (*Oncorhynchus clarki*) trout; mountain whitefish (*Prosopium williamsoni*); longnose (*Rhinichthys cataractae*) and speckled (*Rhinichthys osculus*) dace; leatherside chub (*Gila copei*); and mottled (*Cottus bairdi*) and Piute sculpin (*Cottus beldingi*). Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) is the subspecies of cutthroat trout native to the Study Area.

Fish Surveys

Methods

In order to document the occurrence of fish species in the Study Area, fish surveys were conducted during August 2003. Fish surveys were conducted in all likely fish-bearing streams in the Study Area using a backpack electrofishing unit. Fish surveys of streams containing abundant fish habitat were conducted by sampling stream reaches composed of several contiguous sampling units. Sampling of reaches was conducted to provide both qualitative (presence/absence of fish and species composition) and quantitative (fish population parameters and fish condition) data. Four sampling reaches were established on Deer Creek, two on North Fork Deer Creek, and two on Crow Creek **(Figure 3.8-1)**. South Fork Sage Creek, South Fork Deer Creek, and the Wells Canyon drainage were determined to harbor limited and/or sparsely distributed fish habitat. Therefore, sampling reaches suitable for quantitative analysis were not established on these streams. Areas containing suitable fish habitat on South Fork Sage Creek and South Fork Deer Creek were qualitatively sampled. A small segment of the Wells Canyon drainage near the confluence with Crow Creek was determined to harbor potential fish habitat. A 10-meter segment of this portion of the drainage was sampled to determine presence/absence of fish; no fish were captured and the effort was terminated.

Figure 3.8-1 Fisheries and Aquatics Survey Locations

Manning Creek was found to be an ephemeral drainage with no standing water or potential fish habitat, and was therefore not sampled.

Multiple-pass surveys were conducted on Deer Creek, North Fork Deer Creek, and Crow Creek. Three passes were made in half of these sample reaches (two in Deer Creek, one in North Fork Deer Creek, and one in Crow Creek) while two pass surveys were made in the remaining reaches. Maxim (2004k) reported that population estimates in two-pass reaches were unreliable because the two-pass surveys failed to produce a downward trend in the number of fish captured. As a result, additional surveys were conducted in November 2004 on one reach of Deer Creek (DC-400) and on one reach of Crow Creek (CC-100) at the request of the USFS (Maxim 2005).

Data from multiple pass surveys were used to estimate fish population metrics such as density (number of fish/meter^2) and biomass (Kg/hectare) using the Microfish program developed by Van Deventer and Platts (1983). The Microfish program was also used to compute the mean condition factor for fish captured in sampling reaches on Deer Creek, North Fork Deer Creek, Crow Creek, and South Fork Deer Creek. The Microfish program uses Fulton's condition factor (K) for computation of this metric. The mean value of K for fish sampled is typically close to 1.0 for a robust trout population (Chadwick 2000). Fish per stream mile was calculated as a proportion of the number of fish collected per 100 m. Because population estimates and condition factor results were found to be imprecise for several stream reaches, relative abundance and trophic composition for fish captured in each stream reach were computed to provide additional characterization of fish populations.

<u>Results</u>
Results of fish surveys are summarized in **Table 3.8-3**. Cutthroat trout had the greatest relative abundance in upper reaches of the tributary streams of Deer Creek, North Fork Deer Creek, South Fork Deer Creek, and South Fork Sage Creek. Sculpins and other fish species had the greatest relative abundance in lower stream reaches and in Crow Creek. The greatest number of fish species was captured in Crow Creek, including cutthroat-rainbow hybrid trout. Relative trophic composition results indicate that insectivores (i.e., insect eaters) were primarily captured in upper tributary streams, while both insectivores and piscivores (i.e., fish eaters) were captured in lower reaches and in Crow Creek. All fish captured at North Fork Deer Creek (n = 12), South Fork Deer Creek (n = 7), and South Fork Sage Creek (n = 8) were cutthroat trout. Quantitative analyses were not conducted for these streams due to low sample numbers and limited and/or sparsely distributed fish habitat.

TABLE 3.8-3 SPECIES COMPOSITION, RELATIVE ABUNDANCE, BIOMASS, AND TROPHIC COMPOSITION FOR STREAMS IN THE STUDY AREA

STREAM SAMPLED		RELATIVE ABUNDANCE (%)[1]							RELATIVE BIOMASS (%)[2,3,4]							TROPHIC COMPOSITION[5]		
STREAM	REACH NUMBER	SPECIES[6]							SPECIES[6]							% OMN[7]	% INS[7]	% PIS[7]
		CTT	BT	SC	DA	WF	BNT	CRT	CTT	BT	SC	DA	WF	BNT	CRT			
CROW CREEK	CC-100	---	---	75.8	---	---	24	0.7	---	---	17.4	---	---	81.7	0.9	---	76	24
	CC-300	---	---	64.7	8.9	17.6	7.4	1.2	---	---	NA	NA	NA	NA	NA	---	92.6	7.4
DEER CREEK	DC-100	92.5	7.5	---	---	---	---	---	NA	NA	---	---	---	---	---	---	92.5	7.5
	DC-200	100	---	---	---	---	---	---	100	---	---	---	---	---	---	---	100	---
	DC-400	23	---	77	---	---	---	---	32.4	---	67.6	---	---	---	---	---	100	---
	DC-600	15	---	85	---	---	---	---	35.9	---	64.1	---	---	---	---	---	100	---
NORTH FORK DEER CREEK	NFDC-700	100	---	---	---	---	---	---	100	---	---	---	---	---	---	---	100	---
SOUTH FORK DEER CREEK	SFDC-100	100	---	---	---	---	---	---	100	---	---	---	---	---	---	---	100	---
SOUTH FORK SAGE CREEK	SFSC-SS	100	---	---	---	---	---	---	100	---	---	---	---	---	---	---	100	---

1) Relative abundance (%) = Total number of a given species per reach/combined total number of all species per reach or stream segment X 100
2) Relative Biomass (%) = Total weight (g) of a given species per reach/combined total weight (g) all species per reach or stream segment X 100
3) Computation of relative biomass included only fish greater than or equal to 50 mm in length and less than 1000 grams
4) NA = Not available due to absence or unreliability of weight data
5) Relative trophic composition = % of combined trophic categories captured within reach or stream segment
6) CTT = Cutthroat Trout, BT = Brook Trout, SC = Sculpin Spp., DA = Dace spp., WF = Whitefish, BNT = Brown Trout, CRT = Cutthroat-Rainbow Trout Hybrid
7) OMN = Omnivorous. INS = Insectivorous. PIS = Piscivorous

Deer Creek

Four separate sampling reaches were established on Deer Creek; results are summarized in **Tables 3.8-4, 3.8-5**, and **3.8-6**. Sculpin were the most abundant fish species captured but were only caught in the two lower reaches, DC-400 and DC-600. Cutthroat trout were captured in all reaches, and there were a small number of brook trout caught in the headwaters (DC-100). IDEQ also performed a presence/absence survey of fish on a section of Deer Creek on 14 August 2003 approximately 300m upstream from DC-600; they found cutthroat trout and a large number of sculpin (Maxim 2004k).

In two reaches of Deer Creek (DC-100 and DC-200), cutthroat trout weights were estimated from lengths of individuals using a linear regression on length and weight data collected for cutthroat in DC-400 and DC-600 (R^2=0.9036; Maxim 2005). Young-of-year (YOY) fish were included in population parameters and estimates (**Tables 3.8-4** and **3.8-5**) and also treated separately (**Table 3.8-6**). YOY individuals were defined as individuals measuring <35mm in length. Altered abundance of YOY individuals is an early indicator of detrimental effects from disturbance (Maxim 2005).

TABLE 3.8-4 FISH POPULATION PARAMETERS FOR SAMPLING UNITS OF DEER CREEK

REACH, SPECIES	NUMBER COLLECTED (ALL SIZES)	MEAN LENGTH (MM)	MEAN WEIGHT (G)	MEAN CONDITION (K)
DC-100				
Brook Trout	3	167.0	47.7*	NA
Cutthroat Trout	37	89.8	25.9*	NA
DC-200				
Cutthroat Trout	57	115.4	29.9*	NA
DC-400				
Cutthroat Trout	49	56.2	11.6	1.04
Sculpin	164	69.6	7.8	1.74
Cutthroat Trout	95	118.8	21.8	0.977
Sculpin	220	75.2	6.1	NA
DC-600				
Cutthroat Trout	108	95.8	13.6	1.11
Sculpin	613	61.3	4.8	1.65

K = condition factor; * = estimated; NA = Not available due to absence or unreliability of weight data; Shaded area = November 2004 sample (Maxim 2005).

TABLE 3.8-5 POPULATION AND BIOMASS ESTIMATES FOR QUANTITATIVE SAMPLING UNITS OF DEER CREEK (100-METER DEPLETION SAMPLING UNIT)

REACH, SPECIES	NUMBER COLLECTED	POPULATION ESTIMATE	CI ±	DENSITY ESTIMATE (#/M^2)	FISH PER STREAM MILE	BIOMASS (KG/HA)
DC-100						
Cutthroat Trout	15	15*	1.1	0.042	241	313
DC-200						
Cutthroat Trout	41	42	3.6	0.087	660	654
DC-400						
Cutthroat Trout	28	224	2346.4	0.311	451	704
Sculpin	96	115	22.7	0.160	1,545	749
Cutthroat Trout	13	13	1.3	0.260	209	223
Sculpin	155	199	38.2	3.980	2,494	1,154
DC-600						
Cutthroat Trout	75	141	108.0	0.178	1,207	1,726
Sculpin	359	408	28.2	0.516	5,778	1,820

CI± = Confidence Interval; Shaded area = November 2004 sample (Maxim 2005); * = estimated.

TABLE 3.8-6 YOUNG-OF-YEAR POPULATION AND BIOMASS ESTIMATES FOR QUANTITATIVE SAMPLING UNITS OF DEER CREEK (100-METER DEPLETION SAMPLING UNIT)

REACH, SPECIES	NUMBER COLLECTED	POPULATION ESTIMATE	CI ±	DENSITY ESTIMATE (#/M2)	FISH PER STREAM MILE	BIOMASS (KG/HA)
DC-200						
Cutthroat Trout	2	2	2	0.004	32	2
DC-400						
Cutthroat Trout	14	112	1,732.4	0.156	225	15
Sculpin	8	8	0.8	0.011	129	4
DC-600						
Cutthroat Trout	16	128	1,638.0	0.162	257	14
Sculpin	36	46	18.6	0.058	579	14

Crow Creek

Two separate sampling reaches were established on Crow Creek; results are summarized in **Tables 3.8-7, 3.8-8**, and **3.8-9**. Crow Creek showed the highest species richness of any stream in the Study Area with five different fish species; brown trout, cutthroat-rainbow trout, cutthroat trout, sculpin, mountain whitefish, and speckled dace. Numerous size classes of brown trout, sculpin, and dace indicate resident populations within Crow Creek. The lack of multiple age classes of cutthroat-rainbow trout, in addition to the lack of cutthroat-rainbow individuals in nearby tributaries, points toward migrant populations of fish (Maxim 2004k).

Weights of brown trout and sculpin in one reach of Crow Creek (CC-300) were estimated from lengths of individuals using linear regression on length and weight data collected in CC-100 (R^2=0.9703 for brown trout and R^2=0.956 for sculpin; Maxim 2005). YOY fish were included in population parameters and estimates (**Tables 3.8-7** and **3.8-8**) and also treated separately (**Table 3.8-9)**. Only YOY sculpin and dace were captured in Crow Creek.

TABLE 3.8-7 FISH POPULATION PARAMETERS FOR SAMPLING UNITS OF CROW CREEK

REACH, SPECIES	NUMBER COLLECTED (ALL SIZES)	MEAN LENGTH (MM)	MEAN WEIGHT (G)	MEAN CONDITION (K)
CC-100				
Brown Trout	72	171.8	199.6	1.24
Cutthroat-Rainbow	2	137.5	25.0	0.96
Sculpin	226	61.7	4.3	1.45
Brown Trout	99	155.8	84.2	1.097
Sculpin	528	67.9	4.6	NA
Cutthroat Trout	22	85.7	8.3	0.979
Mountain Whitefish	2	298.5	229.5	NA
CC-300				
Brown Trout	30	245.9	200.0	NA
Cutthroat-Rainbow	5	232.8	169.6	NA
Speckled Dace	36	81.8	20.6	NA
Mountain Whitefish	71	296.4	309.6	NA
Sculpin	261	49.7	4.4	NA

K = condition factor, NA = Condition factor unable to be computed due to lack of weight data; Shaded area = November 2004 sample (Maxim 2005).

TABLE 3.8-8 POPULATION AND BIOMASS ESTIMATES FOR QUANTITATIVE SAMPLING UNITS OF CROW CREEK (100-METER DEPLETION SAMPLING UNIT)

REACH, SPECIES	NUMBER COLLECTED	POPULATION ESTIMATE	CI ±	DENSITY ESTIMATE (#/M^2)	FISH PER STREAM MILE	BIOMASS (KG/HA)
CC-100						
Brown Trout	37	39	5.1	0.036	595	10,438
Cutthroat-Rainbow	1	1	3.4	0.001	16	25
Sculpin	107	153	55.1	0.140	1,722	794
Brown Trout	49	50	2.8	0.167	789	1,806
Sculpin	346	421	42.9	1.403	5,568	1,979
Cutthroat Trout	8	8	1.0	0.027	129	65
Mountain Whitefish	1	1	1.4	0.003	16	259
CC-300						
Brown Trout	17	19	6.3	0.014	274	4,632
Cutthroat-Rainbow	4	4	1.9	0.003	64	NA
Speckled Dace	24	29	11.8	0.021	386	NA
Mountain Whitefish	68	68	1.7	0.050	1,094	NA
Sculpin	137	310	247.2	0.226	2,205	1,737

CI± = Confidence Interval; Shaded area = November 2004 sample (Maxim 2005).

TABLE 3.8-9 YOUNG-OF-YEAR POPULATION AND BIOMASS ESTIMATES FOR QUANTITATIVE SAMPLING UNITS OF CROW CREEK (100-METER DEPLETION SAMPLING UNIT)

REACH, SPECIES	NUMBER COLLECTED	POPULATION ESTIMATE	CI ±	DENSITY ESTIMATE (#/M^2)	FISH PER STREAM MILE	BIOMASS (KG/HA)
CC-100						
Sculpin	11	11	0.6	0.010	177	5
CC-300						
Speckled Dace	3	3	1.5	0.002	48	NA
Sculpin	79	188	215.5	0.137	1,271	63

Special Status Species

No Threatened, Endangered, Proposed, or Candidate (TEPC) fish species are known or expected to occur on the CNF (Species List #1-4-05-SP-0354), as identified by the US Fish and Wildlife Service (USFWS). Based on a review of the Idaho Conservation Data Center (CDC) rare species database, the USFS Region 4 Sensitive species list, and other existing data sources, two rare fish species, Yellowstone cutthroat trout and leatherside chub, have the potential to occur in the Study Area. Yellowstone cutthroat trout are Sensitive; leatherside chub are designated as Species of Concern by the state of Idaho. The Regional Forester identifies Sensitive species as those for which population viability is a concern, as evidenced by significant current and predicted downward trends in population numbers, density, and/or habitat capability that would reduce a species' existing distribution. Sensitive species must receive special management emphasis to endure their viability and to preclude trends toward endangerment that could result in the need for federal listing (FSM 2672.1). Sensitive fish species potentially occurring on the CNF are listed in **Table 3.8-10**, followed by background information on each species. Additional information can be found in Maxim (2004k).

TABLE 3.8-10 SENSITIVE FISH SPECIES KNOWN OR SUSPECTED TO OCCUR ON THE CNF

COMMON NAME	SPECIFIC NAME	USFS STATUS
Bonneville Cutthroat Trout	*Oncorhynchus clarki utah*	Sensitive
Yellowstone Cutthroat Trout	*Oncorhynchus clarki bouvieri*	Sensitive

Bonneville Cutthroat Trout

Intensive surveys for Bonneville cutthroat trout have been conducted on the CNF since 1998. This subspecies appears to be distributed throughout the southern part of the CNF within the Bonneville Basin, outside of the Study Area. The species is not expected to occur in the Study Area (Maxim 2004k) and is not discussed further in this EIS.

Yellowstone Cutthroat Trout

The Yellowstone cutthroat trout occurs in southeastern Idaho, in tributary rivers to the Snake River above Shoshone Falls. Intensive surveys for Yellowstone cutthroat trout have been conducted on the CNF since 1996. This subspecies appear to be well distributed throughout the parts of the CNF within the Snake River Basin, but populations in various streams or stream segments vary in strength.

Yellowstone cutthroat trout are adapted to cold water. Water temperatures between 4.5 and 15.5° C appear to be optimum. Streams selected for spawning are commonly low gradient (up to 3 percent), perennial streams, with groundwater and snow-fed water sources. Use of intermittent streams for spawning is not well documented, but has been noted in some intermittent tributaries to Yellowstone Lake. Spawning occurs where optimal size gravels (10-80 mm in diameter with 5-15 percent fine sediment; see **Appendix 2A**) and optimum water temperatures (5.5-15.5° C) are found. Juveniles congregate in shallow, slow-moving parts of the stream (USFS 2003b:D-194).

During fish sampling surveys within the Study Area, Yellowstone cutthroat trout were noted in Deer Creek, its North and South forks, South Fork Sage Creek, and Crow Creek. Cutthroat-rainbow trout hybrids were also observed in Crow Creek (see below).

3.8.4 Abiotic Condition

Stream reference reaches were located and established along Crow Creek (two), South Fork Sage Creek (two), Deer Creek (four), North Fork Deer Creek (two), South Fork Deer Creek (one), and Wells Canyon (one, see Maxim 2004k). Stream cross-sections and longitudinal profiles were measured, and stream morphology characteristics were either measured or evaluated in the field for each of the 12 reaches. As part of the longitudinal surveys, an R4 Level I fish habitat inventory was also conducted in each reach. Field methods employed were in accordance with protocols provided by Overton et al. (1997). Habitat inventories involved defining habitat type; measuring length, width, and depth of pool/riffle/run features; and identifying streambed materials.

A wide variety of channel types, patterns, and habitats were observed within the Study Area. The majority of reaches were determined to consist of stable meander riffle-pool channels, with the exception of two sites within Deer Creek (DC-100 and DC-400) and two within the North Fork Deer Creek (NFDC-200 and NFDC-700) that exhibited a potentially more sensitive degrading channel. The large woody debris recruitment potential throughout the Study Area was observed to be low to none except within the upper South Fork Sage Creek drainage. Bank vegetation consisted of various shrubs and grasses, frequently providing ample cover for aquatic life, and channels within the Study Area appear to be capable of handling a wide range of flows.

Substrate Composition

Substrate composition, or the relative proportions of fine sediment, gravels, cobbles, and larger rocks on the stream bottom, was evaluated in each stream reference reach. Trout reproduction and food supply are quite dependent on substrate composition. Egg mortality is directly related to the proportion of fine sediment to gravel (see **Appendix 3B**). Sedimentation into a stream from road or culvert construction can thus reduce or eliminate the possibility that trout will find the local area suitable for spawning. Sedimentation effects can also spread downstream from a local disturbance. Ideal conditions for cutthroat trout spawning consist of approximately 5-15 percent fine sediment (particles <6 mm), with the majority of gravels 10-80 cm in diameter. Trout are more likely to spawn in habitats characterized by faster-moving water because currents must be strong enough to carry fines downstream as they are cleared from the nest during redd development (Chapman 1988).

All stream reference reaches were first divided into habitat types (i.e., pool, riffle, or run; Maxim 2005), then substrate composition was evaluated within each area of the reach. For simplicity, the categories of small gravel (2-8 mm), cobble (128-256 mm), and small boulders (>256 mm) were eliminated from this analysis because less than 9 percent of the total areas evaluated (n = 267) contained any substrate within these ranges (see Maxim 2005 for complete data). Wells Canyon (WC-900) substrate was determined to contain 100 percent fine sediment throughout (Maxim 2005), and was also eliminated from further analysis. This substrate composition and the lack of fish observed during baseline surveys in Wells Canyon eliminate the possibility that this reach contains suitable spawning habitat for trout.

The majority of the stream reference reaches evaluated by Maxim contained a mixture of fines (particles <2mm in diameter), gravels (8-64mm), and small cobbles (64-128mm). Concerning spawning habitat, “riffles,” which include pool tailouts, evaluated in the Study Area contained an average of 12 percent fines (range = 0-68%; **Table 3.8-11**). In their proper functioning analysis of riparian habitats, Maxim rated Crow Creek, Deer Creek, and Deer Creek tributaries as functioning-at-risk South Fork Sage Creek was rated as properly functioning (**Section 3.5**; Maxim 2004e).

TABLE 3.8-11 SUBSTRATE COMPOSITION SUMMARY

REACH	HABITAT TYPE* (N)	MEAN % FINES (<2MM)	MEAN % GRAVEL (8-64MM)	MEAN % SMALL COBBLE (64-128 MM)
CC-100	Pool (8)	38	63	0
	Riffle (9)	0	78	22
	Run (5)	12	64	16
CC-300	Pool (6)	20	40	40
	Riffle (6)	0	60	40
	HG Riffle (1)	0	0	0
	Run (3)	40	0	60
DC-100	Pool (17)	51	44	6
	Riffle (3)	0	40	47
	HG Riffle (3)	13	60	27
	Run (12)	13	77	10
DC-200	Pool (12)	8	29	33
	Riffle (13)	0	26	68
	Run (5)	0	20	76
DC-400	Pool (9)	53	38	7
	Riffle (9)	2	38	60
	Run (6)	47	48	3
DC-600	Pool (7)	24	51	24
	Riffle (7)	1	14	84
	HG Riffle (2)	0	5	40
	Run (2)	0	15	85
NFDC-200	Pool (5)	36	35	36
	Riffle (11)	39	48	13
	HG Riffle (4)	13	26	60
	Run (3)	17	50	33
NFDC-700	Pool (7)	11	86	3
	Riffle (11)	20	47	33
	HG Riffle (2)	5	15	80
	Run (3)	27	60	13
SFDC-100	Pool (7)	89	11	0
	Riffle (5)	68	32	0
	HG Riffle (1)	90	10	0
	Run (4)	95	5	0
SFSC-500	Pool (13)	46	22	17
	Riffle (12)	0	70	30
	HG Riffle (1)	0	60	40
	Run (4)	0	90	10
SFSC-700	Pool (13)	43	14	38
	Riffle (1)	0	60	40
	HG Riffle (13)	5	48	45
	Run (2)	80	20	0
TOTAL	**(267)**	**24**	**42**	**29**

*The relatively rare “cascade” habitat type was eliminated from this analysis; HG=high gradient.

Crow Creek

The average proportion of fine sediment in Crow Creek substrates (reaches CC-100 and CC-300) is 15-16 percent across all habitat types. There were no (0 percent) fine sediments in riffle habitats within either reach, and both reaches contained an adequate mean proportion of gravels (**Table 3.8-11**). Reach CC-100 also has relatively high-quality spawning habitat in run habitats whereas reach CC-300 does not (**Table 3.8-11**). The overall quality of potential spawning habitat in Crow Creek appears to be relatively high and resilient to small increases in fine sediment.

Deer Creek

Across habitat types, the average proportion of fine sediment in Deer Creek substrates (reaches DC-100, DC-200, DC-400, and DC-600) ranges from 3-33 percent. Average percent fines range from 0-2 percent in riffle habitats across all four reaches (**Table 3.8-11**). Although the mean proportions of gravels across riffles in Deer Creek reaches are not ideal for spawning (i.e., not the majority substrate), the low level of fine sediment in riffles (and in most run habitats, excluding DC-400) makes the quality of potential spawning habitat in Deer Creek relatively high and appears to be resilient to small increases in sediment.

North Fork Deer Creek

Across all habitat types, the average proportion of fine sediments in North Fork Deer Creek substrates (reaches NFDC-200 and NFDC-700) range from 17-31 percent. Riffle habitats in these reaches range from marginal (fines = 20% in NFDC-700) to unsuitable (fines = 39% in NFDC-200) for spawning (**Table 3.8-11**). Run habitats in North Fork Deer Creek may provide marginal spawning habitat, although average fines in runs for both reaches are greater than 15%. The overall quality of potential spawning habitat in North Fork Deer Creek appears to be relatively low and vulnerable to further degradation from small increases in fine sediment.

South Fork Deer Creek

The South Fork Deer Creek reach evaluated by Maxim (SFDC-100) is currently constrained by a dirt road and does not contain suitable spawning habitat. Mean sediment content is greater than 60 percent in riffle habitats, the most likely area for spawning (**Table 3.8-11**). The perennial reach of South Fork Deer Creek lies mainly upstream from a culvert proposed under the Proposed Action West Haul Road. The overall quality of potential spawning habitat in South Fork Deer Creek appears to be relatively low and vulnerable to further degradation from small increases in fine sediment.

South Fork Sage Creek

The average proportion of fine sediment in South Fork Sage Creek substrates (reaches SFSC-500 and SFSC-700) ranges from 20-27 percent across all habitat types. There were no fine sediments in riffle habitats within either reach (**Table 3.8-11**). These are suitable conditions for trout reproduction considering South Fork Sage Creek riffles also contain a high mean proportion of gravels (**Table 3.8-11**). Habitat quality in these reaches may also be relatively robust in the face of small sediment increases.

3.8.5 Trace Elements

Selenium

From studies of warm water fish in closed basins, Lemly (1993) proposed a biological effect value of 4.0 mg/Kg dry weight (dw) in whole body tissue concentrations for selenium. Hamilton (2002) also used this value, and Maier and Knight (1994) proposed a similar value (4.5 mg/Kg dw selenium). At these concentrations, mortality of juvenile fish and reproductive failure of adults are effects of selenium exposure (Lemly 1993). The EPA has proposed that aquatic life should be protected such that concentrations of selenium in whole-body fish tissues do not exceed 7.9 mg/Kg dw (GLEC 2002). This value, if finalized, will supersede previous aquatic life water quality criteria for selenium used by the EPA and will be used to establish water quality standards under the Clean Water Act for the protection of aquatic life from the toxic effects of selenium.

Maxim obtained collection permits from IDFG in order to analyze fish tissues. Fish from various size classes were collected from South Fork Sage Creek, South Fork Deer Creek, main stem Deer Creek, North Fork Deer Creek, and Crow Creek during electrofishing surveys, and analyzed for whole body concentrations of selenium and cadmium. Fish sampled from portions of South Fork Sage Creek and South Fork Deer Creek were found to have selenium tissue concentrations below the biological effect threshold value of 4.0 mg/Kg (**Table 3.8-12**). Two fish analyzed from North Fork Deer Creek and Deer Creek had levels of selenium that exceeded the threshold, as did fish in Crow Creek reaches upstream of Deer Creek (CC-100) and downstream (CC-300). Elevated selenium values observed in fish from North Fork Deer Creek and Crow Creek suggest that fish in these streams may be already affected by exposure to natural sources of selenium unrelated to mining activities. No fish collected were above the EPA's draft chronic exposure value (7.9 mg/Kg). Noticeable differences in the concentrations of selenium in cutthroat trout can be seen in **Table 3.8-12**.

Hamilton and Buhl (2003) sampled selenium levels on Deer Creek (DC), 0.5 km upstream from its confluence with Crow Creek, and on Crow Creek (CC), just upstream of its confluence with Deer Creek. Selenium concentrations in water were below their detection levels (0.002 mg/l). Concerning sediment, their results were reported to be 4.5 mg/Kg for DC and 2.1 mg/Kg for CC. Selenium concentrations in whole-body fish tissue were reported as 11.5 mg/Kg for DC and 10.4 mg/Kg for CC. In addition to sampling water, sediment, and fish, they also sampled aquatic plants and invertebrates. Selenium concentrations in aquatic plants were 4.3 mg/Kg and 4.6 mg/Kg for DC and CC, respectively. Selenium concentrations in aquatic invertebrates were 8.7 mg/Kg and 6.7 mg/Kg for DC and CC, respectively. Their results indicated a statistically significant correlation between selenium concentrations in aquatic plants and invertebrates and between selenium concentrations in aquatic invertebrates and fish. They concluded that selenium bioaccumulation in aquatic plants lead to bioaccumulation in aquatic invertebrates, which resulted in elevated concentrations in fish.

Selenium concentrations in fish have been shown to follow a similar pattern of accumulation as stream sediments, aquatic plants, and aquatic invertebrates. Studies show that fish bioaccumulate selenium primarily via ingestion (Hamilton et al. 2004). Invertebrates and plants can concentrate dissolved selenium from the water, and this selenium can then be part of the food base for fish feeding in contaminated reaches of streams. The effect of this dissolved selenium on the ecosystem would be expected to vary with the selenium concentration in the water. Studies conducted in southeast Idaho have shown that dissolved selenium concentrations downstream from phosphate mining sources do vary seasonally, peaking during spring runoff and decreasing during low-flow periods (Presser et al. 2004). Selenium that is initially released to streams as dissolved compounds or particulates can also be removed from the water through chemical and microbial reduction, adsorption to clay and organic detritus, reaction with iron, precipitation, co-precipitation, and settling. The eventual location for this selenium may be in the bottom sediment of surface streams where it may be perennially available for bioaccumulation in plants, benthic invertebrates, and fish, even though selenium concentrations in the water may seasonally be less than published aquatic life toxicity thresholds for selenium concentrations in water (2 to 5 µg/L, USDI 1998 and 5 µg/L, EPA 1987).

TABLE 3.8-12 TRACE ELEMENT ANALYSIS SUMMARY FOR SELENIUM AND CADMIUM

LOCATION	SPECIES	LENGTH (MM)	WEIGHT (G)	SELENIUM MG/KG DW	CADMIUM MG/KG DW
SOUTH FORK SAGE CREEK					
SFSC-SS-B	Cutthroat trout	126	20	2.6	0.26
SFSC-SS-B	Cutthroat trout	178	70	2.5	0.25
SFSC-SS-B	Cutthroat trout	191	80	2.2	0.16
NORTH FORK DEER CREEK					
NFDC-700	Cutthroat trout	113	15	3.6	0.51
NFDC-700	Cutthroat trout	115	16	5.0*	0.48
NFDC-700	Cutthroat trout	240	170	7.1*	0.26
DEER CREEK					
DC-100	Cutthroat trout	240	170	0.76	0.27
DC-200	Cutthroat trout	116	20	0.57	5.9**
DC-200	Cutthroat trout	178	60	0.34	0.37
DC-200	Cutthroat trout	220	115	0.42	0.19
DC-400	Sculpin	85	10	0.7	0.32
DC-400	Sculpin	90	10.5	6.4*	0.63
DC-400	Sculpin	100	13	5.8*	0.75
DC-400	Cutthroat trout	120	15	0.48	0.27
DC-400	Cutthroat trout	130	20	0.8	0.21
DC-400	Cutthroat trout	230	120	0.64	0.29
SOUTH FORK DEER CREEK					
SFDC-100	Cutthroat trout	105	13	2.3	0.07
SFDC-100	Cutthroat trout	130	24	1.9	0.04
SFDC-100	Cutthroat trout	165	51	2.7	0.06
CROW CREEK					
CC-100	Sculpin	75	5.3	4.7*	0.12
CC-100	Sculpin	75	5.3	3.9	0.27
CC-100	Sculpin	75	5.3	6.5*	0.29
CC-100	Brown trout	320	1000	4.6*	0.2
CC-100	Brown trout	370	1000	6.7*	0.12
CC-300	Brown trout	315	360	5.4*	0.03
CC-300	Mountain whitefish	352	500	5.0*	0.03

*Values Exceed Current Biological Effect Thresholds

**This fish was re-analyzed by Silver Valley Laboratory and results of the second analysis were similar to the first. This fish appears to be an anomaly.

Recent studies have been conducted to determine selenium concentrations and other trace elements in water, stream bottom sediment, aquatic plants, aquatic invertebrates, and fish from streams in southeastern Idaho near phosphate mining areas (e.g., Hamilton and Buhl 2003, Hamilton et al. 2004, NewFields 2005). Selenium data derived from samples of fish tissue, macroinvertebrates, sediment, or water have been reported in the Blackfoot River watershed, in upper and lower East Mill Creek and Dry Valley Creek (Hamilton et al. 2004), as well as in the Salt River and Bear River watersheds within Blackfoot River, State Land Creek, upper and lower Georgetown Creek, Deer Creek, and Crow Creek (Hamilton and Buhl 2003). The mean selenium concentration in fish tissue assessed by IDEQ in 2001 in upper and lower East Mill Creek (3 sample locations) was 20.7 mg/Kg (TtEMI 2002d), and by Montgomery Watson was 24 mg/Kg (Montgomery Watson 1999), exceeding values reported above the proposed biological threshold. Although still above the threshold, fish in the Salt River watershed (including two sample locations in Sage Creek) had a much lower mean selenium concentration of 8.2 mg/Kg (TtEMI 2002d). NewFields' fish samples at five out of six sites in Sage Creek were below the threshold (NewFields 2005). Moreover, NewFields' Sage Creek and South Fork Sage Creek samples both up- and downstream of Panel D and E mining activities, respectively, were below the threshold. The finding of elevated selenium in Deer and upper Crow Creek, where mining activities have not yet taken place, implies that these selenium levels have accumulated via erosion of naturally occurring Meade Peak shales in these watersheds (see **Sections 3.3.2** and **4.3.2**).

Selenium residues in some salmonids sampled within the phosphate mining area were above concentrations found to cause adverse effects in early life stages of fish, including salmonids (4.5 mg/Kg; Hamilton et al. 2000). Lemly (1999) documented reproductive failure and congenital deformities in other fish (not trout) living in waters with levels of selenium twice the IDEQ removal action level (0.01 mg/L). Hardy (2003), however, showed that cutthroat trout grown for 44 weeks on a steady diet of selenomethionine (the form of selenium found in the aquatic food chain) showed no signs of toxicity, including cranial-facial deformities in fry, despite measured whole-body selenium levels of up to 12.5 mg/Kg.

A health advisory was issued in the fall of 2002 by the Idaho Division of Heath recommending limited consumption of fish from East Mill Creek by children based upon elevated selenium concentrations in edible fish tissue. Their exposure calculations indicated a potential risk to child subsistence level users, although they agreed that subsistence use of this area is considered highly unlikely. Under the child subsistence lifestyle scenario, it is assumed that the receptor lives near the impacted media and that the only source of some component of their diet is from a single area over an extended period, assumed to be six years for a child. Consumption of fish and elk in the southeast Idaho phosphate mining area by the recreational user was evaluated in the Area Wide Human Health and Ecological Risk Assessment (TtEMI 2002d). The risk assessment calculated a hazard index of less than one for the adult recreationalist, indicating no adverse health effects were expected. The child recreationalist hazard index was 2.0 for ingestion of aquatic life but less than one for elk consumption. Based on fish sampled from East Mill Creek, a hazard index of greater than one indicates a potential for adverse noncarcinogenic health effects.

Cadmium

Fish that were analyzed for whole body selenium concentrations were also analyzed for whole body cadmium concentrations. IDEQ has proposed a cadmium removal action level for sediments supporting aquatic life of 5.1 mg/Kg dw for aquatic life (IDEQ 2003c). These action levels have been established to identify impacted areas, uncontrolled release areas, and those that are in violation of federal or state law. The majority of fish that were sampled within the Study Area were below the proposed threshold value. One exception was a fish collected from DC-200 with a cadmium concentration of 5.9 mg/Kg dw, which appears to be an anomaly.

3.9 Grazing Management

Livestock grazing has been a historic and traditional use of CNF lands in and around the Study Area. Sheep were brought into the area as early as the 1830s-1840s by missionaries and emigrants (Fiori 1981: 145-146). Small herds of cattle were driven into the region during the 1860s. Evidence of historic livestock grazing is still present within the Project Area, as described further in the Cultural Resources section of this EIS.

The Baseline Technical Report for Land Use, Access, Recreation and Grazing (Maxim 2004g) that was prepared for use in this EIS describes various laws, regulations, and policies that authorize grazing and set forth grazing management strategies. Forest Service Handbook 2209 (USFS 2004b) forms the basis for the grazing administration program, including developing permit terms and conditions. For the CNF, grazing management strategies are incorporated into the RFP (USFS 2003a) through the identification of management prescriptions, such as Prescription 2.8.3 *Aquatic Influence Zones*, which includes livestock grazing standards and guidelines for riparian areas. Under *Grazing Management*, the RFP includes the goal of providing "opportunities for livestock grazing within the capability and suitability of the land and in coordination with other resources goals."

There are seven range allotments on CNF lands (or portions of allotments) in the Study Area: Manning Creek Sheep Allotment, Deer Creek Sheep Allotment, Green Mountain Sheep Allotment, Sage Creek Sheep Allotment, Sage Valley Allotment, Lower Crow Creek Allotment, and Wells Canyon Allotment. **Figure 3.9-1** shows the allotment boundaries and range improvements, and **Table 3.9-1** provides allotment information on suitable acreage, range improvements, and stocking rates as well as other relevant notes. Most of this information was compiled by Maxim (2004g); the Lower Crow Creek Allotment information came directly from the CTNF. These allotments consist of varying proportions of the following vegetation community types: aspen, aspen/conifer, conifer, grass/shrub, mahogany, and riparian. Additional allotment details can be found in Maxim (2004g).

On CNF lands, the suitability of land within an allotment for grazing either cattle or sheep refers to whether it is compatible with management direction for a management area's other uses and values. It represents the integration of rangeland capability (the biophysical characteristics conducive to livestock grazing) and appropriateness of grazing livestock on a particular area, considering economics, social concerns, and compatibility with other land uses. For the CNF, capability was assessed based upon topographic slope, distance from water, and vegetative cover type. Suitable acres can change over time or with different management options. The suitable acreage numbers used in this EIS are those determined during the forest planning process for the alternative (7R) that was chosen for implementation (CNF RFP EIS). However, it is important to note that these numbers do not bind the CNF to any certain level of grazing. One way that suitability designations can change is during the site-specific allotment planning process and regardless of suitability numbers, actual livestock use of vegetation is based upon proper implementation and monitoring of forage utilization standards.

As part of its planning process, the CNF determines capability, suitability, and rangeland condition and then administers livestock permits on various allotments through site-specific Allotment Management Plans (AMPs). AMPs include livestock rotation schedules, utilization requirements, planned structural and non-structural improvements, maintenance standards, and tentative grazing capacities. Site-specific standards are also included in the Annual Operating

Instructions (AOI) that are issued annually to livestock permittees. Typical AOIs include approximate numbers and rotation dates for grazing throughout the season. The RFP prescribes allowable utilization levels that represent the maximum vegetation use in general locations such as riparian or upland areas; allotment-specific use levels can be can be stipulated to be lower, if necessary, in the AMP process.

TABLE 3.9-1 RANGE ALLOTMENT INFORMATION FOR THE STUDY AREA

ALLOTMENT	SUITABLE ACRES		RANGE IMPROVEMENTS	STOCKING RATE (ANIMAL MONTHS)	
	FOR CATTLE	FOR SHEEP		CATTLE (COW/CALF MONTHS)	SHEEP (SHEEP MONTHS)
Sage Valley	1,308	1,656	Stock ponds (3I8RA9)(3I8RB9) (3I8RC9)(3I8RD9)	528	N/A
Sage Creek	1,223	2,348	None	N/A	2,000
Green Mtn.	2,979	4,163	None	N/A	2,390
Manning Creek (currently being temporarily managed as one unit with Deer Creek)	3,001	4,877	Headbox & troughs (344SC9) (344SA9) Stock ponds (344RB9 & 318RP9) Water pipeline (344NA9) (344TA9) Reservoir (344RA9)	N/A	3,250
Deer Creek	942	1,601	Nate Canyon Stock Pond (335RA9)	Currently being included in the Manning Creek Allotment	
Wells Canyon	1,527	2,163	Headbox and troughs (337A9)	Allotment is currently vacant, can be used with either the Deer Creek or Green Mountain Allotment.	
Lower Crow	107	129	None	15	N/A

Generally, livestock may be trailed or trucked through the CNF, depending upon the AMP and AOI stipulations. Trailing corridors in the Study Area include a route along Rock Creek to Manning Creek to access the Manning Creek and Deer Creek Allotments from the south and a route along Diamond Creek to Sage Creek to access the Sage Creek Allotment from the north.

For the Study Area allotments, grazing is allowed for varying specific dates between June 1 and September 30. Most of the allotments allow about two month's consecutive time; the Sage Valley Allotment can be grazed over the entire 4-month timeframe. However, if CNF personnel determine a shortage of forage production or other unacceptable impacts, early removal of livestock from an allotment or pasture may be required. Livestock grazing on USFS lands relies upon nearby stream and spring water sources, with water rights held by the CNF; some of these sources are developed with head boxes and troughs. Sheep typically are moved to new areas every day for feed, which helps to maintain water quality and rangeland condition.

Figure 3.9-1 Grazing Allotments in the CEA

In addition to the structural range improvements on CNF allotments listed in **Table 3.9-1**, other range improvement projects on area allotments include continued treatment of noxious weeds such as musk thistle, Dyer's woad, and Canada thistle. As established by prescriptions in the recently completed RFP (USFS 2003a), additional improvements, revisions to AOIs and AMPs, riparian zone restrictions, utilization guidelines, and other changes may be made for various allotments in the future to ensure that forage can continue to be provided while maintaining diverse and healthy rangelands.

Although the USFS lands in the Study Area comprise most of the lands that are grazed, state-owned and privately owned lands are also subject to livestock uses. Grazing on private land is based upon a given landowner's preferences and detailed records of amount, type of use, etc. are not necessarily available to the public. There is one section of land in the Study Area (Section 36 in T 9 S, R 45 E) that is owned by the State of Idaho, and grazing in that area is regulated by the Idaho Department of Lands. According to their records (Jeff Nauman, personal communication, 2004), there are two leases currently operating in that section. One is comprised of 560 acres and 45 billable animal unit months, with grazing allowed between July 1 and September 20. The other is in the East ½ of the SE ¼, covering 80 acres with 32 animal unit months. Its period of use is from June 1 to September 30. The former, larger parcel has no perennial water sources, while the latter has a riparian area that is reportedly spring-fed. In the last cycle of lease renewal, a range assessment indicated that vegetation conditions were good in both of these State lease areas.

3.10 Recreation and Land Use

3.10.1 Recreation

The majority of the Study Area is within the Montpelier Ranger District of the CNF. The Study Area also includes Idaho state land, private lands, and Wyoming county and/or private lands. Recreation information and use data is available predominately for CNF lands. Many recreation opportunities are offered on the CNF, such as camping, hiking, fishing, hunting, snowmobiling, horseback riding, and mountain biking. Within the Study Area, all of these are available, although there are no developed campgrounds. Recreation and travel access are closely related topics; access is discussed below under Land Use (**Section 3.10.2**).

Recreation visits to the CNF have increased an average of four percent annually since 1980 (USFS 2003b). CNF use figures are based on personal observation by CNF staff and fee receipts from campgrounds and recreation special uses. Percentages of various recreation uses on the CNF include camping/picnicking (43 percent), motorized activity (25 percent), hunting/fishing (17 percent), and other (15 percent) (USFS 2003b). The CNF is conducting recreation use surveys from October 2004 to October 2005 to update and broaden the base of use data for the CNF and for future planning efforts.

The State of Idaho has prepared a 2003-2007 Statewide Comprehensive Outdoor Recreation and Tourism Plan (SCORTP). This plan was developed with input from all types of recreation management agencies and groups in Idaho.

Recreation sites and activities are divided into two broad categories – Developed and Dispersed. Developed recreation sites are areas of concentrated development, such as a campground or trailhead with improvements. Dispersed recreation requires few, if any improvements and occurs typically in conjunction with roads or trails. Dispersed activities are often day-use oriented and involve many types of activities, including fishing, hunting, berry picking, off-road vehicle use, hiking, horseback riding, picnicking, camping, viewing and photographing scenery, and snowmobiling. Most recreation in the Study Area is dispersed.

In order to inventory and manage recreation areas and activities, the CNF uses a planning tool called the Recreation Opportunity Spectrum (ROS), which categorizes recreation settings by the amount of development and other attributes. ROS categories include: Primitive, Semi-Primitive Non-motorized, Semi-Primitive Motorized, Roaded Modified, Roaded Natural, and Urban. Recreation use is allocated using the ROS classes, which help visitors find the setting that best provides for their desired experience.

There are two ROS categories in the Study Area listed below. Their class setting descriptions include the following factors:

Semi-primitive Motorized (SPM) - The setting for SPM lands includes a moderate probability of: solitude, closeness to nature, a high degree of challenge and risk using motorized equipment, predominantly natural-appearing environment, few users but evidence shows on trails, and few vegetation alterations that are widely dispersed and visually subordinate. Semi-primitive Motorized areas range from 2,500 to 5,000 acres that are screened by vegetation or topography, creating a “buffer” from surrounding development. The majority of lands in the Study Area are designated as SPM, comprising a block of approximately 14,890 acres.

Roaded Modified (RM) – The setting for RM lands includes the opportunity to be with others in developed sites, little challenge or risk, relatively natural appearing environment as viewed from roads and trails, moderate evidence of human activity; access and travel by standardized motor vehicles, and resource modification and utilization is evident but generally harmonizes with the natural environment. The RM corridors in the Study Area (for Diamond Creek Road, Wells Canyon Road, Timber Creek Road, and Crow Creek Road) generally surround the SPM block noted above.

The ROS categories are shown on **Figure 3.10-1**. The RFP Guidelines suggest project planning that meets the ROS per the CNF ROS map.

Developed Recreation

Campgrounds & Guard Stations

There are no developed campgrounds within the Study Area. Diamond Creek Campground, approximately 7 miles north and Summit View Campground, approximately 5 miles west, are the closest designated campgrounds to the Study Area. Diamond Creek Campground is a rustic campground, consisting of 12 sites, without tables or grates. It experiences moderate use during summer months for general recreation and relatively heavy use during the fall big game hunting season. There are no fees charged for use of the Diamond Creek Campground. The site has been fenced to exclude livestock use of the area.

Figure 3.10-1 USFS Road Designations and Recreational Points

The Diamond Creek Warming Hut is adjacent to the campground and consists of two A-frame structures moved from the Johnson Guard Station to the current location in 2000. The hut was constructed as a joint effort of the Caribou Trail Riders, the CNF, and the Idaho Department of Parks and Recreation. The hut provides a gathering place and shelter for summer and winter recreationists using ATVs (all-terrain vehicles) and snowmobiles. The Caribou Trail Riders maintain the site under an agreement with the CNF, Soda Springs Ranger District (Moe 2003).

Summit View Campground is at an elevation of 7,200 feet, and is open from 6/1 to 9/30. It includes 23 units and 3 group sites. Use fees are required.

The Johnson Guard Station is located approximately one mile north of the Diamond Creek Campground and is available for rent year round. Clear Creek Guard Station is located on Crow Creek Road (FR 111) about three miles south of the junction with Wells Canyon Road (FR 146) and is also available for rent.

Dispersed Recreation

The dominant type of dispersed recreation in the vicinity of the Smoky Canyon Mine is big game hunting for elk, moose, and deer. Hunters place a high demand on the developed and dispersed campsites, and on CNF roads and trails. ATVs provide many advantages to hunters but also create some hunter conflicts. Elk use typically declines in areas open to motorized vehicles (USFS et al. 2001).

Fishing is also popular on Crow, Deer, and Diamond Creeks. Other dispersed recreation activities occurring in the area include snowmobiling, cross-country skiing, horseback riding, upland bird hunting, camping, picnicking, driving for pleasure/sight-seeing, and off-road vehicle use. Popular dispersed use areas include Manning Creek, South Fork Sage Creek, Deer Creek, North Fork Deer Creek, Upper Diamond Fork, and Sage Meadows.

<u>Big Game Hunting</u>

Game Management Unit (Hunt Area) 76 (Diamond Creek) encompasses the Study Area.

Archery season for deer and elk extends from August 30 to September 30. General (any weapon) season for mule deer generally occurs for a two-week period in early October. There are no controlled hunts for mule deer in Hunt Area 76 (IDFG 2003).

Elk populations are stable or increasing in Idaho. Security areas are blocks of habitat that provide hiding cover for elk and increase the chances that elk will survive the hunting season, increasing hunter opportunity overall. The greatest concentrations of elk are in areas least accessible to motorized vehicles.

Controlled hunts for antlerless elk occur from mid-November thru December. Controlled hunts for antlered moose occur from August 30 through the third week of November and for antlerless moose from October 15 through the third week of November. There are no special permits or hunts for bighorn sheep or mountain goats in Hunt Area 76. For 2004, in Hunt Area 66A, which includes southeastern Idaho from the Utah/Idaho line to McCoy Creek, there were 641 antlered elk permits, 1300 antlerless elk permits, and 9 antlered only-outfitter allocated permits.

Mule deer season for antlered deer is October 5-19. Due to high demand in areas 75, 76, 77, and 78 (includes portions of Franklin, Bear Lake and Caribou counties, Idaho), a limited entry drawing is offered for non-residents, who must then purchase a special Southeast Idaho Deer tag.

Hunting for black bear and mountain lion also occurs within the Study Area. Black bear hunting is allowed from August 30 through October and during a spring season from April 15 to June 15. Mountain lion season extends from August 30 through March 31 (IDFG 2003). Mountain lion harvest in Hunt Area 76 has ranged from 1 to 9 with an average of about 3 per year from 1991 to 2002 (IDFG 2004).

Other Hunting

Hunting of grouse (blue, ruffed) on the CNF occurs from September 1 through December. Sage grouse occur in lower Crow Creek and can be hunted from mid-September through mid-October. Other upland birds such as pheasant, quail, and partridge do not typically occur in the Study Area (IDFG 2003).

Hunting of badger, fox, and raccoon is open year round. Hunting for bobcat is allowed from mid-December to mid-February (IDFG 2003).

Off-Highway Vehicle (OHV) and/or All-Terrain Vehicle (ATV) Use

ATVs have grown in popularity during the past decade, increasing the demand on the CNF to accommodate this type of recreation. In Idaho, 95 percent of ATV and motorbike riding opportunities occurs on USFS or other public land (Maxim 2004g). During the period from 2000 to 2004, Idaho experienced an 87.6 percent increase in registration of ATVs and motorbikes (IDPR 2005). In Caribou County, Idaho, ATV and motorbike registration increased 53 percent in the same time frame. Information on 2004 registrations shows there are over 11,483 OHVs registered in southeast Idaho (IDPR 2005).

Under a USFS policy (New OHV Rule was issued November 2005) for OHV use on National Forest System lands and Grasslands, each forest is required to designate a system of roads, trails, and areas where OHV use would be allowed. OHVs include motor vehicles that are designed or retro-fitted primarily for recreational use off road, such as minibikes, amphibious vehicles, snowmobiles, motorcycles, go-carts, motorized trail bikes, and dune buggies.

The CNF initiated a Travel Plan Revision in March 2003 to address summer and winter travel, and tier to the RFP (USFS 2003a), which provides limits on open motorized route densities. The CNF Revised Travel Plan EIS and ROD were signed in November 2005.

Hiking

Most hiking in the area occurs during the fall months and is likely associated with big game hunting. There are several trailheads in the Study Area: #33 Sage Meadows; #34 Camel Hollow; and #35 Trappers Cabin are shown on CNF maps, although the ‘trailheads’ are undeveloped, and similar to other points where trails intersect roads. Parking provided at trailheads varies from three to five spaces. No other facilities are provided. Trails partially or completely within the Study Area are shown on **Figure 3.10-1.** Location and approximate length of trails that occur in the Study Area are described in **Table 3.10-1.** Trail lengths and restrictions may change pending revisions to the Travel Management Plan.

TABLE 3.10-1 TRAILS WITHIN THE STUDY AREA

TRAIL NO.*	NAME	APPROXIMATE LENGTH	LOCATION DESCRIPTION
092	S. Fork Sage Cr.	4 miles	Extends from FR 145 to FR 144 through S. Fork Sage Creek.
093	Deer Cr.	5 miles	Extends from Diamond Creek Road (FR 1102) to Crow Creek Road (FR 111). Portion of trail near Crow Cr. crosses private land.
095	Camel Hollow	2 miles	Extends from Crow Creek Road (FR 111) connecting to Pine Creek Trail No. 096.
102	N. Fork Deer Cr.	2.5 miles	Extends from FR 145 to Deer Creek Trail No. 093.
401	Panther Springs	2 miles	Connects between S. Fork Sage Creek Trail No. 092 and Manning Creek Trail No. 402.
402	Manning Basin	3 miles	Extends from FR 740 connecting with S. Fork Sage Creek Trail No. 092
403	Pinnacle Peak	1.5 miles	Extends from Diamond Creek Road (FR 1102) connecting with N. Fork Deer Creek Trail No. 102.
404	Well Park	1 mile	Extends from FR 146 connecting with Deer Creek Trail No. 093.
405	Sage Valley	3 miles	Extends from end of FR 586 to FR 179.
406	Sage Meadows	1 mile	Extends from Diamond Creek Road (FR 1102) to FR 145.

Source: USFS 2002.
*These trails are all non-motorized.

A designated CNF Point of Interest near the Study Area is The Snowdrift Mountain Trail (No. 113). This high ridge often holds snow yearlong. Huge snowfields pile up on the leeward side and often slide as avalanches to canyons below (USFS 2002). The Snowdrift Mountain Point of Interest is shown on **Figure 3.10-1.**

<u>Winter Season Recreation Use</u>

Snowmobile registration in Idaho increased 110 percent (from 22,300 to 46,800) between 1989 and 2001(USFS 2003b), and 10 percent from 2001 to 2004 (IDPR 2005). In 2004 there were 760 snowmobiles registered in Caribou County, Idaho (IDPR 2005). Most of the Study Area currently is open to cross-country snowmobile use. However, the Travel Map (USFS 2002) restricts snowmobile use to designated routes in some areas of big game winter range. Although big game winter range occurs between Deer Creek and Manning Creek, the area is not restricted. The Bear Lake State Park program and Caribou Trail Riders club help provide groomed trails, signing and warming shelters. The Diamond Creek Warming Hut is operated and maintained by the Caribou Trail Riders club. Diamond Creek Road (FR 1102), Crow Creek Road (FR 111), Wells Canyon Road (FR 146), and Freeman Pass areas are popular snowmobile routes. Currently in the winter months along Crow Creek Road, snow plowing stops approximately three miles southwest of the Idaho/Wyoming border. Trucks and trailers can park here and unload snowmobiles.

<u>Cross-country Skiing</u>

Cross-country skiing in the Study Area is limited. The area is distant from population centers where other more attractive and nearby cross-country skiing experiences are available.

<u>Mountain Biking</u>

All roads in the Study Area are open to mountain biking.

3.10.2 Land Use

The types of lands within the Study Area provide for a variety of uses. CNF lands are used for recreation, CNF products such as timber sales and firewood, livestock grazing (see **Section 3.9**), wildlife habitat (see **Section 3.7**), and minerals extraction. Private lands in the Study Area are used for seasonal homes, ranching, and recreation. Rights-of-way provide access and utilities. All of these uses, in addition to ongoing or event-type, natural and human-induced disturbances influence the land or ecosystem condition. The desired condition of CNF ecosystems is one of sufficient complexity, diversity, and productivity to be resilient to disturbances (USFS 2003a).

The CNF lies on the western edge of an area defined as the Greater Yellowstone Ecosystem (GYE). At over 12 million acres overall, the GYE is the largest block of relatively undisturbed plant and animal habitat in the contiguous U.S. The United Nation (U.N.) has defined the area as a Biosphere Reserve (CTNF 2004). The Study Area covers approximately 20,414 acres, less than 0.2 percent of the area of the GYE. Wildlife habitat and plant habitats in the Study Area are discussed in **Sections 3.7** and **3.5**, respectively. Inventoried Roadless Areas, Research Natural Areas, and Wilderness areas are discussed in **Section 3.11**.

Land Status/Ownership

Lands in the Study Area are a compilation of CNF, State of Idaho, and private ownership (**Figure 3.10-2**). CNF lands make up the majority of the Study Area. The State of Idaho has one section within the Study Area.

The larger private parcels are predominantly ranching properties along Crow Creek Road; however, smaller parcels (from under 1 acre to 6 acres) are also held privately. According to Caribou County records, the landowners along the Crow Creek Road are listed as follows and shown on **Figure 3.10-2**: Peter Reide, Fred K. Nate, Larry Alleman et al., Karolyn Alleman, Nevada Rock & Sand Company, Tolman Family Association, Dickson Whitney and Osprey Partners, Dan C. Peart, Ruth L. Rasmussen, Bruce W. Jensen, and Karen Oakden,

CNF Management

The Caribou and Targhee National Forests were officially combined in 2000. The RFP for the Caribou portion was approved early in 2003. Goals identified in the RFP for the CNF (USFS 2003a) include development of phosphate resources using practices for surface resource protection and reclamation, and with consideration to social and economic resources. Based on this premise, proposed development of Smoky Canyon Mine Panels F and G would be consistent with the RFP for the CNF, Travel Plan for the CNF, and the current management regulations concerning roadless areas (as described previously in **Section 1.3.2**).

In addition to the goals for development of phosphate resources, the RFP also has management prescriptions (MPs) that are designed to meet the DFC's of the CNF.

Management Prescriptions

Management prescriptions are a set of practices applied to a specific area to attain multiple-use and provide a basis for consistently displaying management direction on land administered by the CNF. Prescriptions identify the emphasis or focus of management activities for an area, but do not necessarily construe exclusive use. Management prescriptions do not stand alone, but are part of the management direction package for the CNF that also includes *Forest-wide* goals, objectives, standards (S), and guidelines (G). Where a management prescription allows an

Figure 3.10-2 Private Owners

activity, such as recreation or livestock grazing, the standards and guidelines in the prescription or in the CNF-wide direction provide specific parameters within which the activity must be managed. In areas where prescriptions are applied, direction in this section would overrule CNF-wide direction only if the prescription conflicts with the CNF-wide S&Gs (USFS 2003a). Although the management prescription that applies to the majority of the Proposed Action is 8.2.2, all components of the Proposed Action that occur outside the ½-mile buffer area (i.e. haul access roads) need to follow the appropriate management prescription that would be in effect. Management prescriptions in the Study Area are shown on **Figure 3.10-3** and include:

Prescription 2.7.2 – Elk and Deer Winter Range

This management prescription emphasizes management actions and resource conditions that provide quality elk and deer winter range habitat. Access is managed or restricted to provide security for wintering elk and deer. Motorized travel is restricted to designated roads and trails. This prescription applies to an area including the southern half of Panel F.

Prescription 5.2 – CNF Vegetation Management

Emphasis of this prescription is on scheduled wood-fiber production, timber growth, and yield while maintaining or restoring forested ecosystem processes and functions to more closely resemble historical ranges of variability with consideration for long-term CNF resilience. Motorized use is prevalent for timber management activities and recreation. This prescription applies to an area including the northern half of Panel F.

Prescription 6.2 – Rangeland Vegetation Management

This prescription focuses on maintaining and restoring rangeland ecosystem processes and functions to achieve sustainable resource conditions. Activities in these areas are designed to achieve restoration of non-forested vegetation to the historic range of variability and include watershed restoration, thinning, prescribed fire, wildfire for resource benefit, and noxious weed treatments. Dispersed recreation activities occur throughout these areas. Motorized transportation is common, but some seasonal restrictions may occur. This prescription applies to an area including Panel G.

Prescription 2.8.3 – Aquatic Influence Zone (AIZ)

As stated in various previous sections, this prescription applies to the habitats associated with aquatic areas (wetlands, streams, springs, bogs, lakes, ponds, etc.), in order to protect, restore, and maintain health of these areas. AIZ attributes must be maintained in areas developed for minerals. Standards require minimum instream flows to be maintained at road crossings or other instream facilities, and fish passage provided where needed**.** **Figure 3.3-2** displays the AIZs within the Study Area.

Prescription 8.2.1 – Inactive Phosphate Leases

This prescription applies to existing federal phosphate leases that have not been or are not scheduled for development and KPLAs. A KPLA is land known to contain phosphate deposits that have been formally classified by the U.S. Geological Survey as subject to leasing. A ½-mile buffer of land around each KPLA is also included in this management prescription. Exploration and road construction may be allowed in these areas, subject to NEPA analysis.

Prescription 8.2.2 – Phosphate Mine Areas

These areas are federal phosphate lease areas where mining, post-mining reclamation, or exploration is taking place. This prescription realizes the dynamic process involving research and technology that affects the BMPs that are implemented for mining operations. Phosphate deposits on federal land are managed under the 1920 Mineral Leasing Act, as amended, and Federal Regulations at 43 CFR, Part 3500. BLM is the designated federal agency with authority to issue or modify federal phosphate leases and/or approve exploration and development activities. Where Forest land is involved, the USFS provides BLM with formal recommendations for lease issuance and development proposals, but the final authority rests solely with BLM. The USFS issues decisions with formal BLM recommendations for off-lease activities.

In addition to Prescription 8.2.2, which applies to Phosphate Mine Areas and provides goals and objectives for development of existing leases, a direction is provided in the RFP under Reclamation of Mined/Drastically Disturbed Lands. This management prescription applies to the majority of the Project Area, with the exception of any areas that occur outside the ½-mile buffer area. In those cases, the appropriate management prescription described above applies.

Special Use Authorizations

The RFP (USFS 2003a) allows special uses that are compatible with other resources. Special Use Authorizations (SUAs) are issued for uses that serve the public, promote public health and safety, protect the environment, and are legally mandated. Bonds or other security instruments are required if the CNF determines that a use has potential for disturbance that may require rehabilitation or when needed to ensure other performance. The CNF establishes and maintains rental and user fees for all SUAs. Current SUAs located in the Study Area are described in **Table 3.10-2** and their general locations are shown on **Figure 3.10-4**.

TABLE 3.10-2 SPECIAL USE AUTHORIZATIONS

SPECIAL USE AUTHORIZATIONS				
PERMITEE	**AUTHORIZATION NO.**	**DATE ISSUED**	**EXPIRATION DATE**	**DESCRIPTION**
U.S. Fish & Wildlife Service	CAR0004-01	Nov. 1954	Dec. 2017	Covers 10 acres in NW¼, Sec. 5, T. 10 S., R. 45 E. on South Fork of Deer Creek for the purpose of constructing and maintaining a cabin for use by trappers engaged in predator control and game management on the CNF.
Stewart Brothers	CMT31	July 2003	Dec. 2022	Issued for irrigation pipe and related intake system in Sec. 15 & 16, T. 10 S., R. 45 E.
Tolman Family Association	CAR5429-01	Nov. 1997	Dec. 2017	Issued on .15 acres in NW¼ NE¼, Sec. 31, T. 9 S., R. 46 E. for headbox, water collection system and pipeline.
Bridger-Teton National CNF	CAR0008-01	July 1975	Dec. 2015	Issued for 0.5 acres in Sec. 12, T. 9 S., R. 45 E. to establish an electronic site on Sage Peak consisting of small buildings and related antenna facilities.
Lower Valley P&L Co,	CAR4033-02	Nov. 1982	Dec. 2012	Issued for powerline right-of-way 40-feet in width and 1.42 miles in length in Sec. 31 & 6, T. 10 S., R 46 E.; and Sec. 2, T. 10 S., R. 45 E.
J.R. Simplot Co.	CAR4067-02	Sept. 1992	Dec. 2021	Issued for 1,070 acres for the purpose of mill site, stockpile waste dumps, service roads, warehouse facilities, offices, parking area, maintenance shops, processing plant, and related facilities associated with processing phosphate rock from Federal Phosphate Lease I-012980.
	SSC17	April 2002	Dec. 2007	Issued to allow Simplot and subcontractors access to Deer and Manning Creek lease areas to begin baseline data collection activities.

Figure 3.10-3 Management Prescriptions – Suitable Timber

Figure 3.10-4 Land Status and Special Use Permits

The CNF can issue SUAs for those portions of exploration and mining operations that lie on CNF land outside mineral lease boundaries. Off-lease mine related SUA facilities could include portions of haul roads, mill sites, power lines, communication sites, temporary stockpiles (topsoil/ore/waste rock), or drainage control structures. However, permanent disposal of mine overburden solid waste is not permitted under SUAs [36 CFR 251.54].

Other Utilities and ROWs in the Study Area

In addition to SUA areas, which are located on CNF lands, other rights-of-way occur within the Study Area. The portion of Crow Creek Road north of Wells Canyon and within the CNF is in an easement granted to Caribou County by the CNF for operation and maintenance of the road; it extends 33 feet each side of the road center line. Other sections of Crow Creek Road outside the CNF are under county jurisdictions – Caribou County in Idaho, and Lincoln County in Wyoming.

The Wells Canyon Road east of the CNF boundary is under a ROW easement granted by the property owner to the CNF. It extends 12.5 feet each side of centerline for a total width of 25 feet.

Timber Management

The timber harvest in Idaho has declined by 31 percent since 1990 (USFS 2003b), along with national trends of reduced demand for timber. The decline in USFS timber harvest during this time has been even more dramatic, a 78 percent decrease. Each year, the CNF offers timber for sale, and these sales are completed based upon supply/demand. An operator has a specified period to harvest timber once a sale is completed. The CNF provides a variety of wood products to the public, including saw timber, house logs, chips, firewood, Christmas trees, posts, and poles.

The Montpelier District had no timber sale offerings in 2003. The Twin Creek Timber Sale located in Georgetown Canyon will be offered in 2006 in the watershed to the west of the Study Area. No timber sales are planned in the Crow Creek watershed in the 5-year timber sale plan.

Tentatively suitable timberlands have been reassessed as part of the RFP for the CNF (USFS 2003a). Tentatively suitable acres are those forest land areas available and capable of sustainable timber production. These lands represent the maximum acres that could be managed for regular predictable timber outputs and are used in determining the Allowable Sale Quantity (ASQ) (USFS 2003b). Allowable Sale Quantity is the amount of timber that may be sold from the area of suitable land covered by the CNF Plan for a time period specified by the Plan. This quantity is normally expressed as the "average annual allowable sale quantity" (USFS 2003b). Other forested areas can be cut under the Plan for different management reasons, regardless of whether or not the ASQ is met for a specific year.

Under the RFP (USFS 2003a), Management Prescription 5.2 – CNF Vegetation Management, is the only prescription where suitable timber is included in the ASQ. Timbered land in all other prescriptions within the Study Area has been removed from the suitable timber base and does not contribute to the ASQ on the CNF.

The Panel F and Panel G Lease areas encompass a total of approximately 2,000 acres (including lease modification areas of Panel F). The lease areas contain approximately 1,600 acres of tentatively suitable timber. However, only the portion of Panel F that lies within Prescription 5.2 is included in the ASQ. This portion of Panel F contains 641 acres of tentatively suitable timber (108 acres aspen, 170 acres aspen/conifer, and 363 acres conifer).

Overall, Panel F contains 1,057 acres of tentatively suitable timber (359 acres aspen; 210 acres aspen/conifer; 488 acres conifer); Panel G contains 553 acres of tentatively suitable timber (276 acres aspen; 1 acre aspen/conifer; 276 acres conifer).

3.10.3 Access Roads and Trails

Public access to the Panels F and G Project Area is via County Road 236 from Afton and Fairview, Wyoming and southwest on Crow Creek Road for several miles into the CNF. From Montpelier, Idaho, access is via Highway 89, up Montpelier Canyon and north on Crow Creek Road. Access from Georgetown, Idaho is up Georgetown Canyon to FR 1102.

Primary access routes to the Study Area include the Crow Creek, Georgetown, Wells Canyon, and Diamond Creek roads. Crow Creek Road (FR 111) extends approximately 50 miles northeast from U.S. Highway 89 near Montpelier to near Afton, Wyoming. Georgetown Canyon Road (FR 102) extends northeast from its intersection with Hwy 30 at Georgetown, Idaho to its intersection with the Wells Canyon Road. Diamond Creek Road (FR 1102) extends south from its intersection with the Blackfoot River Road in Upper Blackfoot River Valley approximately 25 miles to the intersection with the Wells Canyon Road (FR 146). Wells Canyon Road (FR 146) extends northwest from its intersection with the Crow Creek Road approximately 4.2 miles to its intersection with the Georgetown Canyon and Diamond Creek Roads. Access to the area is also possible using the Smoky Canyon/Timber Creek Road (FR 110). Active mine areas are closed to public, motorized travel for safety reasons.

Traffic on CNF roads in this area is light to moderate. Shift changes at Smoky Canyon Mine reflect periodic traffic increases along Smoky Canyon Road (FR 110) between the mine and the Star Valley area. Moderate traffic on Crow Creek Road (FR 111) is mostly local access with some through traffic (seasonal) to Montpelier Reservoir and the town of Montpelier. Diamond Creek Road (FR 1102), Georgetown Canyon Road (FR 102), and Wells Canyon Road (FR146) traffic varies from light to moderate on weekdays and weekends, respectively. Traffic increases noticeably on all CNF roads in the area during the fall hunting season (Duehren 2003).

An objective identified in the RFP is to revise the CNF travel plan to incorporate RFP direction for access management. RFP Standards and Guidelines that are applicable to travel planning include:

- Open Motorized Route Densities (OMRDs) shall not exceed the limits identified in the Plan OMRD Map. OMRD is defined as the miles of designated motorized roads and trails per square mile within a specific prescription polygon.
- The OMRD standard and restrictions depicted on the travel plan map do not restrict responses to emergency events to protect human life, property values, structures, and CNF resources.
- The travel planning process shall consider additional areas for non-motorized winter recreation.
- Any motorized vehicle access on a restricted road or trail or in a restricted area shall be for official administrative business only and shall be officially approved.
- Unless otherwise posted, motorized access is allowed for parking, wood gathering and dispersed camping within 300 feet of an open designated road.
- The construction of new or maintenance of existing motorized and non-motorized access routes should be consistent with the ROS class in which they are located.

Mine access roads, as well as other special use roads, that are not open to the public are not included in the OMRD calculations.

Travel plans are legally enforced through the issue of a Special Order signed by the CNF Supervisor. In 2003, a Special Order was added to the 2002 CNF travel plan map prohibiting cross-country motorized access during the snow-free season on most areas of the CNF. In areas that were formerly open to cross-country, motorized use, all roads and trails depicted on the 2002 map became the designated routes, until the revised travel plan analysis and decision are complete. This was done to comply with RFP direction.

The 2003 RFP closed 96 percent of the CNF to cross-country motorized travel (USFS 2003a). Only a small area on the Soda Springs Ranger District remains open for this type of use. In addition, the RFP set a ceiling for motorized route densities for each management prescription area OMRDs. The Revised Caribou Travel Plan will establish and identify which roads and trails will remain open to motorized travel and which will be closed to motorized travel to meet the OMRDs in the RFP. This is reflected in the 2005 Draft EIS for the Caribou Travel Plan Revision (USFS 2005b).

Under the Proposed Action for the Revised Travel Plan, the following summer travel routes within the Study Area would remain open to motorized use:

20111 – Crow Creek Road
20740 – Manning Creek Road
20586 – Sage Valley Road
20146 – Wells Canyon Road
20220 – Snowdrift Road
20690 – Middle Deer Creek Road
20535 – Trappers Cabin Road
21102 – Diamond Creek Road
20102 – Georgetown Canyon Road
20145 – Sage Meadows Road
20179 – South Fork of Sage Creek Road

Winter travel routes include snowmobile routes up Manning Canyon and Wells Canyon. Within elk and deer winter range, which includes the entire northern end of the Study Area, snowmobile use would be limited to designated routes only. Non–motorized travel is generally allowed on all routes.

RS 2477 (Revised Statute 2477) is legislation that allows counties to assert that they have access rights on roads and/or trails that existed prior to the establishment of the CNF. The RFP provides for resolution to RS 2477 issues. There are no known RS 2477 assertions within the Study Area. However, the Crow Creek Road was established prior to the reservation of the forest and would probably qualify as a RS 2477 route.

Under the Revised Travel Plan, the construction of new roads or maintenance of existing routes should be consistent with the ROS classes in which they are located.

3.11 Inventoried Roadless Areas/Recommended Wilderness and Research Natural Areas

3.11.1 Inventoried Roadless Areas/Recommended Wilderness

As displayed on **Figure 3.11-1**, portions of the Proposed Action and Action Alternatives lie within portions of two Inventoried Roadless Areas (IRAs): the Sage Creek Roadless Area (SCRA) and the Meade Peak Roadless Area (MPRA). The SCRA encompasses approximately 12,710 acres of which 3,021 acres are under existing active phosphate leases. The majority of Panel F, including proposed lease modifications, the majority of Panel G, and the majority of the haul/access roads to Panel G lie within the SCRA. An additional 2,287 acres are within unleased KPLAs that represent 18 percent of the SCRA. The MPRA encompasses approximately 44,585 acres of which approximately 1,140 acres are leased for phosphate mining with an additional 2,580 acres having been identified as KPLAs (USFS 2003b). A small portion of the extreme southwestern area of Panel G and a short segment of the Proposed Action Panel G haul/access road occurs within the MPRA. National Forests are required to re-evaluate and re-inventory roadless areas for possible inclusion in the National Wilderness Preservation System as part of Forest Plan revisions. Under the RFP (USFS 2003a), no Recommended Wilderness areas occur within the Study Area. The IRA characteristics (i.e. roadless and wilderness attributes) for each of the IRAs in the Study Area are summarized below. The summarized information applies to the entire IRA being described, not just the portion of the IRA within the Study Area. Currently, according to the roadless rule, lessees are permitted to access leases and produce minerals within the IRAs.

Sage Creek Roadless Area

Roadless Attributes

The SCRA is described by the Roadless Area Conservation Initiative (RACI) resource attributes listed below, which have been summarized from USFS 2003b.

Soil: Soils are mainly stable in the SCRA; only two percent of the soils are rated unstable. Approximately 23 percent of the area has an erosion hazard.

Air: The SCRA is within the twenty-mile sensitive receptor radius and is within 200 kilometers of a Class I area. Nearby towns that are classified as sensitive air quality receptors are Afton, Wyoming and Soda Springs, Idaho.

Water/Sources of Public Drinking Water: Overall the watersheds are rated in moderate condition. Three tributaries of Crow Creek, South Sage, Manning, and Deer Creeks, drain the area. In contrast to neighboring watersheds to the north and west, the Deer Creek watershed has been relatively unimpacted by mining and related activities.

Diversity of Plant and Animal Communities

Vegetation: Vegetation communities are composed of forest and grass/shrub communities. Forests comprise approximately 78 percent of the vegetation; grass/shrub communities account for approximately 22 percent of the vegetation. Conifers cover over 40 percent of the area. Forested communities are composed of Douglas-fir, aspen, mixed conifer, lodgepole pine, and aspen/conifer. Aspen decline is rated high because of aging and conifer encroachment of aspen stands. The ratings for both insect and fire hazard in forested communities are moderate because of the older conifer composition

Figure 3.11-1 Inventoried Roadless Areas of Sage Creek, Meade Peak and Gannett Spring

and fuel buildup in the understory. Grass/shrub communities occur only in small patches in the area. Invasive species (Canada thistle and Musk thistle) comprise less than one percent (0.2) of the area (22 aces). The South Fork Sage Creek, Pole Canyon, and Sage Creek Timber Sales and historic and active exploration and mining activities are past/current disturbances to vegetation in the area.

Wildlife and Fish: The Noss ranking analysis was not completed for this area (Noss et al. 2001), but the area was ranked low for wildlife biological strongholds during the resource management plan analysis. In addition, the departure from Proper Functioning Condition (PFC) is moderate (USFS 2003b). The grass/shrub habitats are rated low for sage grouse because of the patchy grass/shrub habitat and the distance to the nearest sage leks (5 miles). Fisheries biological strongholds are rated high because of the presence of Yellowstone cutthroat trout, a Forest sensitive species, is expected in Sage and Deer Creeks (USFS 2003b). Forest personnel also believe Yellowstone cutthroat trout occur in the North Fork of Deer Creek. Fisheries surveys in 2003 have verified and confirmed that Yellowstone cutthroat trout are present in Deer Creek and the North Fork of Deer Creek.

Threatened, Endangered, Sensitive, and Rare Species Occurrence/Habitat: Threatened and endangered species known to occur in the area include the gray wolf. The area is rated high for lynx linkage habitat because of the following factors: 1) the presence of a major north-south ridge, which could provide a movement corridor; 2) the area has 41 percent conifer; 3) location midway between the Targhee and south end of the Preuss Range; and 4) the area offers about 9 percent for security areas. The area is ranked low for the gray wolf because of the low amount of security.

USFS sensitive species that have documented occurrences include three-toed woodpecker, Northern goshawk, and great gray owls. The area is rated high for forest-associated sensitive species.

Rare plants, rare plant communities, or plant community references have not been documented in the area.

Reference Landscapes: The Deer Creek watershed has not been impacted by mining and could be used as a unique aquatic reference (i.e., control comparison watershed at landscape level).

Scenic Integrity: Scenic integrity is low including partial retention areas with moderate scenic integrity (4,043 acres), and modification areas with low scenic integrity (8,688 acres).

Recreation (Primitive, Semi-Primitive non-motorized, and Semi-Primitive Motorized): Recreation use has increased in the area. The area is managed for both summer and winter recreation. In summer, part of the area (10,764 acres) is managed for semi-primitive motorized recreation experience while the remaining land (2,037 acres) is managed for Roaded Modified experiences. In winter, the entire area is managed for semi-primitive motorized recreation experiences.

Traditional Cultural Properties and Sacred Sites: Four cultural resource sites have been found in the SCRA. The sites were surface scatters composed of lithics (chert and obsidian), waste flakes, and some artifacts.

Special Use Permits, Utility Corridors: Several special use permits (SUPs) have been granted for phosphate mine related uses, including a phosphate slurry pipeline along the northern boundary of the area, and a power line on the northeastern boundary of the area; an additional SUP is for the USFS radio repeater tower site (2 acres).

Wilderness Attributes

In addition to the roadless attributes described above, the SCRA is also characterized by the wilderness attributes described and summarized by the CNF (USFS 2003b).

Natural Integrity/Apparent Naturalness: Natural integrity is the extent to which long-term ecological processes are intact and operating. Impacts to natural integrity are measured by the presence and magnitude of human induced change to an area. Apparent naturalness means that the environment looks natural to most people using the area.

The SCRA has been rated as low in natural integrity and apparent naturalness, as the area has been affected by the following physical or man-caused impacts: range improvements, prescribed fire, mineral exploration and development, and unimproved roads. Further, the appearance of man-made facilities or management activities in the area detract from the natural appearance because of grazing and recreation activities, timber harvest activities, roads, past fire history, and minerals.

Solitude/Primitive Recreation: Solitude is a personal and subjective value, defined as isolation from the sights, sounds, and presence of others as well as human developments. Primitive recreation is a perceived condition of being secluded, inaccessible and out of the way. The physical factors that can create primitive recreation settings include topography, vegetative screening, distance from human impacts such as roads and logging operations (sight and sound) and difficulty of travel. A user's sense of remoteness in an area is also influenced by the presence or absence of roads, their condition and whether they are open to motorized vehicles.

The opportunity for solitude within the SCRA is low because of its small size, moderate topographic and vegetative screening, and moderate distances from the perimeter to the center of the area (USFS 2003b). The existing Smoky Canyon Mine occurs on the northeast side of the SCRA. Primitive recreation opportunities are rated as moderate because of the small area of the SCRA, road corridors projecting into the area, moderate topographic and vegetative screening, and because limited facilities are present.

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

There are few opportunities for challenging experiences within the SCRA, as terrain is typical of the mountains in southeast Idaho.

Special Features/Special Places/Special Values: These consist of unique geological, biological, ecological, cultural or scenic features that may be located in a roadless area.

Unique or special features are not represented within the SCRA.

Wilderness Manageability/Boundaries: These are elements that relate to the ability of the Forest Service to manage an area to meet size criteria and the attributes discussed above. The shape of an area and changes of that shape influence how it can be managed.

The manageability of the SCRA along inventoried boundaries would be fair. Minor boundary adjustments could eliminate conflicts, including the Smoky Canyon Mine.

Meade Peak Roadless Area

Roadless Attributes

The MPRA is also described by the RACI resource attributes listed below and have been summarized from USFS 2003b.

Soil: Approximately 17 percent of the MPRA soils is considered unstable; about 64 percent of the area is considered an erosion hazard.

Air: The MPRA is outside the twenty-mile sensitive receptor radius and is not within 200 kilometers of a Class I area. Nearby towns that are classified as sensitive air quality receptors are Montpelier and Soda Springs, Idaho (USFS 2003b).

Water/Sources of Public Drinking Water: No 303(d) streams are present in the MPRA and the northern portion (within the Study Area) is drained by Crow Creek.

Diversity of Plant and Animal Communities

Vegetation: Vegetation communities are composed of aspen, aspen/conifer, grass/shrub cover, and mixed conifer. A wildfire occurred in the early 1900's in the area. In addition, the Snowdrift area was treated with prescribed fire, and the Clear Creek and Home Canyon timber sales have occurred in these areas. As of 2003, approximately 1.4 percent of the MPRA contained invasive species. These species included Canada thistle, Dyers woad, and Musk thistle.

Wildlife and Fish: According to the Noss study, this area has some of the highest game values in Idaho. The MPRA was ranked moderate for wildlife biological strongholds during the resource management plan analysis. In addition, the departure from PFC is moderate (USFS 2003). Approximately 52 percent of the area has grass/shrub cover, which is within five miles of the nearest sage grouse leks (5 miles). Fisheries biological strongholds are rated high because the presence of Yellowstone cutthroat trout in Crow Creek that drains into the Snake River Basin and Bonneville cutthroat trout in Preuss Creek (south of the Study Area) that drains into the Bear River Drainage.

Threatened, Endangered, Sensitive, and Rare Species Occurrence/Habitat: Threatened and endangered species known to occur in the area include the gray wolf and lynx. The area is rated moderate for lynx linkage habitat because of the following factors: 1) the amount of security areas (31 percent); and 2) the major ridge along Snowdrift Mountain and the major drainage along the Montpelier drainage. Because of the moderate amount of security (27 percent), the MPRA also ranks moderate for wolverine and wolves. The northern goshawk has been documented in the MPRA. The area is rated low for forest-associated sensitive species but high for grass/shrub habitat-associated MIS.

Two proposed sensitive plants: Uinta Basin Cryptantha and Starveling milkvetch have been documented in the MPRA. Rare upland plant communities are found within the Meade Peak Research Natural Area (RNA) discussed in **Section 3.12.2**; the riparian/wetland communities around the Preuss Creek headwaters are considered plant community reference areas.

Reference Landscapes: The Meade Peak RNA and the Snowdrift prescribed fire treatment area could serve as unique reference values.

Scenic Integrity: High scenic integrity is maintained along and adjacent to Highway 30, the City of Georgetown, Idaho, and Crow Creek Road. Partial retention (moderate) is maintained on 28,457 acres, while Modification (low scenic integrity) is maintained on 13,084 acres.

Recreation (Semi-Primitive non-motorized and Semi-Primitive Motorized): The area is managed for both summer and winter recreation. In summer, 9,827 acres are managed for semi-primitive non-motorized recreation experience, while 11,403 acres are managed for semi-primitive motorized. In winter, a wildlife closure of 6,400 acres is managed as semi-primitive non-motorized. The remaining 34,277 acres are managed for semi-primitive motorized recreation experiences.

Traditional Cultural Properties and Sacred Sites: No information on Traditional Cultural Properties and/or Scared Sites has been documented within the MPRA.

Special Use Permits, Utility Corridors, Other: No special use permits or utility corridors are found in the area. There are 636 acres of State land in-holdings within this IRA.

<u>Wilderness Attributes</u>
In addition to the roadless attributes described above, the MPRA is also characterized by the wilderness attributes described below.

Natural Integrity/Apparent Naturalness (defined previously): The MPRA has been rated as moderate because of the evidence of human activities such as unimproved roads and timber harvest activities.

Solitude/Primitive Recreation (defined previously): The opportunity for solitude within the MPRA is rated as moderate because of road intrusions into the area. Primitive recreation opportunities are rated as moderate because of the small size of the MPRA, but there are many road intrusions.

Challenging Experience (defined previously): There are few opportunities for challenging experiences within the MPRA, as terrain is typical of the mountains in southeast Idaho.

Special Features/Special Places/Special Values (defined previously): The MPRA contains Meade Peak, the highest point on the CNF, and a Research Natural Area (discussed below). The area also includes good wildlife and fish habitat.

Wilderness Manageability/Boundaries (defined previously): The manageability of the MPRA is considered poor due to the road intrusions into the area. A core area could be achieved, with boundaries along natural features.

3.11.2 Research Natural Areas

Research Natural Areas (RNAs) are part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands (USFS 2003b). RNAs are for non-manipulative research, observation, and study. They also assist in implementing provisions of the National Forest Management Act, 1976 (USFS 2003a). Currently there are seven established RNAs on the CNF. None of the alternatives analyzed in this EIS are located inside any RNAs. Meade Peak RNA is the closest to the Project Area and occurs approximately 5.5 miles south of the Panel G lease area. The

Meade Peak RNA was established in 1988 and contains about 300 acres. The objective for this RNA is to maintain and preserve the subalpine conditions it represents in as near an undisturbed (by man) condition as possible without the use of practices such as livestock grazing and prescribed burning and without disruptive effects of wildlife (USFS 2003b). This RNA provides an area undisturbed by man where relationships between a severe environment and the resulting vegetation can be observed and studied. The other six RNAs occur at least 10 miles away from the Project Area and are not addressed further in this EIS (USFS 2003a).

3.12 Visual and Aesthetic Resources

3.12.1 Overview

Visual resources are a composite of basic terrain, geologic features, water features, vegetative patterns, and land use activities that typify an area and influence the visual appeal that area may have to people. The measure of visual appeal, or viewer response to the landscape, in combination with the visual quality and character of an area, is expressed as aesthetic value. Aesthetic value and visual appeal are inherently subjective. The opportunity to experience the landscape and interpret scenery and visual change is dependent upon the degree of public access and use of an area. Public access to the CNF in the Project Area is via paved county and gravel FS roads from Afton and Fairview, Wyoming, and Montpelier and Georgetown, Idaho. Public use of the CNF lands in this area is highest during elk and deer hunting seasons, and otherwise occurs mainly as dispersed recreation (See **Section 3.10**).

The Simplot Panels F and G Project Area ranges in elevation from approximately 6,500 to 8,500 feet. The western portions of the Project Area include the northern part of Snowdrift Mountain, and the southern extent of Freeman Ridge, which are characterized by high elevation forested slopes and sagebrush meadows, and incised drainages with steep gradients. Lower elevation slopes extend easterly to Sage Valley and Crow Creek – including meadows, pastures, and several large ranches along Crow Creek Road.

3.12.2 Visual Resource Management (Scenery Management)

National Forest lands are typically inventoried based upon a system of Visual Quality Objectives (VQOs) as part of the forest unit planning process. The VQOs are categories of acceptable landscape alteration measured in degrees of deviation from the natural landscape. The VQOs are interpreted as guidelines for phosphate activities, since it is understood that most post-phosphate mining activities after reclamation do not meet Modification (defined below). All CNF lands have been classified by VQOs in the Visual Management System (VMS). They are described as follows from most restrictive (Preservation) to least restrictive (Maximum Modification):

- Preservation (P) - Ecological change only.
- Retention (R) - Human activities should not be evident to the casual Forest visitor.
- Partial Retention (PR) - Human activities may be evident but must remain subordinate to the characteristic landscape.
- Modification (M) - Human activity may dominate the characteristic landscape, but at the same time must utilize naturally occurring elements of the landscape including form, line, color, and texture.
- Maximum Modification (MM) - Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as a background.

The majority of lands within the Project Area are classified as Partial Retention and Modification (See **Figure 3.12-1**). According to the RFP (USFS 2003a), the scenic environment of the Forest will be maintained through adherence to existing VQOs, with the exception of phosphate mining. Phosphate mining activities and reclamation may or may not meet the given VQO (USFS 2003b:Vol.II p. 4-9 Final EIS for the CNF RFP). In the case where the VQO is not met, the mine operation and reclamation plan would mitigate visual changes to the degree that reclamation methods and economics allow.

The visual management program is applied to resource development activities on a project-by-project basis. Since 1996, National Forests have been directed to use a revised system for project planning, based upon the USDA publication Landscape Aesthetics: A Handbook for Scenery Management (USDA Handbook 701). Under this Scenery Management System (SMS), SMS values are assigned based upon the VMS data, bridging the two systems.

Concern Levels categorize the importance of scenic resources to forest visitors. Concern Level 1 roads are those such as designated scenic highways and byways; they are managed at a level of at least high scenic integrity. There are no designated scenic trails, highways, or byways in the Project Area.

Scenic integrity indicates the current status of a landscape. It is determined on the basis of visual changes that detract from the scenic quality of the area (USDA 1996). The Scenic Integrity Objective (SIO) refers to the degree of acceptable change or alteration of the valued landscape theme. Under the SMS, higher SIOs represent highly valued natural landscapes where management activities would result in little or no deviation from those values. Greater modification to the landscape is acceptable in low SIO landscapes.

High Scenic Integrity applies to an area that appears unaltered and where the valued landscape character appears intact. Moderate Scenic Integrity may appear slightly altered, but alterations are visually subordinate to the overall landscape. In Low Scenic Integrity areas, deviations may begin to dominate the landscape view. The Project Area landscape in Partial Retention Areas has moderate scenic integrity; in Modification areas, low scenic integrity would apply.

3.12.3 Access & Use

The importance of scenic values is affected by access, ownership, and development, and by recreational and seasonal uses of an area. Crow Creek Road is designated as a Forest Highway (FR 111) for the section in Bear Lake County and serves as one of the main routes of access to the Project Area. Private lands along Crow Creek Road nearest the Project Area are used for seasonal ranching operations and recreation. Several homes and outbuildings, as well as fences, gates, a power line, and pasturelands, are evident along the road. The backdrop for these ranches and summer homes is one of brush-covered hills and steep, forested slopes so the area retains its rural, agricultural setting.

Crow Creek Road nearest the Project Area is closed due to snow cover about 6 months of the year; year-round access is maintained only to the boundary of Sections 20 and 21 in T.9S R.46E, near the confluence of Sage Creek and Crow Creek. This is outside, or east of, the CNF boundary. The unplowed portions of Crow Creek Road through the Forest, as well as Wells Canyon Road, are groomed snowmobile trails in the winter.

Figure 3.12-1 Visual Quality Objectives

Traffic counts taken on Crow Creek Road to the south of the Project Area (approximately 10 miles south of Wells Canyon Road) between July 26 and October 25, 2000 indicated that summer use of this road averages about 20 vehicles per day during the week and 60 vehicles per day (includes both directions) during the weekends. During hunting season in October, those averages triple during weekdays and nearly double during weekends. These counts provide an example of use near the Project Area; however, actual use north of the Wells Canyon intersection along Crow Creek Road is expected to be higher (Tate 2004).

Diamond Creek Road, Georgetown Canyon Road, and Wells Canyon Road are also considered primary routes across the CNF. These roads provide the only east-west route across the CNF for 30 miles. Traffic counts on these roads would be slightly lower than those discussed above, but would have the same type of distribution. Several trails, described in Recreation (**Section 3.10**), also provide hiking access to back-country views in the Project Area.

Active mine areas are closed to public travel for safety reasons.

3.12.4 Viewers & Views in the Project Area

Those who reside seasonally along Crow Creek Road and those who hike or camp regularly in this portion of the CNF are likely to value the scenic quality of the surrounding landscapes in this area. Seasonal residents, in particular, have commented during public scoping on this EIS, on the visual beauty of the area. Hunters, who comprise the highest use category for the Project Area, would be expected to value the scenic landscape as a part of their recreational experience, though a successful hunt would not necessarily depend on the scenery.

The following photos show some of the views in the Project Area, from points on Crow Creek Road (FR 111), Wells Canyon Road (FR 146), and Diamond Fork Road (FR 1102). Following the photos are representations (**Figures 3.12-2 through 3.12-8**) of what portions of the landscape are ‘seen’ or ‘unseen’ from specific points along Crow Creek Road or from other potential viewpoints in the Crow Creek Valley. The seen/unseen point shown in **Figure 3.12-2** is taken from a high elevation point along a horse trail on the Stewart Ranch property. **Figure 3.12-3** is taken from the Stewart Ranch buildings area. **Figures 3.12-4**, **6**, and **7** represent views of the Project Area from points along Crow Creek Road. The view area from the Osprey Ranch is shown in **Figure 3.12-5**. **Figure 3.12-8** shows view from a high elevation point along a CNF hiking trail on the northwest-facing slopes above Crow Creek Valley. Seen/unseen representations are plotted from a height of approximately 5 feet, to show what areas of the surrounding landscape would be included in the view of a person standing at a given point.

View northwest up Sage Creek from Crow Creek Road (T9S. R46E. Sec. 20)

View north along Crow Creek Road from vicinity of Stewart Ranch
(T10S. R45E. Sec. 14)

View of Snowdrift Mountain from Panel G (looking south)
(T10S. R45E. Sec. 4)

View south along Diamond Creek Road west of Freeman Ridge (T9S. R45E. Sec. 21)

Osprey Ranch from Crow Creek Road, view to southeast (T9S. R46E. Sec. 31)

Panel G area from viewpoint near Wells Canyon Road. Panel G is on the forested slope in the middleground and the south end of Panel F is in the pass on the background horizon.

Figure 3.12-2 Viewshed

Figure 3.12-3 Viewshed

Figure 3.12-4 Viewshed

Figure 3.12-5 Viewshed

Figure 3.12-6 Viewshed

Figure 3.12-7 Viewshed

Figure 3.12-8 Viewshed

3.13 Cultural Resources

Cultural resources are non-renewable resources. Federal regulations obligate federal agencies to protect and manage cultural resource properties and prohibit the destruction of significant cultural sites without first mitigating the "adverse effect" to the site. Mitigation measures include, but are not limited to, complete, detailed site documentation, complete avoidance of the site, and/or data recovery efforts. The National Historic Preservation Act (NHPA) of 1966 (as amended) and the Archaeological Resources Protection Act (ARPA) of 1979 are the primary laws regulating preservation of cultural resources.

Section 106 of the *National Historic Preservation Act of 1966*, as amended, requires federal agencies to take into account any action that may adversely affect any structure or object that is, or can be included in the NRHP. These regulations, codified at 36 CFR 800, provide a basis for which to determine if a site is eligible. Beyond that, the regulations define how those properties or sites are to be dealt with by federal agencies or other involved parties. These regulations must be considered for historic properties or sites of historic importance, as well as for archaeological sites.

Cultural resources provide data regarding past technologies, settlement patterns, subsistence strategies, and many other aspects of history. The guidelines for evaluation of significance and procedures for nominating cultural resources to the National Register of Historic Places (NRHP) can be found in 36 CFR 60.4. In order to be nominated to the NRHP, a cultural resource site/historic property must meet at least one of the four National Register Criteria:

a) association with events that have made a significant contribution to the broad patterns of our history, or
b) association with the lives of persons significant to our past, or
c) embody the distinctive characteristics of a type, period, or method of construction; or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, or
d) have yielded or may be likely to yield information important in prehistory or history.

A Traditional Cultural Property (TCP), as defined in the NHPA, is a property that is eligible for inclusion on the National Register of Historic Places "because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1994). Stated another way, a significant TCP is defined as a property with "significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices" (Parker and King 1994).

The term "Heritage Resources", used by the Forest Service, encompasses not only cultural resources but also traditional and historic use areas by all groups (Native Americans, Euro-Americans, etc.). Heritage resources include lifeways or the way humans interact and survive within an ecosystem (USFS 2003b). Objects, buildings, places, and their uses become recognized as "heritage" through conscious decisions and unspoken values of particular people, for reasons that are strongly shaped by social contexts and processes (Avrami et al. 2000). Heritage resources define the characteristics of a social group (i.e. community, families, ethnic group, disciplines or professional groups). Places and objects are transformed into "heritage" through values that give them significance.

3.13.1 Cultural Context

Evidence of 11,000 years of prehistoric occupation and use of the CNF has been documented through rock shelters, stone circles, hunting blinds, bison kill sites, and projectile points (USFS 2003a). The prehistory of southeastern Idaho and the northeastern Great Basin has been previously detailed (Butler 1978 & 1986; Carambelas et al. 1994; Franzen 1981; Gehr et al. 1982; Lohse 1993; Madsen 1982; Meatte 1990; Ringe et al. 1987; Swanson 1972 & 1974). Overviews specific to the history of southeastern Idaho have been written to address the needs of cultural resources management (Franzen 1981; Fiori 1981; Sommers and Fiori 1981; Wegars and Bruder 1992) and to identify a number of significant themes for the region. The following brief prehistoric overview is summarized from the Final EIS for the CNF Phosphate Leasing Proposal (BLM and USFS 1998).

Prehistory

The prehistory of southeastern Idaho can be divided into at least three periods; Paleo-Indian (ca. 10,000 to 7,000 B.P.), Archaic (7,000 to 300 B.P.), and Protohistoric (300 B.P. to present). These periods are generally defined by distinct artifact types and characterized by different settlement and subsistence patterns.

<u>Paleo-Indian Period</u>

The Paleo-Indian period largely is defined by three projectile point types: Clovis, Folsom, and Plano. Paleo-Indian groups who occupied the region focused their subsistence efforts on large, migratory animals as indicated by the association of Folsom spear points and large animal remains. It may be reasonable to assume that Paleo-Indian groups in southeastern Idaho also traveled over large annual ranges (Goodyear 1979; Letourneau 1992) and exhibited a high degree of residential mobility (Binford 1980; Kelly and Todd 1988).

<u>Archaic Period</u>

The Archaic period is generally defined by the introduction of stemmed (Pinto series) and notched (Northern Side-notched and Elko series) projectile points and the apparent broadening of the resource base. The shift from large, lanceolate-shaped points to small, stemmed and notched points is believed to be related to the introduction of the atlatl and dart from two separate regions, the Great Basin and the Plains (Butler 1986:130, citing Gruhn 1961). Although data indicates that large mammals were the primary food resource of Archaic groups, the exploitation of a wider array of resources is evidenced in ground stone artifacts and small mammal remains at some sites (Sant and Douglas 1992). The Archaic Period can be subdivided into three subperiods based on variation in artifact assemblages and settlement and subsistence practices (Sant and Douglas 1992). These subperiods are the Early Archaic (7,000 to 4,500 B.P.), Middle Archaic (4,500 B.P. to 1,300 B.P.), and the Late Archaic (1,300 to 300 B.P.).

Subsistence and settlement patterns in southeastern Idaho remained fairly consistent between the Early and Middle Archaic (Sant and Douglas 1992; citing Gruhn 1961; Ranere 1971; Swanson 1972), although artifact assemblages differ. The Late Archaic is defined by the introduction of ceramics and small triangular and side-notched points. These artifact classes, particularly the ceramics, indicate the occupation of at least two groups or "cultural manifestations" (Butler 1986:131) in southeastern Idaho: the Fremont (ca. 1300 to 650 B.P.) and the Shoshonean (ca. 700 B.P. to present).

The Fremont are typically thought of as horticulturalists. Evidence for horticulture has not been found in southeastern Idaho (Holmer 1986:243; Ringe et al. 1987); therefore, the presence of Fremont artifacts has been problematic to some. Sant and Douglas (1992) suggest that Fremont artifacts arrived in southeastern Idaho through trade. Some have argued that northern Fremont populations were primarily hunters and gatherers, rather than horticulturalists (Madsen 1982:217-218; Sharp 1989; Simms 1990); if that is the case, then the presence of Fremont artifacts in southeastern Idaho would likely be a consequence of Fremont hunter-gatherers occupying the area.

Occupation of southeastern Idaho by the Shoshone and Bannock coincides with the expansion of Numic speaking people from the southwestern Great Basin to the north and east. Brown-ware ceramics and Desert Side-notched and Cottonwood triangular projectile points are thought to be temporally and ethnically sensitive artifacts. Artifacts recovered from the Wahmuza site, in southeastern Idaho, indicate continuous Shoshonean occupation since 700 B.P. (Geminis 1986, cited by Sant and Douglas 1992). The Shoshone and Bannock groups are characterized as relatively mobile hunter-gatherers.

Protohistoric

The introduction of the horse has been credited with changes to Shoshone and Bannock lifeways in southeastern Idaho over the past few hundred years (Manning and Deaver 1992; Murphy and Murphy 1986; Stewart 1938:201). According to Stewart (1938:201), the horse transformed the Shoshoni economy by facilitating the use of new hunting techniques, which ultimately yielded more resources and enabled people to live in large, relatively permanent settlements. Rather than being tethered to their food caches, these groups could forage over greater distances and transport food to a central location (Stewart 1938:201).

Two horse-owning groups may have passed through the Manning Creek Tract during their annual forays. According to Stewart (1938:218-219, Figure 12), the Cache Valley Shoshone hunted and gathered along the Bear River and crossed the Wasatch Mountains (south of the Project Area) during bison hunting excursions to Wyoming. Bannock and Shoshone groups living at Fort Hall also may have passed through the area while hunting elk, deer, and mountain sheep and gathering berries along the Bear River (Murphy and Murphy 1986:288, 292) or when traveling to Wyoming to hunt bison (Stewart 1938:198-216, Figure 10). These hunting and gathering forays began to change during the nineteenth century, when westward expansion and increasing conflicts with Euro-Americans eventually forced most of the Shoshone and Bannock into the reservation system. Mixed bands of Shoshoni signed a treaty with the United States Government at Soda Springs, Idaho on October 14, 1863 (Keppler 1941). Unbeknown to the Shoshone people, this treaty was not ratified by the United States Government. The Western Shoshone signed a treaty in 1863 with the United States Government, which set aside large tracts of Indian land in Idaho, Nevada, Oregon, Utah, and Wyoming (Manning and Deaver 1992). In 1867 and 1868, the Fort Hall and Wind River Valley Reservations, respectively, were established, and by 1868, the Shoshone had relinquished all their lands in Idaho and Wyoming except for lands specifically set aside as reserves (Clements and Forbush 1970:21, cited by Manning and Deaver 1992). The Bannock were assigned to the Fort Hall Reservation in 1869, and between 1879 and 1907, a number of other Native American groups were relocated to Fort Hall (Manning and Deaver 1992).

Sacred sites, such as burials, rock art, monumental rock features and formations, rock structures or rings, sweat lodges, timber and brush structures, eagle catching pits, and prayer and offering locales, are located throughout the region (Manning and Deaver 1992). Much of the landscape in southeastern Idaho also is sacred to local Native American groups and, thus, is not defined by archaeological remains.

Euro-American History

Fur trappers and explorers were the first non-native Americans to pass through the region (Fiori 1981:115-127) and are documented as early as the early 1800s. In the early-1800s, under the command of Robert Stuart, one group of Astorians made their way from the Bear River to the Salt River and thence to the Snake, a route which likely took them through Georgetown Canyon, Crow Creek, and Star Valley. During the early I840's, great numbers of emigrants began moving westward. In Idaho, emigrants could follow the Oregon Trail, via Fort Hall and Fort Boise, or the California Trail at Soda Springs, Fort Hall, or Raft River (Fiori 1981:170). Brigham Young led Mormon pioneers into the Salt Lake Valley in 1847, and by early-1860, had dispatched settlers into southeastern Idaho (Fiori 1981:148). The general area surrounding the Project, including the town of Soda Springs (the County seat), was along the routes of the earliest explorers, fur trappers, and emigrants.

Soda Springs was an early transportation hub (ISHS 1981a) with open valley connections to Bear Lake and Wyoming, with the Blackfoot River north to Montana, with Portneuf Valley used by Oregon Trail emigrants to Fort Hall, with Hudspeth's Cutoff west to California, and down Bear River to Cache Valley and Salt Lake.

Between the 1860s and 1890s, miners and railroad workers came to southeastern Idaho. Cariboo Fairchild, who had taken part in the gold rush in the Cariboo region of British Columbia in 1860, discovered gold in this region two years later (Welcome to Caribou County 2004). A modest gold rush began in the Caribou Mountain area in 1870 and ended in the early 1900s (USFS 2003a). During this time, Keenan and Caribou City became thriving boomtowns. Sulphur mining commenced in the early 1880's.

The mines in the Cariboo District depended on distant sources for supplies. The miners' needs provided an enticement for settlers to develop the surrounding country at a time when not too many other economic attractions were available to encourage settlement of southeastern Idaho (ISHS 1981b:9).

<u>Livestock</u>

As necessitated by the mining boom, small herds of cattle were driven into the region during the 1860s. Crowding on the plains prompted cattlemen to locate larger herds in southeastern Idaho during the 1870s and 1880s (Fiori 1981:144). Sheep were brought into the area as early as the 1830s-1840s by missionaries and emigrants (Fiori 1981: 145-146), with larger herds brought in during the mining boom. Large herds of sheep were established in Caribou County during the late 1890's and early1900's (Barnard et al. 1958). Basque sheep herders moved to the area after 1925 (Carambelas et al. 1994:12). Grazing allotments encompass the Project Area (See **Section 3.9** Grazing). Evidence of historic and modern livestock grazing is present within the Project Area in the form of arborglyphs, livestock trails, and temporary campsites. Arborglyphs are etchings or carvings of art and words in aspen trees that over time turn black against the white trunk, becoming more apparent. Recent studies (Mallea-Olaetxe 2000) indicate the relevance of tree carvings in depicting livestock usage/trailways, range boundaries, sheep herder lifeways, cultural affiliations, periods of use, and transportation routes.

Roads

Freighting was the original mode of mass transportation of goods in southeastern Idaho. The discovery of gold and the explosive growth of mining towns in Idaho and Montana resulted in a surge of freighting activities along the trade routes to the mines. By the 1860s, freight and stage roads passed through southeastern Idaho and contributed to its settlement (Franzen 1981; ISHS 1971). Large scale freighting occurred between 1864 and 1884. There were two main routes in this region: the Montana Road (from Corrine, Utah to western Montana) and the Kelton Road (from Kelton, Utah to Boise, Idaho). Approximately 1000 freighters hauled between Idaho and Montana on the Montana Road in 1873 (Franzen 1981). One early report states that the only "direct and safe route [to Cariboo Mountain gold deposits] is to go up the regular Montana road to Ross Fork…"(ISHS 1981b:3). Road conditions were poor, and tolls were often charged to obtain funding for improvements. Railroads diminished the need for freighting except in the areas not served by railroads.

Early settlers developed the Crow Creek Road, in the Project Area, as a path of commerce from Fairview, Wyoming to Montpelier, Idaho (Druss et al. 1979). This road is still well traveled and is known as the Crow Creek Road. It runs southwest and south to Montpelier Canyon and west to the town of Montpelier. It appears on historic General Land Office (GLO) maps (1901, 1902) of the area as *Montpelier to Star Valley Road.*

The Fairview Cutoff was a route from Fairview, Wyoming to Soda Springs, Idaho. The route cut off from Crow Creek at Hardmans Hollow, ran north to Tygee Creek, then southwest through Smoky Canyon to Soda Springs (Druss et al. 1980). Located north of the Project Area, this road is known currently as the Smoky Canyon Road.

Timber

Timber resources in southeastern Idaho are not as abundant as in other parts of the State, but still played a role in the development of the area. As communities were established, lumber was harvested locally through primitive means such as the pit saw (BLM 1981). As the demand for lumber grew, other means of lumbering were needed. A water-powered sawmill was the next technology introduced into the region, built by Samuel Parkinson and Thomas Smart in 1863 in Franklin. In response to railroad construction in the West, Majors Tie Camp was established in 1868 by Alexander Majors, who directed the cutting of thousands of trees along the Bear River. Majors floated the resulting ties down the Bear River to Corrine, Utah, where they were used for the Transcontinental Railroad. A steam sawmill was brought into the area in 1871. Approximately 30 sawmills were operating in southeastern Idaho by 1883. Historic sites associated with sawmills and lumbering activities have been recorded in the general Project Area.

3.13.2 Previous Research

Cultural resource inventories for previous mine expansions have recorded prehistoric and historic sites in and around the current Project Area. Site types in the general vicinity include prehistoric campsites, mining sites, and livestock/ranching sites. Also, historic sites associated with sawmills and lumbering activities have been recorded. Other known historic sites near but not within the Project Area include the Lander Trail, Fairview Cutoff, and Oneida Salt Works. Historic GLO maps show transportation corridors, a telephone line, a cabin, and a ditch were historically present in the Project Area. Prehistoric sites found in the area are generally considered significant due to the paucity of prehistoric sites in this high elevation environment.

Table 3.13-1 presents the seventeen previous cultural resource inventories in and around the current Project Area. Five of these projects were specific to the proposed Panels F and G mine expansion. Class III cultural resource inventories were conducted to encompass each component of the proposed mine expansion (i.e., Panel F lease, lease modifications, access roads, soil stockpiles, etc.) in order to identify any sites within the proposed Mining and Transportation Alternatives. Cultural resource inventory reports are on file at the associated agency office (i.e. Forest Service, BLM) and the State Historic Preservation Office. Site location information is considered sensitive; therefore, these reports are for limited circulation and not available to the general public.

TABLE 3.13-1 PREVIOUS CULTURAL RESOURCE INVENTORIES IN THE PROJECT AREA

PROJECT DESCRIPTION	AUTHOR	YEAR	FINDINGS
Archeological Investigations in the Smoky Canyon Area	Druss, Mark, Max Dahlstrom, Claudia Druss, and Steve Wright (ISU)	1980	10CU86, 10CU88, 10CU89, 10CU90, 10CU76
Stage I Investigation and Analysis of Archaeological Resources in Pit Area, Mill Sites, and Dump Site, Smoky Canyon Lease I-012890	Druss, Mark, Max Dahlstrom, Claudia Hallock, and Steve Wright (ISU)	1980	10CU76, 10CU77, 10CU78, 10CU79
Crow Creek Fish Habitat Improvement	Hendrikson, N. (Idaho State University)	1991	None
Manning Creek Drilling Project (CB-92-262)	Hamilton, J. (USFS)	1992	None
North and Upper Manning Timber Sale (CB-93-307)	Robertson, Mary (USFS)	1993	None
South Fork Sage Creek Timber Sale (CB-94-337)	Robertson, Mary (USFS)	1994	None
Freeman Ridge Phosphate Exploration	Robertson, M. (USFS)	1994	None
Wells Canyon/Deer Creek Exploration Federal Lease I-01441	Robertson, M. (USFS)	1996	None
Manning Creek Exploration Plan Modification (CB-94-333)	Satter, Norris (BLM)	1994	None
Galland Special Use Permit Pipeline	Robertson, M. (USFS)	1996	None
Sage Valley Phosphate Exploration, I-31982	Cresswell, L. (BLM)	1997a	None
Simplot Phosphate Prospecting Permit	Cresswell, L. (BLM)	1997b	None
A Cultural Resource Inventory of 880 Acres of the Manning Creek Property, Caribou County, Idaho.	Penner, William and Richard Crosland (JBR)	2001*	Sites: 10CU245, 10CU246; Isolates: 10CU243, 10CU244
Baseline Technical Report for Cultural Resources, South Manning Creek Exploration Area, Caribou County, Idaho	Statham, William (Frontier Historical Consultants)	2003*	Two isolates: DG-3, DG-4
Baseline Technical Report for Cultural Resources, Deer and Manning Creek Phosphate Lease Areas, Smoky Canyon Mine, Caribou County, Idaho (CB-04-495)	Gray, Dale, Dawn S. Statham, and William P. Statham (Frontier Historical Consultants)	2003*	CB-341 (isolate), CB-342, CB-343
Addendum to Baseline Technical Report for Cultural Resources, Panels F and G Extension and Transportation Corridors, Smoky Canyon Mine, Caribou County, Idaho (CB-04-495)	Gray, Dale and William P. Statham (Frontier Historical Consultants)	2004*	Sites: CB-317, CB-318, CB-319, CB-320 Isolates: CB-326, CB-327, CB-328
Addendum B to Baseline Technical Report for Cultural Resources, Panels F and G Extension and Transportation Corridors, Smoky Canyon Mine, Caribou County, Idaho (CB-04-495)	Gray, Dale (Frontier Historical Consultants)	2005*	None

*Specific to current Project

3.13.3 Cultural Resource Sites

As a result of the Project specific cultural resource inventories, eight historic sites are known to occur within the Proposed Action and Alternatives areas. No prehistoric sites were encountered during the inventories. Six of the eight sites have been evaluated as ineligible for the NRHP (**Table 3.13-2**) while two arborglyph sites are considered unevaluated due to insufficient information (thematic context) to evaluate. Consultation with the Forest Archaeologist and the Idaho SHPO resulted in these unevaluated determinations, as additional research and recordation is needed to establish the relationship of these features to local and regional history. In addition, nine isolates have been documented, but by definition are ineligible for the NRHP.

TABLE 3.13-2 CULTURAL RESOURCE SITES IN THE PROJECT AREA

SITE NUMBER	SITE TYPE	AFFILIATION	NRHP EVALUATION
CB-340	Spring Box	Euro-American	Ineligible
CB-342	Arborglyphs	Euro-American	Unevaluated
10CU245	Arborglyphs	Euro-American	Ineligible
10CU246	Arborglyphs	Euro-American	Ineligible
CB-317	Arborglyphs	Euro-American	Unevaluated
CB-318	Road	Euro-American	Ineligible Segment
CB-319	Telephone Line	Euro-American	Ineligible Segment
CB-320	Footbridge	Euro-American	Ineligible

The Proposed Action mining and Mining Alternatives B, C, D, and F would have the same basic footprint and Alternative A – No North or South Panel F Lease Modifications is slightly smaller but within the same footprint; therefore, each of these Mining Alternatives would encompass the same known cultural resource sites. Mining Alternative E – Power Line Connection from Panel F to Panel G Along Haul/Access Road would be situated within whatever Transportation Alternative is chosen; therefore, there would be no additional disturbance. The Transportation Alternatives, on the other hand, would each include different areas and therefore differ in cultural resources present. **Table 3.13-3** presents the Proposed Action and Transportation Alternatives and the associated cultural resource sites.

Cultural resource sites that have been determined ineligible for the NRHP do not need further protection, and therefore, would not need to be avoided by the Project. Isolates are by definition ineligible. Thus, isolates and ineligible sites are not carried through in the Chapter 4 analysis.

No TCPs or sacred sites have been designated or defined in or adjacent to the Project Area.

TABLE 3.13-3 ELIGIBLE OR UNEVALUATED CULTURAL RESOURCE SITES IN THE PROJECT AREA BY ALTERNATIVE COMPONENT

ALTERNATIVE	COMPONENT	SITE NUMBER	SITE TYPE
Proposed Action	Panel F Lease	No Eligible Sites	
	Panel F South Lease Modification	No Sites	
	Panel F North Lease Modification	No Sites	
	Panel F Haul/Access Road	No Sites	
	Panel G Lease	CB-342	Arborglyphs
	Panel G West Haul/Access Road	CB-317	Arborglyphs
		CB-342	Arborglyphs
TRANSPORTATION ALTERNATIVE			
1	Alternative F Panel Haul/Access Road	No Sites	
2	East Haul/Access Road	CB-342	Arborglyphs
3	Modified East Haul/Access Road	No Eligible Sites	
4	Middle Haul/Access Road	No Sites	
5	Alternate West Haul/Access Road	CB-317	Arborglyphs
6	Conveyor Route Corridor	No Sites	
7	East Access Road via Crow Creek Haul and Wells Canyon	CB-342	Arborglyphs
8	Middle Access Road	No Sites	

3.13.4 Heritage Resources

Southeastern Idaho has been traditionally utilized by the Shoshone-Bannock Tribes for subsistence and ceremonial uses. Since 1868, all unoccupied federal lands have been available to the Tribes' for exercise of Treaty Rights under the Fort Bridger Treaty of 1868 (See **Section 3.14**). Physical remains of prehistoric lifeways on the CNF include campsites and associated artifacts (USFS 2003a). During consultation, the Tribes have stated that the Project Area is currently used for traditional activities such as hunting, gathering, and ceremonial uses. According to the RFP (2003a), representations of historic lifeways on the forest include wagon trails, homesteads, mining sites, and Civilian Conservation Corps camps. Heritage resources in the Project Area also include the historic uses of livestock trailing and grazing. This is in part evidenced in the numerous arborglyphs (tree carvings) present in the Project Area. One permittee's family has utilized the Deer Creek Sheep Allotment for four generations (Peart 2003), trailing their sheep from Utah following a historic sheep driveway through the Kemmerer and Grey River Ranger District to the Deer Creek Sheep Allotment (Heyrend 2004) via FR 740 (Manning Canyon Road) and Trail 402 (non-motorized trail) along Manning Creek. A cabin has been constructed on private property adjacent to the grazing allotment by this permittee in order to be closer to the summer allotment. Grazing availability and allotments in the Project Area are described in **Section 3.9**. Roads and trails in the Project Area are described in **Section 3.15** (Transportation) and **3.10** (Recreation and Land Use), respectively.

The importance (value) of traditional lifeways in the local and regional communities is manifest in histories, cultural resource sites, traditional use sites, and the continued use of the area for these activities.

3.14 Native American Concerns and Treaty Rights Resources

The Shoshone-Bannock Tribes are a sovereign nation with their own governing system and not simply members of the general public. Communication between the Agencies and the Tribes constitutes Government-to-Government consultation and is therefore conducted at the appropriate levels.

Federal agencies are required by law (National Historic Preservation Act of 1966 and Archaeological Resources Protection Act of 1979) to consult with Native Americans on actions that may affect their traditions or uses of public lands. Specifically, the agencies are required to follow the Section 106 process as recorded in 36 CFR 800 - Subpart B, as amended January 11, 2001. As per the Fort Bridger Treaty, Native Americans should comment on proposed actions and participate in decisions prior to implementation, as the product of consultation. The goal of the BLM Manual Section 8160 is to "assure that tribal governments, Native American communities, and individuals whose interests might be affected have a sufficient opportunity for productive participation in BLM planning and resource management decision making." To this end, the Pocatello BLM Field Office and the CTNF, Soda Springs Ranger District have engaged in consultation with the Native Americans associated with southeast Idaho.

The American Indian Religious Freedom Act (AIRFA) of 1978 states "...henceforth it shall be the policy of the United States to protect and preserve for American Indians their inherent right to freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites [42 United States Code (U.S.C.) 1996]." Agencies are required to review their policies and procedures in consultation with traditional native religious leaders.

Executive Order (EO) 13007 - Indian Sacred Sites requires agencies to accommodate access to and ceremonial use of Indian sacred sites and to avoid adversely affecting the physical integrity of said sites. According to EO 13007, a sacred site is defined as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site." Sacred sites may consist of a variety of places and landscapes.

The Department of the Interior (DOI) Departmental Manual 512 DM 2 (DOI 1995) requires that all bureaus within DOI develop policies and procedures to identify, conserve, and protect Indian Trust Assets, trust resources, and tribal health and safety. Indian Trust Assets are legal interests in assets held in trust by the United States for Indian Tribes or individuals and can include: minerals, hunting and fishing rights, and water rights.

3.14.1 Introduction

The Shoshone-Bannock Tribes (Tribes) are headquartered at the Fort Hall Reservation, in southeast Idaho. The current reservation boundary encompasses about 544,000 acres of land along the Snake River. The original reservation totaled over 1.8 million acres but due to the expansion of white settlements, Congress required the Tribes to cede much of this land. However, the Tribes did retain grazing rights on those ceded lands. Some of the CTNF is in those ceded lands. The 1868 Fort Bridger Treaty established off-reservation treaty rights on all unoccupied lands. These rights include hunting, fishing, gathering, and other practices such as trade.

The CTNF is also part of the ancestral homeland of the Northwest Band of the Shoshoni. In their 1863 Treaty they assented to the Fort Bridger Treaty (Treaty with the Shoshoni-Northwestern Bands, July 30, 1863). Thus, tribal members of the Northwest Band also have rights to hunt, fish, and gather on all unoccupied lands of the United States.

Prior to white settlement of the west, the Shoshone and Bannock peoples were comprised of many smaller nomadic bands inhabiting a vast area of the west. Their aboriginal territory includes six states and ranged north into Canada and south to Mexico. The bands were generally extended family groups who moved across the western landscape hunting, fishing and gathering with the changing seasons. The Fort Hall area was a traditional wintering area for many of the bands. In addition to gathering camas bulbs, many bands met on the Camas Prairie for trade events each spring. The CTNF was an integral part of the Shoshone-Bannock Tribes ancestral lands.

Few “traditional use sites” have been documented through consultation with the Tribes. This is due mostly to privacy issues. For this analysis, we assume that the National Forest System lands were, and are, used for traditional practices such as hunting, fishing, and gathering. We also assume that tribal members utilize the CTNF for traditional activities such as ceremonies and religious practices. To protect the privacy of the Tribes, these activities will be discussed and analyzed in general terms. The following information is from “Shoshone-Bannock Tribes” published by the Shoshone-Bannock Tribal Cultural Committee and Tribal Elders.

> *Spirituality and religious ceremonies have always played a significant role in Indian cultures. Natural resources played an integral part of these ceremonies. Items such as sweet sage and tobacco made from a variety of plants were and are used in ceremonies. The Indians gathered many plants for medicinal purposes, including chokecherry, sagebrush, and peppermint. A myriad of other plants were gathered for food and to provide shelter. Rocks and clays were also used for ceremonies, ornamentation and shelter. Some bands inhabiting the upper Snake region were known as the “sheepeaters” since bighorn sheep were a staple of their diet. Buffalo, elk, deer and moose were also hunted and used by the aboriginal people. The Shoshone and Bannock bands also relied on upland game birds and small mammals. Salmon fishing was an integral part of aboriginal culture. Geysers, thermal pools and other water features were also utilized heavily by the Shoshone-Bannock Tribes.*

These activities are still practiced today across the CTNF and southeastern Idaho although the extent of those activities is unknown. Many tribal members hunt, fish and gather for subsistence and to maintain their traditional way of life.

3.14.2 Indian Treaty Rights

The federal government has federal trust responsibilities to Native American Tribes (DOI 1995). As discussed above, the 1868 Fort Bridger Treaty, between the United States and the Shoshone and Bannock Tribes, reserves the Tribes' right to continue traditional activities on all unoccupied federal lands. The Tribes' advocate the preservation of harvest opportunity on culturally significant resources necessary to fulfill inherent, traditional, and contemporary Treaty Rights (Bannock-Shoshone 1994). The Project Area is within the portion of southeast Idaho that is of historical usage for hunting and gathering (Shoshone-Bannock 2003) and continues to retain cultural values.

Article 4 of the 1868 Treaty states, "The Indians herein named…shall have the right to hunt on the unoccupied land of the United States so long as game may be found thereon…" While the Treaty itself only specifies hunting, the lawsuit "State of Idaho v. Tinno" established that any rights not specifically given up in the Treaty were, in fact, reserved by the Tribes. Further, in the Shoshone language, the same verb is used for hunt, fish, and gather so it is assumed that the Tribes' expect to retain rights for all of those practices (from a presentation at the Shoshone-Bannock Tribes, 1868 Fort Bridger Treaty Rights Seminar: April 12-13, 2004).

The Tribes' Fish and Game Department regulates and enforces the 1975 Tribal Fish and Game Code, for all off-reservation hunting and fishing activities. The federal agencies recognize that the Tribes' regulate their own Tribal members for hunting and do not require Tribal members to secure state hunting permits to hunt within BLM or Forest Service lands.

In regard to federal trust responsibilities, known items of interest to the Tribes include:

Tribal Historical/Archaeological Sites
Project-specific cultural resource inventories have been conducted in the Project Area. This information is in **Section 3.13** Cultural Resources. No prehistoric archaeological sites were located within Project boundaries during the inventories.

Rock Art
No resources of this nature have been identified in the Project Area.

Sacred Sites (EO 13007)/Traditional Cultural Properties (NHPA)
Executive Order (EO) 13007 directs federal land-managing agencies to accommodate Native Americans' use of sacred sites for religious purposes and to avoid adversely affecting the physical integrity of sacred sites. Federal agencies managing lands must implement procedures to ensure reasonable notice where an agency's action may restrict ceremonial use of a sacred site or adversely affect its physical integrity. No sacred sites have been identified in the Project Area.

A Traditional Cultural Property (TCP), as defined in the National Historic Preservation Act of 1966, is defined as a property that is eligible for inclusion on the National Register of Historic Places "because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community" (Parker and King 1994). Stated another way, a significant TCP is defined as a property with "significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices" (Parker and King 1994). No Traditional Cultural Properties have been nominated or designated in the Project Area.

Traditional Use Sites
Traditional use sites are those historically used by tribes for traditional land uses including fishing, hunting, gathering, ceremonies and religious practices. Few traditional use sites have been documented through consultation with the Tribes as Tribal information regarding these sites is closely guarded. The Tribes have not disclosed specific details of traditional use in the Project Area, however, they have asserted that the area is significant, traditionally used, and retains cultural values.

Water Quality
The Project Area includes lands in South Fork Sage Creek, Manning Creek, Deer Creek, Nate Canyon basin, and Wells Canyon basin, all in the Crow Creek watershed. A detailed discussion of water resources is located in **Section 3.3** of this EIS.

Wetlands
Numerous wetlands were identified throughout the area. See **Section 3.6** for a detailed discussion of wetland resources in the Project Area.

Fisheries
Fisheries and Aquatics resources are addressed in detail in **Section 3.8** of this EIS. Cutthroat trout are the most abundant game fish species in the upper reaches of Deer Creek, North Fork Deer Creek, South Fork Deer Creek, and South Fork Sage Creek and are also present in lower Deer Creek and Crow Creek, although sculpins and other fish species are more numerous.

Studies of macroinvertebrate diversity and channel characteristics indicate relatively poor environmental conditions in the North Fork Deer Creek, South Fork Deer Creek, and some areas in lower Deer Creek; these areas probably do not provide spawning areas for cutthroat trout. Habitat in the upper reaches of Deer Creek, in Crow Creek, and in South Fork Sage Creek is relatively more suitable and could provide areas for spawning and longer-term persistence of a trout population.

A few trout individuals captured in Crow Creek (1 fish) and North Fork Deer Creek (2 fish) had body tissue selenium levels above the currently established "biological effect threshold," for fish presumably from naturally occurring selenium in these areas.

The Tribes have not designated any specific traditional fishing areas on the CTNF but the whole Forest is used for exercising fishing rights.

Vegetation
Specific information regarding vegetation in the Project Area can be found in **Section 3.5**. Access to traditional plant resources is protected under the Fort Bridger Treaty of 1868. The Tribes have indicated that certain plants are important for traditional uses including, but not limited to, chokecherry, elderberry, current, red-twig dogwood (red willow), tulles, onions, turnips, all water plants (such as mint and watercress), huckleberry, gooseberry, raspberry, strawberry, sweet sage, carrots, bitterroot, camas, aspen, juniper, and lodge pole pine. Many of these plant species are present in the Project Area.

The Tribes use specific sized lodge pole pine trees for tipi poles. Baseline studies indicate that 15 percent of the vegetation in the Project Area is comprised of the Subalpine fir community and 7.8 percent is the aspen/conifer community, both of which include lodge pole pine.

Noxious Weeds and Invasive Species
There is Tribal concern about non-native vegetation replacing native vegetation. See the Vegetation **Section 3.5** for discussion on noxious weeds and invasive species.

Wildlife
Detailed information regarding the wildlife in the Project Area can be found in **Section 3.7**. Big game wildlife important for Tribal hunting includes elk, deer, antelope, and moose. Small game important for Tribal hunting includes sharp-tailed grouse, sage grouse, rabbits, rockchucks (marmots), squirrels, and partridges. Eagle, wolves, and grizzlies are also of concern to the Tribes.

Grizzly bear, antelope, and partridge are likely absent from the Project Area. No bald eagle nests occur within 2.5 miles of the Study Area. No sharp-tailed grouse are known to occur within the Study Area.

There is suitable habitat for the gray wolf, but wolves are known only as transient visitors. Mule deer, elk, and moose roam through most of the Study Area year-round. There is a known elk spring calving ground at Sage Meadows, about 1 to 2 miles from Panel F.

Land Access/Transportation
Currently motorized access to the Project Area is via the Crow Creek Road (FR 111), Wells Canyon Road (FR 146), Smoky Canyon/Timber Creek Road (FR 110), Diamond Creek Road (FR 1102), Manning Creek Road (FR 740), Sage Creek Road (FR 145), and Georgetown Canyon Road (also FR 102).

In addition, there are 4-wheel drive/OHV roads and trails through the Project Area along South Fork Sage Creek, Deer Creek, and Manning Creek. The area can also be accessed by horse and foot with few or no areas of restriction. Additional information regarding access into the Project Area can be found in **Section 3.10**, Land Use and Recreation, and **Section 3.15** Transportation.

Access
The Tribes are concerned with retaining access on unoccupied federal lands in order to exercise Tribal Treaty Rights. The Tribes assert their responsibility to preserve their Treaty Rights for future use of lands to ensure future opportunity, and therefore it is Tribal policy to "promote the conservation, protection, restoration, and enhancement of natural resources".

According to the Tribes, "access" to exercise Treaty Rights goes beyond the concept of simple entry into the Project Area by vehicle or foot. "Access" also includes continued availability of the traditional natural resources in an area. Therefore, the Tribal interpretation of loss of access extends to the exclusion, limitation, or unavailability of the traditional resources due to mining disturbance and road construction. It would also presumably apply to the displacement of wildlife in those areas.

Recreation
There are no known Tribal traditional camping areas on the CTNF. Most recreation in the Project Area is dispersed (no improvements). There are no developed campgrounds. The area does contain a semi-primitive motorized ROS area (see **Section 3.10**). The dominant type of dispersed recreation is hunting for elk, moose, and deer. Fishing occurs on Crow, Deer, and Diamond Creeks.

As discussed above, Tribal hunting and gathering rights, reserved by the 1868 Treaty, need no state regulations or permits to be exercised by tribal members. The Tribes' Fish & Game Department regulates and enforces the 1975 Tribal Fish & Game Code for all off-reservation hunting and fishing activities. Federal agencies recognize that the Tribes regulate their own Tribal members for hunting, and do not require Tribal members to secure State hunting or fishing permits within BLM or USFS lands.

Land Status

The Project Area is administered by the CTNF and is considered unoccupied federal lands; therefore, it is available for Treaty Rights use as stated in the Fort Bridger Treaty of 1868. These rights include hunting, fishing, gathering, and other practices such as trade. The Tribal concern is that changes in land status can diminish the locations at which the Tribes can exercise treaty rights; thus forcing Tribal members to relocate these activities to other areas or cease to exercise treaty rights on specific areas. It is the Shoshone Bannock Tribes' concern that the transfer or purchase of federal lands, and the extension of leases for mining on federal lands by private businesses enable them to control access and use, which jeopardizes access to certain Shoshone-Bannock traditional fishing, hunting, and gathering areas, as well as grazing and timber use (Shoshone-Bannock 2005).

Air Quality

Specific data regarding air resources is located in **Section 3.2** of this EIS. All lands within the Project Area have been designated Class II for National Ambient Air Quality Standards. The air quality in the vicinity of the Smoky Canyon Mine is good to excellent because of the site's remote location, and relatively limited industrial activity in the area. Air quality in the Study Area is designated as in attainment or unclassifiable for all NAAQS and Idaho Ambient Air Quality Standards.

Socioeconomics and Environmental Justice

See **Sections 3.16** and **3.17**, respectively, for data regarding socioeconomics and environmental justice (EO 12898).

EO12898 Section 4-4 directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife. The affected environment for wildlife and fish can be found in **Sections 3.7** and **3.8**, respectively.

3.14.3 Consultation

Native American consultation began with the initial public scoping effort for this Project. The public scoping letter was sent to the Tribes on September 15, 2003. A follow-up meeting was held with Tribal technical staff in Fort Hall on October 2, 2003. A field trip to the Project Area was conducted on October 14, 2003 to show Tribal specialists the area for the proposed mining activity. A response letter was received from the Tribes dated October 17, 2003. Tribal concerns outlined in the letter included: Trust Assets/Treaty Resources; the cultural significance of the area to the tribes; change in the interpretation of the area as unoccupied federal lands; specific disturbances of proposed mine support facilities; unreclaimed acres within a Roadless Area; minimization of overburden in external dumps; lack of watershed baseline data; development of new roads; preservation of the quality, quantity, and integrity of the Deer Creek and Manning Creek ecosystem and environment; and the size of the cumulative impacts area.

Field meetings, presentations at Fort Hall Reservation for tribal technical staff and the tribal council, agency-tribal meetings, and verbal and written communication have been utilized to keep the Tribes informed and apprised of the Project. Consultation to date is summarized in the following table.

TABLE 3.14-1 SUMMARY OF CONSULTATION

CONSULTATION TYPE	PARTIES INVOLVED	DATE
Scoping Letter	To Shoshone-Bannock Tribes from BLM and FS	September 15, 2003
Meeting	Shoshone-Bannock Tribal Technical Staff, BLM, FS	October 2, 2003
Field Meeting	Shoshone-Bannock Tribal Technical Staff, BLM, FS	October 14, 2003
Field Meeting	Shoshone-Bannock Tribes, BLM, FS, Simplot	October 30, 2003
Field Meeting	Shoshone-Bannock Tribal Cultural Committee, BLM	July 29, 2004
Letter	To Shoshone- Bannock Tribes from BLM and FS	August 26, 2004
Technical Consultation Meeting	Shoshone-Bannock Tribal Technical Staff, BLM, FS	April 15, 2005
Meeting	Shoshone-Bannock Tribal Land Use Policy Commission, Simplot	May 11, 2005
Letter	To Shoshone-Bannock Tribes from BLM	June 13, 2005
Tribal Business Council Meeting	Shoshone-Bannock Tribes Business Council, BLM, FS	June 27, 2005
Technical Consultation Meeting	Shoshone-Bannock Tribal Technical Staff, BLM, and Third-party contractor	July 18, 2005

Consultation with the Tribes will be on-going throughout the EIS process.

3.15 Transportation

The Smoky Canyon Mine is most commonly accessed by FR 110 (the Smoky Canyon Road). Under a special use permit for the buried slurry line that runs down the Smoky Canyon/Timber Creek Road, Simplot conducts normal maintenance on this road including removal of debris, blading, and shaping of roadway surfaces and ditches, repair of any roadway structures, restoration of eroded fills or berms, removal of snow, and installation of safety signs as appropriate. Except for normal maintenance, there are no repairs or general upgrades planned for the Smoky Canyon Road under the existing operations. The section of this road within the CNF is under USFS jurisdiction, with primary maintenance assigned to Simplot through the special use agreement. The sections of this road below the Forest boundary are under county jurisdiction (Caribou County, Idaho and Lincoln County, Wyoming), and Simplot performs primary maintenance of parts of these sections.

During the winter months, this road provides the only access to the Mine property. Current use for the Smoky Canyon Road includes continued access to upper Smoky Creek and further west to Timber Creek and the Diamond Creek area (during late spring through early fall months only), although primary use of the road is for mine access traffic used by mine employees, commercial vendors, and suppliers. From Auburn, Wyoming to the Wyoming/Idaho State line and then continuing west and south nearly another 5.2 miles, FR 110 is about 24 feet wide with an asphalt surface. From that point, it is an improved surface, gravel, double-lane road to the intersection with the mine haul road. A five-strand barbed wire fence lines the road on each side, and there are numerous cattle guards. As Smoky Canyon Road turns west, it transitions into a single lane, native surface road which connects with the Diamond Creek Road.

In order to estimate the approximate use of the Smoky Canyon Mine Road by employees and vendors, surveys of mine personnel were conducted that inquired about car-pooling and the use of either a car or pick-up truck for modes of transportation. Of the 214 full time employees that work at the Smoky Canyon Mine, 141 employees completed the survey. Of these, approximately two-thirds of the employees car-pool to and from the mine. Mine traffic is present seven days a week, 365 days a year, although approximately one-fourth of the employees work a standard Monday-Friday week. The majority of employees work 14 days per month (rotating 12-hour shifts of 3 days/week then 4 days/week). Thus, assuming that two-thirds of the employees car-pool, it was estimated that approximately 36 vehicles per day travel to the mine between Monday and Friday and an additional 105 vehicles working 12-hour rotating shifts travel on FR 110 seven days a week. The busiest times on this road would occur around shift changes and normal arrival and departure times from work that occur between 5:00 to 7:00 am and 5:00 to 6:00 pm. Saturdays and Sundays would have the least amount of travel on FR 110 from mine related (employees and vendors) traffic, but likely these are the busiest travel days by recreational users.

In addition, an estimate on the approximate number of vendor vehicles/visits to the mine each day was estimated using the Smoky Canyon Mine security log/sign-in sheets for the months of May and June 2004 and 20 random day counts (two per month) from January through September 2004. Based upon this data, it is estimated that approximately 15 vehicles/day from vendors/visitors use FR 110 to access the Smoky Canyon Mine. Visitor numbers to the mine are highest during the late spring months when groups of teachers and students take tours.

Although no traffic counts have been taken on roads within the Study Area, data was reviewed from a traffic counter on Crow Creek Road (located just south of Whiskey Flat Road, FR 114), approximately 10 miles south of the Wells Canyon Road (FR 146). Crow Creek Road, which generally follows Crow Creek through this fairly, narrow valley, is designated as a Forest Highway (FR 111), and serves as one of the main routes of access to the Project Area. Traffic counts taken between July 26 and October 25, 2000 indicated that summer use of this road averages about 20 vehicles per day during the week and 60 vehicles per day (includes both directions) during the weekends. During hunting season in October, those averages triple during weekdays and nearly double during weekends. These counts provide an example of use near the Project Area; however, actual use north of the Wells Canyon intersection along Crow Creek Road is expected to be higher (Tate 2004).

Crow Creek Road is closed due to snow cover at least 6 months of the year; year-round access is maintained only to the boundary of Sections 20 and 21 in T.9S R.46E, near the confluence of Sage Creek and Crow Creek. This is outside, or east of, the Forest boundary. The unplowed portions of Crow Creek Road through the Forest, as well as Wells Canyon Road, are groomed snowmobile trails in the winter.

Diamond Creek Road, Georgetown Canyon Road, and Wells Canyon Road are also considered primary routes across the CNF and are used to access the Study Area.

Active mine areas are closed to public travel for safety reasons, although Smoky Canyon Road is open to public traffic and crosses the area of active mining. Where it crosses, there is a gated guard station to prevent collisions between mine traffic and Smoky Canyon Road users.

3.16 Social & Economic Resources

3.16.1 Introduction

Social and economic resources are addressed for a large geographic area, based upon current conditions with phosphate mining in the area. The area directly affected by the Smoky Canyon Mine is southeastern Idaho and southwestern Wyoming, primarily, Bannock, Caribou, and Power Counties, Idaho and Lincoln County, Wyoming (**Figure 3.16-1**). The mining operation and mill and slurry pipeline pumping facilities are located in Caribou County, Idaho, and a phosphate fertilizer plant is located just west of Pocatello, Idaho in Power County. The mine is about five miles from the Idaho-Wyoming border and the majority of the employees at the mine site live in the Star Valley area of Lincoln County, Wyoming. There is a pumping facility at Conda, north of Soda Springs, in Caribou County, Idaho. Slurried concentrate from the mine is pumped to the Simplot fertilizer plant near Pocatello (Don Plant).

Figure 3.16-1 Four-County Area Directly Affected by the Don Plant and Smoky Canyon Mine

This section describes the socio-economic environment of the four counties. This includes the economic history, land ownership, population, demographics, employment, wages and income, housing, government finance, agriculture, and the economics of the U.S. phosphate industry.

To determine indirect and induced employment as a result of the Smoky Canyon Mine and the Don Plant, the area examined was expanded to the 27-county area shown in **Figure 3.16-2**. The mine purchases heavy equipment parts and operating supplies from dealers in Pocatello, Idaho and engineering supplies from vendors in Salt Lake City, Utah. Natural gas is a major feedstock for anhydrous ammonia and sulfuric acid. These two feedstocks have significant impact upon the cost of phosphate fertilizer manufacturing at the Simplot plant. The area of eastern Utah, northwestern Colorado, and southwestern Wyoming is a significant producer of natural gas, and the area's natural gas industry is integrated by the Questar Pipeline system and the Clay Basin Storage Facility in Daggett County, Utah. The population, employment, and personal income of the 27-county area examined for indirect and induced employment are described in this section.

Figure 3.16-2 Area Analyzed to Determine the Indirect and Induced Employment due to the Don Plant and the Smoky Canyon Mine

3.16.2 Economic History

Bannock County, Idaho

The first permanent Anglo settlement in Bannock County was Fort Hall, a fur trading post established in 1834 by Nathaniel Wyeth. He later sold the fort to the Hudson's Bay Company, which eventually abandoned the site. The Treaty with the Eastern Shoshone signed with Chief Washakie at Fort Bridger, Wyoming and the Treaty of Box Elder of 1863 with Chief Pocatello established the Fort Hall Reservation, which included much of present day Bannock County and surrounding areas. The Union Pacific Railroad purchased the Utah and Northern narrow gage in 1878 and extended the line north to Butte, Montana in 1881. The Oregon Short Line was built west from Wyoming, through Idaho, to Oregon in 1881-1884, crossing the Utah and Northern at the site of Pocatello. The railroad gradually purchased more land from the Bannock-Shoshone tribes until the town site was opened to settlement in 1902. The Academy of Idaho, the predecessor to Idaho State University, was established in 1910. It became an independent four-year institution in 1947 (Conley 1982). With a current enrollment of 12,500, approximately 16 percent of the Bannock County population, the presence of Idaho State University has a significant influence on the economy and demographics of Bannock County. The Gay Mine, a phosphate mine, operated from 1946 to 1993 and was located on the Fort Hall Reservation. It was the first open pit mine in southeast Idaho to mine federally-owned phosphate.

Caribou County, Idaho

Members of the LDS Church, at the direction of Brigham Young, settled in Caribou County in 1870. The Oregon Short Line Railroad reached Soda Springs in 1882, and Soda Springs became a local center for shipping wool and livestock. The phosphate deposits were discovered in 1889 by prospectors hunting for gold, and the first commercial fertilizer mine opened in 1906. In 1919, Soda Springs became the county seat of Caribou County, the youngest county in Idaho. Several phosphate mines have been developed in the county including Dry Valley Mine, Smoky Canyon Mine, Lanes Creek Mine, Conda Mine, Rasmussen Ridge Mine, Mountain Fuel Mine, Champ Mine, North Maybe Mine, Enoch Valley Mine, Henry Mine, Ballard Mine, and Wooley Valley Mine. Monsanto operates an elemental phosphorous plant north of Soda Springs. Agrium operates a wet acid phosphate fertilizer plant five miles northeast of Soda Springs.

Power County, Idaho

American Falls, the first settlement in Power County, Idaho, was a favorite campsite for emigrants on the Oregon Trail. The City of American Falls gradually evolved at the campsite and was made a station on the Union Pacific Railroad when the railroad was constructed. Cattle ranches were established in the area of Rockland as early as 1876. Power County was legally established in 1913, from parts of Bingham, Blaine, and Oneida Counties and was named after hydroelectric development at the American Falls on the Snake River. The construction of the American Falls dam and reservoir during the 1920s marked a major change in the area. The reservoir also inundated the original American Falls town site; which necessitated moving the town one-half mile to the east. American Falls dam resulted in the area becoming a center of wheat farming, and agriculture is a major portion of the county's economy (Federal Writers Project 1937, 1938). The county economy is further supported by the Don Plant, the Simplot phosphate fertilizer operation.

Lincoln County, Wyoming

After the area had been explored by fur trappers and crossed by pioneers utilizing the Lander Cutoff of the Oregon Trail, the first permanent settlers arrived in the 1870's from Utah. In terms of geography, social life, and attitudes, the area more closely resembles southeastern Idaho and northern Utah than Wyoming. Star Valley is populated by small towns approximately five to ten miles apart and separated by grazing and crop land, similar to southeastern Idaho and northern Utah, in contrast to most areas of Wyoming, which are characterized by cities and towns separated by large open areas utilized for ranching and natural resource extraction (Burton 1991).

Residents of Caribou County, Idaho and Star Valley often travel to Pocatello, Idaho, Evanston, Wyoming, and Salt Lake City, Utah for goods and services that are not available locally. Over the past several decades, the western portion of Wyoming has seen an influx of affluent residents, property owners, and tourists centered around Jackson, Wyoming, as has the entire Greater Yellowstone area. Many of these affluent property owners are part-time residents of western Wyoming and maintain permanent residences elsewhere. Simultaneously, the area's economy has become more dependent upon investment income (dividends, interest, and rent) and government transfer payments and less dependent upon mining and manufacturing (Sonoran Institute 2003).

Natural resources are important parts of the residents' lifestyle, recreational activities, and the economy of the three counties. However, in recent years, local leaders have taken steps to diversify the economy and lessen the dependence upon natural resources and the worldwide commodities markets.

3.16.3 Land Ownership and Population

The four counties are contiguous, with Power County, Idaho being the farthest west and Lincoln County, Wyoming being the farthest east. The location of the four counties in relationship to surrounding areas in Idaho, Utah, and Wyoming is shown in **Figure 3.16-1**. Bannock and Power Counties, Idaho comprise the Pocatello, Idaho Metropolitan Area as defined by the Office of Management and Budget. The other two subject counties are not part of any metropolitan statistical area. Government is a significant landowner in each of the three counties (**Table 3.16-1**). Power County has the highest percentage of privately owned land of the four counties. Lincoln County is the largest of the three counties and is over three times as large as Bannock County, the smallest of the four.

TABLE 3.16-1 LAND OWNERSHIP

DESCRIPTION	BANNOCK COUNTY, ID	CARIBOU COUNTY, ID	POWER COUNTY, ID	LINCOLN COUNTY, WY
Acres	712,448	1,130,304	899,648	2,729,157
Federal	32.9%	41.6%	33.4%	71.6%
State	6.7%	9.9%	3.0%	7.6%
City and County	1.7%	0.2%	0.4%	0.0%
Private	58.8%	48.2%	63.2%	20.8%

Source: Idaho Dept. of Commerce, 2003a, 2003b, 2003c. Wyoming State Almanac 2002.

Population

The population of Bannock County, Idaho is concentrated in the city of Pocatello. Pocatello had a 2000 population of 51,466, or 68.1 percent of the Bannock County, Idaho population. Soda Springs is the largest city in Caribou County, Idaho, with a population of 3,381, 46.3 percent of the Caribou County, Idaho population.

American Falls is the largest city in Power County, Idaho, with a population of 4,111 or 54.5 percent of the Power County, Idaho population. Lincoln County, Wyoming has two centers of population. Kemmerer, in the southern part of the county, is the county seat. Kemmerer and surrounding communities account for about 30 percent of the population. Kemmerer had a 2000 population of 2,651, while the nearby towns of Diamondville and Opal had populations of 716 and 102, respectively. The other population center in Lincoln County, Wyoming is the Star Valley in the northwest portion of the county. The Afton Census County Division, essentially Star Valley, had a 2000 population of 9,359. Approximately 174 of the Smoky Canyon Mine's 214 employees reside in the Star Valley.

The total population of the 27-county area analyzed for indirect and induced employment is just under 2 million persons (**Table 3.16-2**). Only 5.3 percent of the total population resides in the four directly affected counties.

TABLE 3.16-2 POPULATION IN THE 27-COUNTY AREA ANALYZED FOR INDIRECT AND INDUCED EMPLOYMENT, 2002 ESTIMATES

COUNTY	POPULATION	PERCENT	COUNTY	POPULATION	PERCENT
Garfield County, CO	47,249	2.4	Daggett County, UT	886	<0.05
Moffat County, CO	13,370	0.7	Davis County, UT	249,224	12.5
Rio Blanco County, CO	6,042	0.3	Duchesne County, UT	14,844	0.7
Routt County, CO	20,405	1.0	Morgan County, UT	7,380	0.4
Bannock County, ID	75,804	3.8	Rich County, UT	1,966	0.1
Bear Lake County, ID	6,360	0.3	Salt Lake County, UT	919,308	46.0
Bingham County, ID	42,458	2.1	Summit County, UT	31,857	1.6
Bonneville County, ID	85,180	4.3	Uintah County, UT	26,155	1.3
Caribou County, ID	7,319	0.4	Weber County, UT	204,167	10.2
Franklin County, ID	11,699	0.6	Lincoln County, WY	14,890	0.7
Oneida County, ID	4,131	0.2	Sublette County, WY	6,240	0.3
Power County, ID	7,379	0.4	Sweetwater County, WY	37,194	1.9
Box Elder County, UT	44,032	2.2	Uinta County, WY	19,793	1.0
Cache County, UT	93,695	4.7	Area Total	1,999,027	100.0

Source: U.S. Census Bureau, 2004a.

Demographics

The four subject counties are relatively uniform demographically. The average demographics for the four counties are highly influenced by Bannock County, Idaho, due to it containing 71.7 percent of the population of the four counties. The presence of Idaho State University in Bannock County, Idaho also influences the demographics. Bannock County, Idaho is 91.3 percent white, while Caribou County, Idaho, Power County, Idaho, and Lincoln County, Wyoming are 96.1percent, 83.8 percent, and 97.1 percent white, respectively. Hispanic is the most populous minority in each of the four counties. The largest Native American populations in the four subject counties are in Bannock and Power Counties, which include portions of the Fort Hall Indian Reservation. Native Americans represent 2.9 and 3.3 percent of these counties populations, respectively.

3.16.4 Employment

Unemployment in the four subject counties has trended downward during the 1990's, with an increase in the past several years (**Table 3.16-3**). Total employment in Bannock County increased from 29,228 to 36,882 from 1992 to 2002, respectively, while the unemployment rate dropped from 7.5 percent to 6.4 percent. Over the same time period, the unemployment rate in Caribou County dropped from 6.6 percent in 1992 to 5.8 percent in 2001 before increasing to 7.6 percent in 2002. The unemployment rate in Power County dropped from 7.4 percent in 1992 to 7.2 percent in 2001, before rising to 9.2 percent in 2002. The unemployment rate in Lincoln County dropped from 8.1 percent in 1992 to 5.4 percent in 2001, and increased to 6.2 percent in 2002.

TABLE 3.16-3 LABOR FORCE AND UNEMPLOYMENT

DESCRIPTION	1992	1999	2000	2001	2002
BANNOCK COUNTY, IDAHO					
Civilian Labor Force	31,601	39,192	39,502	40,751	39,383
Employment	29,228	37,123	37,533	38,818	36,882
Unemployment	2,373	2,069	1,969	1,932	2,501
Unemployment Rate	7.5%	5.3%	5.0%	4.7%	6.4%
CARIBOU COUNTY, IDAHO					
Civilian Labor Force	3,335	3,099	3,083	3,396	3,272
Employment	3,114	2,911	2,897	3,199	3,025
Unemployment	221	188	186	197	248
Unemployment Rate	6.6%	6.1%	6.0%	5.8%	7.6%
POWER COUNTY, IDAHO					
Civilian Labor Force	3,354	3,460	3,543	3,446	3,183
Employment	3,106	3,209	3,297	3,199	2,890
Unemployment	249	254	247	247	293
Unemployment Rate	7.4%	7.2%	7.0%	7.2%	9.2%
LINCOLN COUNTY, WYOMING					
Civilian Labor Force	6,328	6,615	6,596	6,798	6,695
Employment	5,814	6,209	6,253	6,433	6,283
Unemployment	514	406	343	365	412
Unemployment Rate	8.1%	6.1%	5.2%	5.4%	6.2%
NATIONWIDE					
Unemployment Rate	7.5%	4.2%	4.0%	4.7%	5.8%

Source: Idaho Department of Labor 2004a, 2004b, 2004c. Wyoming Department of Employment 2004a. Bureau of Labor Statistics, U.S. Dept. of Labor, Current Population Survey.

Changes in employment by industry for the four counties over the past several decades indicate that the economic structure of the area is changing (**Table 3.16-4**). While employment rose by over 85 percent from 1970 to 2000, not all industrial sectors participated equally. Mining employment peaked at 4.9 percent of total employment in 1980 and has since dropped to 1.5 percent. Much of the peak “mining” employment was due to oil and gas extraction in Lincoln County and is unrelated to the phosphate mining industry. The manufacturing industry, which includes the phosphate fertilizer and elemental phosphorus plants, added employment from 1970 to 2000, but the industry’s share of total employment dropped from 11.2 percent to 10.0 percent. By contrast, the services sector added jobs on both a relative and absolute basis from 1970 to 2000. Employment in the services sector increased by 174 percent from 1970 to 2000, while the sector’s share of total employment in the four counties increased from 16.0 percent to 23.5 percent.

Government is a major source of 2002 employment in each of the four counties (**Table 3.16-5**). Government accounts for 21.4 percent of employment in Bannock County, Idaho, 18.6 percent of employment in Lincoln County, Wyoming, 15.3 percent of Power County, Idaho, and 14.8 percent of employment in Caribou County, Idaho.

Other industrial sectors accounting for significant portions of employment in Bannock County, Idaho are retail trade (13.5 percent), health care (9.5 percent), accommodation and food services (7.4 percent), and manufacturing (6.2 percent).

Important industrial sectors in Caribou County, Idaho are manufacturing, farm employment, and construction. Mining, the sector that includes the phosphate mines accounts for 7.7 percent of

Caribou County employment. The phosphate processing plants are included under the manufacturing sector, which in 2001 accounted for 17.1 percent of employment in Caribou County, while construction accounted for 10.6 percent of employment (manufacturing and construction employment are not disclosed for Caribou County for 2002 to avoid disclosure of individual company data).

The largest industrial sector in Power County in terms of employment is manufacturing, which was responsible for 23.4 percent of employment in 2002. Of the four counties, Power County is also the most dependent upon farm employment, accounting for 20.1 percent of total employment.

Industrial sectors accounting for significant portions of employment in Lincoln County, Wyoming are construction (13.3 percent) and retail trade (11.5 percent). Although a large majority of the employees at the Smoky Canyon Mine live in Lincoln County, Wyoming, the employment is reported under Caribou County, Idaho, since that is where the actual employment occurs.

TABLE 3.16-4 EMPLOYMENT BY INDUSTRIAL SECTOR STANDARD INDUSTRIAL CLASSIFICATION (SIC) BASIS IN THE FOUR COUNTIES, 1970-2000

EMPLOYMENT BY INDUSTRY				
	1970	**1980**	**1990**	**2000**
Total full-time and part-time employment	32,800	47,073	46,592	61,086
Proprietor's employment	5,651	7,567	9,470	12,891
Mining	546[1]	2,294[1]	1,217[1]	923[1,2]
Construction	1,993	2,584	2,143	4,120
Manufacturing	3,663	6,443	5,128	6,096
Transportation and Public Utilities	3,457	4,175	3,343	3,176
Wholesale Trade	1,269[3]	1,734[3]	1,744[3]	2,070
Retail Trade	5,179	7,610	8,399	10,945
Finance, Insurance and Real Estate	1,892	3,420	3,010	3,523[4]
Services	5,238	7,037	8,906	14,330
Government	5,313	7,447	8,194	10,477
EMPLOYMENT BY INDUSTRY, PERCENT				
	1970	**1980**	**1990**	**2000**
Total full-time and part-time employment	100.0	100.0	100.0	100.0
Proprietor's employment	17.2	16.1	20.3	21.1
Mining	1.7[1]	4.9[1]	2.6[1]	1.5[1,2]
Construction	6.1	5.5	4.6	6.7
Manufacturing	11.2	13.7	11.0	10.0
Transportation and Public Utilities	10.5	8.9	7.2	5.2
Wholesale Trade	3.9[3]	3.7[3]	3.7[3]	3.4
Retail Trade	15.8	16.2	18.0	17.9
Finance, Insurance and Real Estate	5.8	7.3	6.5	5.8[4]
Services	16.0	14.9	19.1	23.5
Government	16.2	15.8	17.6	17.2

[1]Does not include Power County, Id. Mining Employment for Power County is not disclosed prior to 1995 and listed as less than 10 jobs in 1995 and afterward.
[2] Does not include Bannock County, Id. Mining Employment for Bannock County is not disclosed after 1997. In 1997, Mining Employment for Bannock County was 23.
[3] Does not include Power County, Id. Wholesale Trade Employment of Power County is not disclosed prior to 1994. Wholesale Trade Employment for Power County was 186 in 1994 and 196 in 2000.
[4] Does not include Power County, Id. Finance, Insurance and Real Estate Employment in Power County is not disclosed after 1998. In 1998 Finance, Insurance and Real Estate Employment in Power County was 138.
Note: May not sum to the total due to exclusion of several minor categories.
Source: Bureau of Economic Analysis 2004a.

TABLE 3.16-5 EMPLOYMENT BY INDUSTRIAL SECTOR, 2002 NORTH AMERICAN INDUSTRIAL CLASSIFICATION SYSTEM (NAICS) BASIS

INDUSTRY	BANNOCK COUNTY, ID	CARIBOU COUNTY, ID	POWER COUNTY, ID	LINCOLN COUNTY, WY
Total employment	42,506	4,752	4,760	8,377
Farm Employment	807	681	957	676
Forestry, fishing, and other	D	D	D	78
Mining	D	367	12	478
Utilities	D	34	D	D
Construction	2,589	D	254	1,114
Manufacturing	2,654	D	1113	341
Wholesale Trade	1,193	78	D	D
Retail Trade	5,721	493	308	960
Transportation and Warehousing	D	96	323	221
Information	808	45	D	146
Finance and Insurance	1,819	85	109	238
Real Estate and Rental and Leasing	1,272	103	46	326
Professional, Scientific, and Technical Services	1,936	101	D	314
Management of Companies and Enterprises	220	0	D	D
Administrative and Waste Services	2,624	202	137	D
Educational Services	313	20	L	22
Health Care and Social Assistance	4,035	149	D	D
Arts, Entertainment, and Recreation	735	D	44	127
Accommodation and Food Services	3,130	D	128	559
Other Service, Except Public Administration	2,080	188	1527	372
Government	9,091	705	731	1,560

D: Not disclosed to avoid revealing individual company data. L: Less than 10 jobs, but the estimates for this item are included in the totals.
Source: Bureau of Economic Analysis 2004b.
Note: May not necessarily agree with data reported by state employment agencies.

Major employers in Bannock County, Idaho are AMI Semiconductor, Inc., Ballard-Kimberly Clark Medical Products, Convergys Customer Management, Farm Bureau Insurance, Farmers Insurance Group, Idaho State University, Pine Ridge Mall, Portneuf Medical Center, Qwest Communications, and Union Pacific Railroad (IDL 2004a).

Major employers in Caribou County, Idaho are Agrium U.S. Inc., Caribou Memorial Hospital, Caribou County, Dravo Corporation, Heritage Safe Company, Monsanto Company, and Washington Group International (IDL 2004b).

Major employers in Power County, Idaho are American Falls School District, Direct Communications, Double L Manufacturing, Harms Memorial Hospital, J. R. Simplot Company, Lamb Weston, and Power County (IDL 2004c).

Major employers in the Star Valley are Lincoln County School District #2, Lincoln County Government, Lower Valley Energy, the Simplot Smoky Canyon Mine, Aviat, Star Valley Cheese, Freedom Arms, and Maverick Corporation (Lincoln County Profile 1998).

The 27-county area analyzed for indirect and induced employment has a total civilian labor force of just over 1 million persons (**Table 3.16-6**). The unemployment rate averaged 5.8 percent over the area in 2002, with a low of 2.3 percent in Rio Blanco County, Colorado to a high of 9.2 percent in Power County, Idaho.

TABLE 3.16-6 LABOR FORCE AND EMPLOYMENT IN THE 27-COUNTY AREA ANALYZED FOR INDIRECT AND INDUCED EMPLOYMENT, 2002

COUNTY	CIVILIAN LABOR FORCE	EMPLOYED	UNEMPLOYED	UNEMPLOYMENT RATE, PERCENT
Garfield County, CO	25,813	24,816	997	3.9
Moffat County, CO	6,408	6,037	371	5.8
Rio Blanco County, CO	3,372	3,295	77	2.3
Routt County, CO	12,387	12,007	380	3.1
Bannock County, ID	39,383	36,882	2,501	6.4
Bear Lake County, ID	2,832	2,677	155	5.5
Bingham County, ID	22,424	21,422	1,002	4.5
Bonneville County, ID	48,764	47,013	1,751	3.6
Caribou County, ID	3,272	3,025	248	7.6
Franklin County, ID	5,094	4,877	217	4.3
Oneida County, ID	1,697	1,624	74	4.3
Power County, ID	3,183	2,890	293	9.2
Box Elder County, UT	18,472	17,224	1,248	6.8
Cache County, UT	47,915	45,866	2,049	4.3
Daggett County, UT	467	445	22	4.7
Davis County, UT	124,391	117,947	6,444	5.2
Duchesne County, UT	6,544	5,991	553	8.5
Morgan County, UT	3,850	3,656	194	5.0
Rich County, UT	1,088	1,032	56	5.1
Salt Lake County, UT	514,614	482,260	32,354	6.3
Summit County, UT	16,647	15,186	1,461	8.8
Uintah County, UT	12,563	11,714	849	6.8
Weber County, UT	108,169	101,170	6,999	6.5
Lincoln County, WY	6,695	6,283	412	6.2
Sublette County, WY	3,501	3,411	90	2.6
Sweetwater County, WY	19,790	18,851	939	4.7
Uinta County, WY	11,345	10,695	650	5.7
Area Total	1,070,680	1,008,296	62,384	5.8

Source: Colorado Department of Labor and Employment 2004. Idaho Department of Labor 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2004g, 2004h. Utah Department of Workforce Services 2004, Wyoming Department of Employment 2004a.

3.16.5 Income

Caribou County, Idaho has the highest average annual wage of the four counties. From 1980 to 2002, Caribou County's average annual, nonagricultural wage increased at an annual rate of 3.4 percent. The average annual wage in Bannock, Power, and Lincoln Counties increased at 3.0 percent, 2.8 percent and 2.6 percent, respectively. Lincoln County, Wyoming's average wage peaked at $22,140 in 1985, dropped to $20,150 in 1990 and has since recovered to $26,621. As with employment, the peak in the average wage in Lincoln County was due to the oil boom during the 1980s.

Lincoln County has the highest median household income, followed closely by Caribou County. Similarly, Lincoln County has the fewest number of household in the lower income brackets, and Power County has the highest number of households in the lower income brackets. The Afton Census County Division (CCD) has a median household income of $39,648, higher than any of the three Idaho counties, but lower than the average for Lincoln County.

Within Star Valley, Turnerville has the highest household income of $52,857, followed by Star Valley Ranch ($47,981), Alpine ($45,313), Etna ($42,917), Bedford ($40,469), Afton ($37,292), Fairview ($35,568), Auburn ($33,125), Grover ($32,500), Smoot ($32,273), and Thayne

($31,875) (Decennial Census 2000e). Within Star Valley, the highest household incomes occur in communities in the northern part of the valley that have been influenced greatest by persons moving to Star Valley for recreational and similar reasons. Communities in the southern portion of Star Valley, which rely more on the traditional industries of agriculture and natural resource extraction, tend to have lower household incomes.

The structural change in the four counties' economy over the past several decades is further shown by the changes in sources of personal income (**Table 3.16-7**). Investments have been rising as a source of personal income in the four counties, with Dividends, Interest, and Rent rising from 11.3 to 17.7 percent of total personal income. Similarly, the Services sector rose from 10.0 percent of workplace earnings to 16.4 percent. The Mining sector peaked at 9.6 percent of workplace earnings in 1980 and has since declined to 3.4 percent of workplace earnings. Manufacturing peaked at 19.6 percent of workplace earnings in 1980, with the 2000 share 11.6 percent.

TABLE 3.16-7 PERSONAL INCOME BY SOURCE (SIC BASIS) IN THE FOUR COUNTIES, 1970-2000

TOTAL PERSONAL INCOME BY SOURCE, $1,000				
	1970	**1980**	**1990**	**2000**
Total Personal Income	259,058	845,156	1,349,920	2,209,166
Dividends, Interest, and Rent	29,132	113,377	217,889	388,222
Transfer Payments	21,563	86,835	175,155	318,351
Mining	8,063[1]	66,457[1]	44,878[1]	49,926[2]
Construction	19,190	48,542	49,604	115,956
Manufacturing	29,986	134,013	159,816	257,252
Transportation and Public Utilities	34,069	104,235	133,449	146,577
Wholesale Trade	10,170[3]	29,616[3]	38,892[3]	65,161
Retail Trade	25,198	65,378	91,757	142,094
Finance, Insurance and Real Estate	9,574	29,968	42,101	69,403[4]
Services	22,356	74,965	126,982	268,545
Government	34,063	103,659	208,137	370,233
TOTAL PERSONAL INCOME BY SOURCE, PERCENT				
	1970	**1980**	**1990**	**2000**
Total Personal Income	100.0	100.0	100.0	100.0
Dividends, Interest, and Rent	11.2	13.4	16.1	17.6
Transfer Payments	8.3	10.3	13.0	14.4
Mining	3.1[1]	7.9[1]	3.3[1]	2.3[2]
Construction	7.4	5.7	3.7	5.2
Manufacturing	11.6	15.9	11.8	11.6
Transportation and Public Utilities	13.2	12.3	9.9	6.6
Wholesale Trade	3.9[3]	3.5[3]	2.9[3]	2.9
Retail Trade	9.7	7.7	6.8	6.4
Finance, Insurance and Real Estate	3.7	3.5	3.1	3.1[4]
Services	8.6	8.9	9.4	12.2
Government	13.1	12.3	15.4	16.8

[1]Does not include Power County, Id. Mining Income is not disclosed for Power County prior to 1994. Mining Income in Power County was $621,000 in 1994 and $693,000 in 2000.
[2] Does not include Bannock County, Id. Mining Income is not disclosed for Bannock County after 1997. Mining Income in Bannock County was $687,000 in 1997.
[3] Does not include Power County, Id. Wholesale Trade Income is not disclosed for Power County prior to 1994. Wholesale Trade Income for Power County was $14,960,000 in 1994 and $6,704,000 in 2000.
[4] Does not include Finance, Insurance, and Real Estate for Power County, Id. Finance, Insurance, and Real Estate Income is not disclosed for Power County after 1999. Finance, Insurance, and Real Estate Income for Power County was $2,161,000 in 1999.
Note: May not sum to the total due to exclusion of several minor categories.
Source: Bureau of Economic Analysis 2004c.

Personal income in the four-county area is concentrated in Bannock County, with 71.5 percent of the personal income (**Table 3.16-8**). This is in line with the population distribution between the four counties, with Bannock County containing 71.9 percent of the population.

Bannock County has the most diversified sources of earnings of the four counties. Government employment is responsible for 28.3 percent of earnings in Bannock County, followed by Health Care (10.5 percent) and Manufacturing (10.5 percent). In determining Personal Income for Bannock County, there is a positive adjustment for residence of $122 million, indicating a net commuting outside of the county for employment.

Caribou County's sources of earnings are more concentrated, indicating a less diversified economy. Manufacturing, which includes the phosphate processing plants, was responsible for 37.5 percent of earnings in the county in 2001. In 2002, manufacturing earnings for Caribou County were not disclosed to avoid disclosure of individual company data. In determining Personal Income for Caribou County, there is a negative adjustment for residence of $36 million, indicating a net commuting into the county for employment.

Power County has the least diversified economy of the four counties; only two industries account for over half of the earnings in Power County. Manufacturing accounts for 31.5 percent of earnings while farm earnings account for an additional 25.1 percent. In determining Personal Income, there is a negative adjustment for residence of $32 million, indicating a net commuting into the county for employment.

In Lincoln County, government is responsible for 23.4 percent of earnings, while mining accounts for an additional 14.4 percent. For Lincoln County, there is a positive adjustment for residence of $29 million in determining total personal income, indicating a net commuting outside of the county for employment. Dividends, interest, and rents are responsible for a quarter (25.2 percent) of personal income in Lincoln County.

The average annual wage in the 27-county area analyzed for indirect and induced employment was $31,014 in 2002 (**Table 3.16-9**). The average annual wage varied from a low of $18,176 in Oneida County, Idaho to a high of $33,345 in Salt Lake County, Utah. The average per capita personal income for the 27-county area was $26,632 in 2002. Daggett County, Utah had the lowest per capita personal income of the 27 counties, with $17,330. The county with the highest per capital personal income was Summit County, Utah with $45,121.

3.16.6 Travel-related Employment and Wages

Most employees at the Smoky Canyon Mine reside in the Star Valley where, in addition to the traditional mining and agriculture industrial sectors, tourism is playing an increasingly important role in the local economy. Between 1990 and 2000, the number of housing units in the Afton CCD held for seasonal, recreational, or occasional use increased from 520 to 843, while the total number of housing units in the Star Valley increased from 2,889 to 4,365. A study conducted by Dean Runyan Associates in 2003 for the Wyoming State Office of Travel and Tourism and the Wyoming Business Council determined there were approximately 600 jobs in Lincoln County that are directly attributable to spending by travelers (Dean Runyan Associates, 2003). An update for 2003 placed the number at 690 jobs in Lincoln County directly attributable to traveler spending. With approximately 6,000 total jobs in Lincoln County, travel-related jobs account from about 11 to 12 percent of total employment (**Table 3.16-10**).

TABLE 3.16-8 PERSONAL INCOME BY SOURCE, 2002 (NAICS BASIS)

PERSONAL INCOME AND EARNINGS	BANNOCK COUNTY, ID		CARIBOU COUNTY, ID		POWER COUNTY, ID		LINCOLN COUNTY, WY	
	INCOME/ EARNINGS, $1,000	% OF TOTAL	INCOME/ EARNINGS, $1,000	% OF TOTAL	INCOME/ EARNINGS, $1,000	% OF TOTAL	INCOME/ EARNINGS, $1,000	PERCENT OF TOTAL
INCOME BY PLACE OF RESIDENCE								
Personal income	1,726,039	100.0[a]	157,683	100.0[a]	159,599	100.0[a]	371,943	100.0[a]
Derivation of Personal Income:								
Earnings by place of work	1,193,427	100.0[b]	156,429	100.0[b]	153,981	100.0[b]	223,333	100.0[b]
less: Contributions for government social insurance	148,733	12.5[b]	18,745	12.0[b]	15,079	9.8[b]	24,859	11.1[b]
plus: Adjustment for residence	122,390	10.3[b]	-36,124	-23.1[b]	-31,830	-20.7[b]	28,552	12.8[b]
equals: Net earnings by place of residence	1,167,084	67.6[a]	101,560	64.4[a]	107,072	67.1[a]	227,026	61.0[a]
plus: Dividends, interest, and rent	255,827	14.8[a]	31,886	20.2[a]	25,465	16.0[a]	93,661	25.2[a]
Plus: Personal current transfer receipts	303,128	17.6[a]	24,237	15.4[a]	27,062	17.0[a]	51,256	13.8[a]
EARNINGS BY PLACE OF WORK BY TYPE								
Wage and salary disbursements	862,168	72.2[b]	112,975	72.2[b]	99,765	64.8[b]	155,813	69.8[b]
Supplements to wages and salaries	210,664	17.7[b]	28,408	18.2[b]	23,352	15.2[b]	34,193	15.3[b]
Proprietors' income	120,595	10.1[b]	15,046	9.6[b]	30,864	20.0[b]	33,327	14.9[b]
Farm proprietors' income	5,944	0.5[b]	5,766	3.7[b]	23,877	15.5[b]	-1,582	-0.7[b]
Nonfarm proprietors' income	114,651	9.6[b]	9,280	5.9[b]	6,987	4.5[b]	34,909	15.6[b]
EARNINGS BY PLACE OF WORK BY INDUSTRY								
Farm earnings	8,152	0.7[b]	10,713	6.8[b]	38,656	25.1[b]	1,262	0.6[b]
Nonfarm earnings	1,185,275	99.3[b]	145,716	93.2[b]	115,325	74.9[b]	222,071	99.4[b]
Forestry, fishing, related activities, and other	(D)	(D)[b]	(D)	(D)[b]	(D)	(D)[b]	1,441	0.6[b]
Mining	(D)	(D)[b]	20,834	13.3[b]	499	0.3[b]	32,114	14.4[b]
Utilities	(D)	(D)[b]	1,824	1.2[b]	(D)	(D)[b]	(D)	(D)[b]
Construction	72,376	6.1[b]	(D)	(D)[b]	7,563	4.9[b]	34,806	15.6[b]
Manufacturing	124,979	10.5[b]	(D)	(D)[b]	48,577	31.5[b]	8,909	4.0[b]
Wholesale trade	47,364	4.0[b]	2,799	1.8[b]	(D)	(D)[b]	(D)	(D)[b]
Retail trade	108,009	9.1[b]	7,773	5.0[b]	4,359	2.8[b]	14,690	6.6[b]
Transportation and warehousing	(D)	(D)[b]	3,463	2.2[b]	8,805	5.7[b]	11,543	5.2[b]
Information	25,568	2.1[b]	922	0.6[b]	(D)	(D)[b]	3,831	1.7[b]
Finance and insurance	54,050	4.5[b]	1,640	1.0[b]	2,060	1.3[b]	6,198	2.8[b]
Real estate and rental and leasing	15,762	1.3[b]	562	0.4[b]	405	0.3[b]	4,598	2.1[b]
Professional and technical services	56,357	4.7[b]	2,536	1.6[b]	(D)	(D)[b]	8,700	3.9[b]
Management of companies and enterprises	11,446	1.0[b]	0	0.0[b]	(D)	(D)[b]	(D)	(D)[b]
Administrative and waste services	34,208	2.9[b]	3,743	2.4[b]	3,505	2.3[b]	(D)	(D)[b]
Educational services	3,983	0.3[b]	(L)	(L)[b]	61	0.0[b]	(L)	(L)[b]
Health care and social assistance	125,675	10.5[b]	2,663	1.7[b]	(D)	(D)[b]	(D)	(D)[b]
Arts, entertainment, and recreation	6,591	0.6[b]	(D)	(D)[b]	341	0.2[b]	2,672	1.2[b]
Accommodation and food services	34,474	2.9[b]	(D)	(D)[b]	885	0.6[b]	5,107	2.3[b]
Other services, except public administration	34,548	2.9[b]	2,323	1.5[b]	2,238	1.5[b]	5,345	2.4[b]
Government and government enterprises	337,552	28.3[b]	22,713	14.5[b]	22,894	14.9[b]	52,181	23.4[b]

[a] Income components of percent of total personal income. [b] Earnings components as percent of total earnings. (D) Not shown to avoid disclosure of individual company information. (L) Less than $50,000. Data included in totals. Source: Bureau of Economic Analysis 2004d.

TABLE 3.16-9 PERSONAL INCOME IN THE 27-COUNTY AREA ANALYZED FOR INDIRECT AND INDUCED EMPLOYMENT, 2002

COUNTY	AVERAGE ANNUAL WAGE ($)	NONAGRICULTURAL PAYROLL ($1,000)	TOTAL PERSONAL INCOME($1,000)	PER CAPITA PERSONAL INCOME ($)
Garfield County, CO	30,899	900,745	1,273,080	27,121
Moffat County, CO	30,205	208,259	323,884	24,136
Rio Blanco County, CO	29,388	131,325	164,498	27,439
Routt County, CO	30,406	588,076	753,228	36,976
Bannock County, ID	25,190	1,161,125	1,726,039	22,754
Bear Lake County, ID	19,023	44,711	121,388	19,320
Bingham County, ID	23,977	460,840	883,126	20,839
Bonneville County, ID	28,107	1,628,462	2,197,906	25,815
Caribou County, ID	33,005	149,483	157,683	21,749
Franklin County, ID	20,611	75,952	230,732	19,610
Oneida County, ID	18,176	25,477	72,682	17,620
Power County, ID	25,987	147,391	159,599	21,512
Box Elder County, UT	32,635	789,479	948,070	21,563
Cache County, UT	23,670	1,291,595	1,867,795	19,792
Daggett County, UT	23,829	14,124	15,476	17,330
Davis County, UT	30,441	3,955,306	6,471,276	25,947
Duchesne County, UT	26,093	188,366	309,876	20,854
Morgan County, UT	26,019	70,191	166,904	22,397
Rich County, UT	19,150	14,978	44,823	22,963
Salt Lake County, UT	33,345	24,835,467	26,184,005	28,539
Summit County, UT	27,133	699,045	1,439,132	45,121
Uintah County, UT	26,323	375,353	480,620	18,341
Weber County, UT	27,790	3,285,935	4,948,880	24,315
Lincoln County, WY	26,621	216,750	371,943	24,948
Sublette County, WY	27,807	103,100	193,972	31,331
Sweetwater County, WY	32,322	972,476	1,131,418	30,400
Uinta County, WY	28,299	352,937	547,651	27,725
Area Total	31,014	42,686,948	53,185,686	26,632

Source: Bureau of Economic Analysis, 2004e.

TABLE 3.16-10 TOTAL AND TRAVEL-RELATED EMPLOYMENT IN LINCOLN COUNTY, WYOMING

	1999	2000	2001	2002	2003
Total Employment	5,083	5,006	5,224	5,234	6,078
Travel-related Employment	600	600	590	630	690
Travel-related Employment, percent of Total	11.8	12.0	11.3	12.0	11.4

Source: Dean Runyan Associates, 2003. Wyoming Business Council, 2004. Wyoming Department of Employment, 2004a.

Travel-related employment is not nearly as important to the three Idaho counties as it is in Lincoln County, Wyoming. Travel-related employment accounted for 1,130 jobs in Bannock County, 124 jobs in Caribou County, and 266 jobs in Power County, Idaho in 1997 (Dean Runyan Associates, 1999). Total employment in the three Idaho counties was 36,607, 3,118, and 3,267 for Bannock, Caribou, and Power Counties, respectively in 1997. Therefore, travel-related employment was responsible for 3.1 percent, 4.0 percent, and 8.1 percent of total employment in Bannock, Caribou, and Power Counties.

Mining employment has higher annual wages than does industrial sectors commonly associated with travel-related spending. The average annual wage for mining in Caribou County, Idaho (site of the Smoky Canyon Mine) was $44,657 (Bureau of Labor Statistics 2004). By comparison, the average annual wage in Lincoln County, Wyoming for six industrial sectors commonly identified with travel-related employment was under $20,000 (**Table 3.16-11**). For this comparison it is necessary to compare mining wages in Caribou County, Idaho to wage for the travel-related industrial codes in Lincoln County, Wyoming because most of the employees at the Smoky Canyon Mine (which is in Caribou County) live in Lincoln County, and most other employment opportunities for the mine's employees would be in Lincoln County.

TABLE 3.16-11 EMPLOYMENT AND AVERAGE WAGE FOR MINING AND TRAVEL-RELATED INDUSTRIAL SECTORS, LINCOLN COUNTY, WYOMING 2003

	AVERAGE ANNUAL EMPLOYMENT	AVERAGE ANNUAL WAGE, $
Mining (NAICS 21)	376	44,657
Retail Trade (NAICS 44-45)	682	15,488
Real Estate (NAICS 53)	37	8,873
Administrative (NAICS 56)	55	19,687
Arts, Entertainment & Recreation (NAICS 71)	29	13,569
Accommodations & Food Services (NAICS 72)	469	7,447
Other Services (NAICS 81)	89	18,564

Note: Mining data is for Caribou County, Idaho. Other Data is for Lincoln County, Wyoming. Average Annual Wage for the travel-related industrial sectors was calculated by the preparer using data from the Wyoming Department of Employment.
Source: Bureau of Labor Statistics, 2004, Wyoming Department of Employment, 2004b.

3.16.7 Local Government Finances

Local government finances for the four counties are summarized in **Table 3.16-12**. These data include all local governments - not only county governments, but also any municipalities, school districts, and special districts within the counties. Bannock County had the highest general revenue, and lowest per capita taxes. Caribou County had the lowest general revenue, and Lincoln County had the highest per capita taxes. Each county spent the largest percentage of its budget on education, with health and hospitals, and highways following. Lincoln County had the highest outstanding debt per capita, followed by Caribou, Power, and Bannock Counties.

TABLE 3.16-12 LOCAL GOVERNMENT FINANCES

DESCRIPTION	BANNOCK COUNTY, ID	CARIBOU COUNTY, ID	POWER COUNTY, ID	LINCOLN COUNTY, WY
General Revenue (million $)	177.4	24.7	25.3	59.3
Intergovernmental Transfers (million $)	69.3	11.5	10.0	23.0
Total Taxes (million $)	39.1	6.9	8.3	18.4
Per Capita Taxes ($)	530	934	999	1,324
Per Capita Property Taxes ($)	505	864	990	1,187
Direct General Expenditures (million $)	171.1	26.3	26.0	63.7
Per Capita Direct General Expenditures ($)	2,317	3,568	3,130	5,492
Education	40.7%	47.7%	41.8%	50.6%
Health and Hospitals	26.7%	14.4%	16.7%	8.4%
Police	5.0%	5.3%	3.8%	3.3%
Public Welfare	0.7%	0.6%	0.6%	0.2%
Highways	4.2%	11.5%	10.1%	3.6%
Total Outstanding Debt (million $)	43.1	10.1	13.7	147.9
Per Capita Outstanding Debt ($)	584	1,375	1,657	10,666

Source: Gaquin and DeBrant 2002.

Crow Creek Valley, within Caribou County, Idaho is the location of seven housing census units (**Table 3.16-13**). There is one housing census unit in Census Block 1155, which is the area south and east of the Crow Creek Road. The other six housing census units in Crow Creek Valley are in Census Block 1161, which is west of Crow Creek Road and south of the Wells Canyon Road. Field visits to this area indicate that there are five houses/ranches north of the Wells Canyon Road and one ranch (Crow Creek Ranch), approximately one mile south of the Wells Canyon Road (see **Figures 2.6-11a and 2.6-11b**). In Lincoln County, Wyoming there are an additional five housing units between the Idaho/Wyoming State Line and the Crow Creek Road/Loch Avenue intersection that is located at the mouth of the Crow Creek drainage as it enters into Star Valley.

TABLE 3.16-13 HOUSING UNITS IN THE CROW CREEK VALLEY BY CENSUS BLOCK

CENSUS BLOCK	HOUSING UNITS	OCCUPIED HOUSING UNITS	SEASONAL, RECREATIONAL, OR OCCASIONAL USE
1155	1	0	1
1156	0	0	0
1157	0	0	0
1158	0	0	0
1159	0	0	0
1160	0	0	0
1161	6	0	6
1230	0	0	0
1231	0	0	0

Source: U.S. Census Bureau 2000a
Note: Census Blocks correspond to those shown in Figure 3.16-3 for Census Tract 9602, Block Group 1 in Caribou County, Idaho.

3.16.8 Agriculture

Agriculture plays a significant role in the economies of each of the four counties (**Table 3.16-14**). Power County is the most significant of the four counties in agricultural production, producing nearly $121 million worth of agricultural products in 1997. The value of production is dominated by crops in Bannock, Caribou, and Power Counties, while livestock accounts for the majority of production in Lincoln County. While crops dominate the value in the three Idaho Counties, cattle are also significant. Cattle accounts for 27.4 percent of the total value of production in Bannock County, 21.9 percent in Caribou County, and 25.8 percent in Power County. Potatoes, wheat, and barley are significant crops in the three Idaho counties, while dairy and sheep are important components of agriculture in Lincoln County (National Agricultural Statistics Service 1997a, 1997b, 1997c, 1997d).

TABLE 3.16-14 AGRICULTURAL PRODUCTION

DESCRIPTION	BANNOCK COUNTY, ID		CARIBOU COUNTY, ID		POWER COUNTY, ID		LINCOLN COUNTY, WY	
Value of Production ($)	25,032,000		42,918,000		120,975,000		22,969,000	
Crops	62%		69%		72%		13%	
Livestock	38%		31%		28%		87%	
Major Commodities (% of total value)	Cattle	27.4%	Barley	27.9%	Potatoes	48.5%	Cattle	56.5%
	Potatoes	22.6%	Cattle	21.9%	Cattle	25.8%	Dairy	18.2%
	Wheat	22.6%	Potatoes	(D)	Wheat	20.6%	Sheep	10.6%
	Hay	9.4%	Wheat	16.0%	Dairy	1.2%	Hay	8.5%percent
	Dairy	7.1%	Dairy	5.5%	Nursery	(D)	Barley	4.1%

Source: National Agricultural Statistics Service 1997a, 1997b, 1997c, 1997d
(D) Not shown to avoid disclosure of individual company information.

Power County, Idaho has the largest and most profitable farms of the four counties (**Table 3.16-15**). The average farm in Power County returned $52,777 in 1997. The farms in the other three counties are not as profitable as those in Power County. For comparison, the average farm in Lincoln County, Wyoming, returned only $12,244.

Collectively, the four counties contained 1,918 farms in 1997 (defined as those with sales of agricultural products of $1,000 or more). The average sales per farm was $110,477, although 49.5 percent of the farms had sales of less than $10,000, and the average return after expenses was $21,021. Nearly half of those engaged in farming (49.3 percent) had a principal occupation other than farming, while 56.0 percent worked at least one day during the year off the farm, and 36.5 percent worked more than 200 days off the farm (National Agricultural Statistics Service 1997e, 1997f, 1997g, 1997h). While agriculture plays a large role in the identity and social life of the area, outside employment is usually necessary in addition to farming.

TABLE 3.16-15 AGRICULTURAL ECONOMICS

	BANNOCK COUNTY, ID	CARIBOU COUNTY, ID	POWER COUNTY, ID	LINCOLN COUNTY, WY	FOUR-COUNTY AREA
Number of Farms	664	427	323	504	1,918
Average Size (acres)	446	1,099	1,313	810	840
Average Return ($)	$7,756	$27,989	$52,777	$12,244	$21,021
Sales less than $10,000 (%)	64.3%	40.5%	32.2%	48.6%	49.5%
Operators Principal Occupation is other than Farming (%)	59.5%	42.2%	34.4%	51.6%	49.3%
Operators Work off the Farm (%)	63.0%	48.2%	45.2%	60.5%	56.0%
Operators Work more than 200 days off the Farm (%)	46.1%	27.4%	26.3%	38.3%	36.5%

Source: National Agricultural Statistics Service 1997e, 1997f, 1997g, 1997h.

3.16.9 Phosphate Mining and Processing Industry

Phosphate is an essential component of the nitrogen-phosphorus-potassium fertilizers that are consumed by the world's agricultural industry. Phosphate rock minerals are the only significant global source of phosphorus. The United States is the world's leading producer and consumer of phosphate rock, which is used to produce fertilizers and industrial products.

Since phosphate mining began in southeastern Idaho, there have been a total of 31 phosphate mines in the area (USGS 2001c). Of these, 12 were small underground mines, all of which produced small quantities of ore and have been closed for years. There have been 20 surface mining operations of which those with significant production and surface area include: Waterloo, Conda, Gay, Ballard, Maybe Canyon, Georgetown Canyon, Mountain Fuel, Henry, Little Long Valley, Lanes Creek, Champ, Smoky Canyon, Enoch Valley, Rasmussen Ridge, and Dry Valley. More than 90 percent of phosphate rock mined in 2002 was used to produce fertilizers and animal feed supplements. The major fertilizer products are super phosphoric acid (SPA), diammonium phosphate (DAP), monoammonium phosphate (MAP), granular triple super phosphate (TSP), and wet process phosphoric acid (WPPA). The WPPA is a feedstock for DAP, MAP, and TSP.

Major feedstocks other than phosphate rock required for the production of ammonium phosphate fertilizers are anhydrous ammonia and sulfuric acid. Most ammonia is manufactured by the Haber process, where nitrogen gas and hydrogen gas are reacted at high temperature and pressure in the presence of a metallic iron catalyst. The nitrogen is obtained from air, and the hydrogen is usually obtained by reforming hydrocarbons with steam to form hydrogen gas and carbon dioxide. Natural gas is commonly the hydrocarbon used to manufacture hydrogen gas (Kroschwitz 1993a).

Sulfuric acid is manufactured by burning sulfur to sulfur dioxide, then reacting the sulfur dioxide with oxygen and water to form sulfuric acid. Over 90 percent of sulfur produced in the United States and Canada is currently recovered from sulfur-containing natural gas and crude oil, with the remaining recovered as sulfuric acid as a byproduct of roasting and smelting sulfide metal ores (Chemical Market Reporter 2003a, 2003b; USGS 2004d). With the natural gas industry supplying two of the major feedstocks for manufacturing ammonium phosphate fertilizers, the fertilizer industry is very sensitive to changing economics in the natural gas industry.

The sulfuric acid is reacted with phosphate rock to produce WPPA and gypsum. The WPPA is then reacted with anhydrous ammonia in the presence of steam and water to produce ammonium phosphate fertilizer. By altering the operating conditions and ratio of the feed material, either DAP or MAP can be manufactured.

Most large ammonium phosphate fertilizer plants are vertically integrated, with onsite sulfuric acid and ammonia manufacturing facilities, although ammonia manufacturing at the Don Plant has been discontinued, and Simplot is purchasing anhydrous ammonia on the open market. Fertilizer manufacturing accounts for 70 percent of sulfuric acid consumption in the United States. Additionally, the fertilizer industry accounts for 89 percent of ammonia consumption in the United States. About 20 percent of ammonia is directly applied as anhydrous ammonia, while 69 percent is used a feedstock for manufacturing various fertilizer materials including urea, ammonium nitrate, ammonium phosphate, ammonium sulfate, and nitric acid (Chemical Market Reporter 2002).

Triple superphosphate (TSP) is manufactured by reacting phosphate rock with WPPA. The WPPA and the sulfuric acid necessary to manufacture TSP are usually made at the TSP plant. Since the late 1960s, TSP has been overshadowed by DAP and MAP, but production is expected to be sustainable for two reasons. First, the production of TSP at an ammonium phosphate plant is a convenient way to use sludge WPPA that is too impure for MAP or DAP production. Second, the absence of nitrogen in TSP makes it the preferred source of phosphorus for the no-nitrogen bulk-blend fertilizers that are often used for leguminous crops such as soybeans, alfalfa, and clover (Kroschwitz 1993b)

Although the United States is a net importer of phosphate rock, with over 99 percent of imports coming from Morocco, domestic mines still account for over ninety percent of the nation's supply (**Table 3.16-16**). Three phosphoric acid producers along the Gulf of Mexico: Agrifos, Mississippi Phosphates, and PCS Nitrogen, are the primary importers of phosphate rock.

TABLE 3.16-16 UNITED STATES SUPPLY OF PHOSPHATE ROCK, THOUSAND TONS

	1998	1999	2000	2001	2002
Marketable Production	48,700	44,800	42,500	35,200	39,800
Exports	417	300	330	10	43
Imports	1,940	2,390	2,130	2,760	2,980

Source: U.S. Geological Survey 2002a.

While the United States is a net importer of phosphate rock, the U.S. is a major exporter of ammonium phosphate fertilizers (**Table 3.16-17**). In fact, the U.S. exports approximately twice the quantity of ammonium phosphate fertilizer (measured in terms of contained P_2O_5) as is consumed domestically. A major portion of production in the southeast is shipped overseas from ports along the Gulf of Mexico. The United States is the world's largest exporter of phosphate fertilizers, accounting for 54 percent of world DAP exports and 37 percent of total world P_2O_5 exports during 2002.

TABLE 3.16-17 UNITED STATES SUPPLY OF AMMONIUM PHOSPHATE FERTILIZERS, THOUSAND TONS P_2O_5

	1997	1998	1999	2000	2001
Production	9,223	6,405	8,780	7,440	7,884
Consumption	2,441	2,264	2,334	2,348	2,569
Exports	5,648	5,913	5,678	4,443	5,231
Imports	96	58	147	171	216

Source: United Nations Food and Agriculture Organization 2004. May not exactly agree with U.S. Census Bureau and USGS Data.

DAP is the predominant phosphate fertilizer produced in the United States, accounting for nearly two-thirds of total production (**Table 3.16-18**). MAP accounts for about one-quarter of phosphate fertilizer produced domestically. The remainder is primarily TSP.

TABLE 3.16-18 PHOSPHATE FERTILIZER PRODUCTION IN THE U.S., TONS P_2O_5

	1998	1999	2000	2001	2002
DAP	6,832,250	6,832,250	5,734,081	5,078,207	5,414,862
Percent	66.6	80.0	64.4	62.6	63.4
MAP	2,017,501	1,656,214	2,336,828	2,232,618	2,291,562
Percent	19.7	19.4	26.3	27.5	26.8
Other	1,409,869	55,350	828,088	798,393	838,315
Percent	13.7	0.6	9.3	9.8	9.8
Total	10,259,620	8,543,814	8,898,997	8,109,218	8,544,739

DAP: Diammonium Phosphate; MAP: Monoammonium Phosphate.
Source: U.S. Census Bureau 2000b, 2000c, 2001, 2002, 2003.

China is the largest consumer for United States diammonium phosphate exports, accounting for over 60 percent of U.S. exports in 2002 (**Table 3.16-19**). Shipments to India have dropped dramatically in recent years. Although the drop in shipments to India was partially offset by increased shipments to some Latin American Countries, a return to export levels seen during the late 1990s is unlikely (USGS 2004e).

There have been several noticeable mine expansions worldwide during the past several years. During 2002, the Coprebras Ouvidor Mine in Brazil completed a 450,000 ton expansion and the El Nasr Sebaya Mine in Egypt completed a 200,000 ton expansion. Several projects at existing mines in Africa are anticipated to increase worldwide phosphate rock production by 5.3 million tons per year by the end of 2004, with the largest increase occurring in Algeria, Morocco, and Tunisia. During 2003, the new owners of the Hahotoe and Kpogame Mines in Togo announced an expansion to double the capacity from 1.3 million ton annually to 2.6 million tons and WMC Resources Ltd. was expected to complete a 220,000 ton expansion at the Duchess Mine in Australia to bring total annual capacity to 2.4 million tons (USGS 2004b).

TABLE 3.16-19 UNITED STATES TRADE IN DIAMMONIUM PHOSPHATE, THOUSAND TONS

	1998	1999	2000	2001	2002
IMPORTS					
	49	40	136	147	172
EXPORTS					
Argentina	249	184	246	276	116
Australia	690	473	455	345	236
Brazil	80	18	132	46	47
Canada	125	112	120	120	263
China	5,710	5,049	4,475	3,153	4,641
Colombia	NA	86	107	114	144
Ecuador	52	68	46	86	54
India	1,400	2,579	380	542	222
Japan	388	368	392	371	341
Kenya	43	126	108	137	85
Mexico	277	282	325	304	474
Pakistan	709	391	325	409	164
Peru	NA	NA	NA	120	73
Thailand	333	263	225	236	108
Other	765	868	636	805	545
Total Exports	10,880	10,869	7,981	7,066	7,518

Source: U.S. Geological Survey 2004e, 2003c, 2002a, 2001c.

The drop in production and export of phosphate fertilizer is typical of the whole agricultural chemicals industry of the past several years (**Figure 3.16-3**). The Industrial Production Index for Pesticide, Fertilizer, and Other Agricultural Chemicals (NAICS 3253) is currently at about the same level it was at in the later part of 1987. The index peaked at 106.059 in July 1998, hit a low of 77.242 in April 2002 and stood at 82.968 at March 2004. While the index has recovered from the low point, it remains at 78 percent of the high reached during 1998. The March 2004 value of 82.968 is about the same level the index stood at during the last part of 1987. In November 1987, the index was 83.237 (Federal Reserve Board 2004).

In 2002, there were 14 operating phosphate mines in the United States, the majority of which were located in Florida and North Carolina. The eastern mines accounted for 86 percent of U.S. production, while four mines in Idaho and one in Utah accounted for the remainder. All of the eastern production was used for manufacturing fertilizer while the western production was used to manufacture both fertilizer and elemental phosphorus. In addition to Florida and North Carolina, there are ammonium phosphate fertilizer manufacturing plants in Louisiana, Mississippi, and Texas. The plants in Louisiana, Mississippi, and Texas use phosphate rock from Florida transported via rail and barge or imported rock from Morocco.

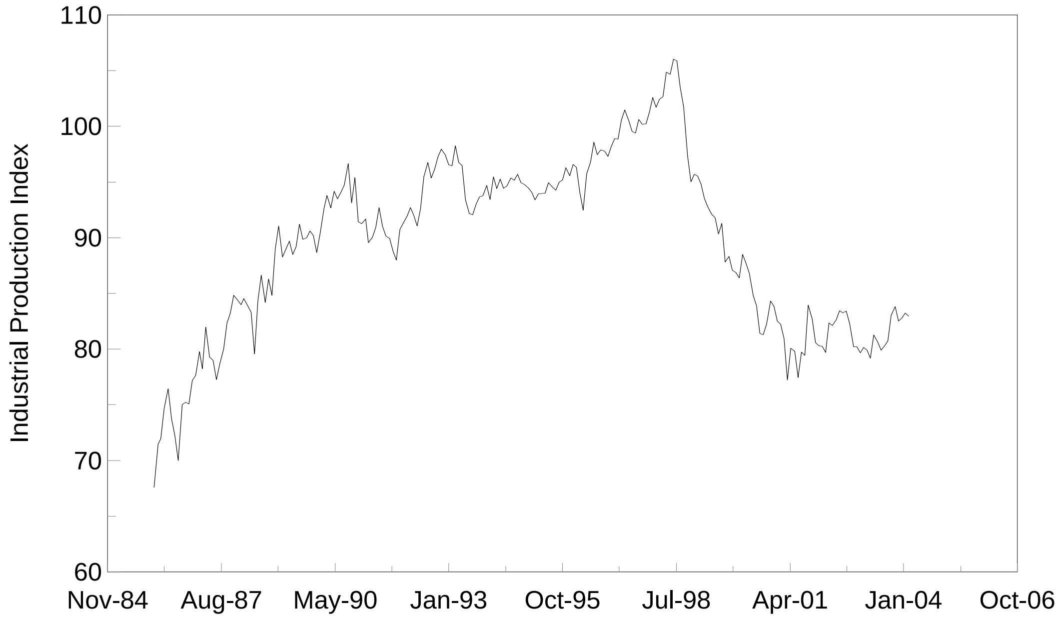

Figure 3.16-3 Industrial Production Index for the Agricultural Chemical Industry
(NAICS 3253 - Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing)
Source: Federal Reserve Board, 2004.

Southeastern Idaho is currently home to three large phosphate mining operations. These mines are operated by Simplot, Agrium, Inc., and Monsanto, Inc. Astaris LLC closed the Dry Valley mine in January 2003, although the mine may be reopened in the future by Agrium, Inc. The phosphate rock is converted into either phosphate fertilizer or elemental phosphorus at processing plants near Soda Springs, Idaho and Pocatello, Idaho. Ore from the Simplot Smoky Canyon Mine is transported via an 86-mile slurry pipeline to the company's WPPA plant in Pocatello. Agrium operates the Rasmussen Ridge Mine which, in the past, fed its Conda WPPA plant. However, Agrium has moved their stockpile to their Plant outside of Soda Springs. They are currently mining in the C Panel of their Dry Valley Mine. Agrium's North Rasmussen Mine is idle and is scheduled to remain idle until the Dry Valley deposit is mined out. Monsanto operates the Enoch Valley Mine, which supplies its elemental phosphorus plant in Soda Springs.

Astaris closed its elemental phosphorus plant in Pocatello in December 2001 and opened a 80,000 ton per year purified phosphoric acid plant in Soda Springs in May 2001 as a joint venture with Agrium. Astaris announced a restructuring program during October 2003 that included closing the PPA opened in 2001. The WPPA plant's closure was made necessary by the closure of the Astaris Green River, Wyoming sodium tripolyphosphate plant, which was supplied exclusively by the Soda Springs PPA plant. Astaris also closed its Dry Valley Mine on January 1, 2003, stating the need to reduce inventory. Agrium acquired 100 percent of the Astaris facility, and will produce phosphoric acid for fertilizer production but will not produce PPA. Agrium will use phosphate rock from its Rasmussen Ridge Mine to supply the plant once the Dry Valley deposit is mined out (USGS 2004e).

Monsanto Co., operates the Enoch Valley Mine, which supplies its elemental phosphorus plant in Soda Springs, Idaho. Elemental phosphorus is used as a feedstock for industrial chemicals. About 58 percent of the elemental phosphorus is used to produce thermal process phosphoric acid, which is used in industrial applications including detergent and food additives, water- and metal-treatment chemicals, vitamins, soft drinks, toothpaste, photographic film, light bulbs, bone china, optical glass and other consumer goods. The remaining elemental phosphorus is used to produce phosphorus trichloride, pentasulfide, and other compounds which are used in herbicides, insecticides, flame-retardant chemicals, and plasticizers (USGS 2004e).

The phosphate mining industry pays royalties to the federal government for ore mined from federal leases on public lands at the rate of five percent of the value of phosphate mined. Since the phosphate mines and fertilizer plants are vertically integrated, and no open market for phosphate rock exists in the western United States, the Minerals Management Service uses an index adjusted annually to determine the value of phosphate rock mined on federal lands. The index is adjusted according to changes in the Bureau of Labor Statistics (BLS) Chemical and Fertilizer Minerals Mining Producer Price Index (PPI) (50 percent weighting), the BLS Phosphate Fertilizer PPI (25 percent weighting) and the USGS Phosphate Rock Price Index as published annually in the Minerals Yearbook (Federal Register 1999).

The Idaho phosphate industry typically pays between four and five million dollars annually in royalties to the federal government for phosphate ore mined from federal land (**Table 3.16-20**). Phosphate royalties account for over 90 percent of mineral lease payments in Idaho. Fifty percent of federal mineral lease payments are returned to the states. Idaho returns 10 percent of the federal mineral royalties it receives from the federal government to the impacted counties, in this case, Caribou County, Idaho. Phosphate rock represents about 30 percent of the value of nonfuel minerals produced in Idaho.

The Smoky Canyon Mine provides royalty payments to the Minerals Management Service that annually ranges from 1.6 to 2.0 million dollars.

TABLE 3.16-20 IDAHO PHOSPHATE SALES AND ROYALTIES FOR OPERATIONS ON FEDERAL LAND

DESCRIPTION	1999	2000	2001	2002	2003
Sales Volume (tons)	5,796,900	6,095,292	4,990,345	5,274,021	4,730,171
Sales Value ($)	97,845,060	96,583,348	81,746,031	78,269,056	72,131,964
Royalties ($)	4,892,253	4,826,139	4,060,302	3,915,022	3,606,598

Source: Minerals Management Service 2004a, 2004b, 2004c.

The Simplot Smoky Canyon Mine produced approximately 2 million tons of ore in 2002 (USGS 2004d), about 2.3 percent of the national production of phosphate rock and 61 percent of western United States production.

In 1997, the Idaho phosphate mining industry, which includes the actual mining operations but not the fertilizer and elemental phosphorus plants, employed 561 workers and had an annual payroll of $27.4 million. The value added by mining was $74.5 million, while the value of shipments and receipts was $111.5 million (U.S. Census Bureau 1997).

The phosphate mining and processing industry is responsible for a significant portion of property taxes paid in Caribou County, Idaho. In 2003, total property taxes levied in Caribou County were $7.9 million. Of this, about 41 percent was paid by the phosphate mining and processing industry. These taxes included property taxes on mining equipment, the processing plants near Soda Springs and a net profits tax on the mines, which is considered a property tax by the Idaho State Tax Commission, in lieu of taxes on ore bodies (Dornfest 2004).

Approximately 3.4 percent of the nonagricultural employment in Bannock, Caribou, and Power Counties, Idaho is due to the phosphate operations (**Table 3.16-21**). No employment is reported for the phosphate industry in Lincoln County, Wyoming since all of the actual operations are in Idaho, although a majority of the employees at the Smoky Canyon Mine actually reside in Lincoln County, Wyoming.

TABLE 3.16-21 IDAHO PHOSPHATE INDUSTRY EMPLOYMENT, BANNOCK, CARIBOU, AND POWER COUNTIES

DESCRIPTION	2002	2003
Mining	350	376
Fertilizer Manufacturing	910	827
Total Phosphate Industry	1,260	1,203
Total Employment	37,002	37,681
Phosphate Employment, percent of Total	3.4	3.2

Date for 2003 are preliminary and subject to revision.
NAICS Codes: 212 - Mining, 3253 - Pesticide, Fertilizer and Other Agricultural Chemical Manufacturing.
Source: Idaho Department of Labor, 2004i.

The phosphate industry provides some of the highest paying jobs in southeastern Idaho. In 2002, mining in the three Idaho counties paid an annual average wage of $43,555, while fertilizer manufacturing paid an annual average wage of $43,149 (Idaho Department of Labor 2004i). For comparison, the average annual wage for Bannock County was $25,190, $33,005 for Caribou County, $25,987 for Power County, and $26,621 for Lincoln County in 2002.

Past closures of phosphate facilities in southeastern Idaho have resulted in noticeable changes in the local economy. The closure of the Astaris LLC elemental phosphorus plant in Pocatello, Idaho and the layoff of 400 employees during December 2001 resulted in the unemployment rate in the three Idaho counties (Bannock, Caribou, and Power) jumping from 5.75 percent in December 2001 to 6.84 percent in January 2002. The unemployment rate continued to rise, until it peaked at 7.32 percent in April 2002 (**Figure 3.16-4**). The Dry Valley Mine closure in January 2003 resulted in only a slight increase in unemployment, from 5.83 to 5.94 in February 2003 as a generally improving economy masked part of the effect. The closure of the Astaris PPA plant on October 2003 had little effect on unemployment in the area, as the economy was generally improving, and only a few dozen employees were affected.

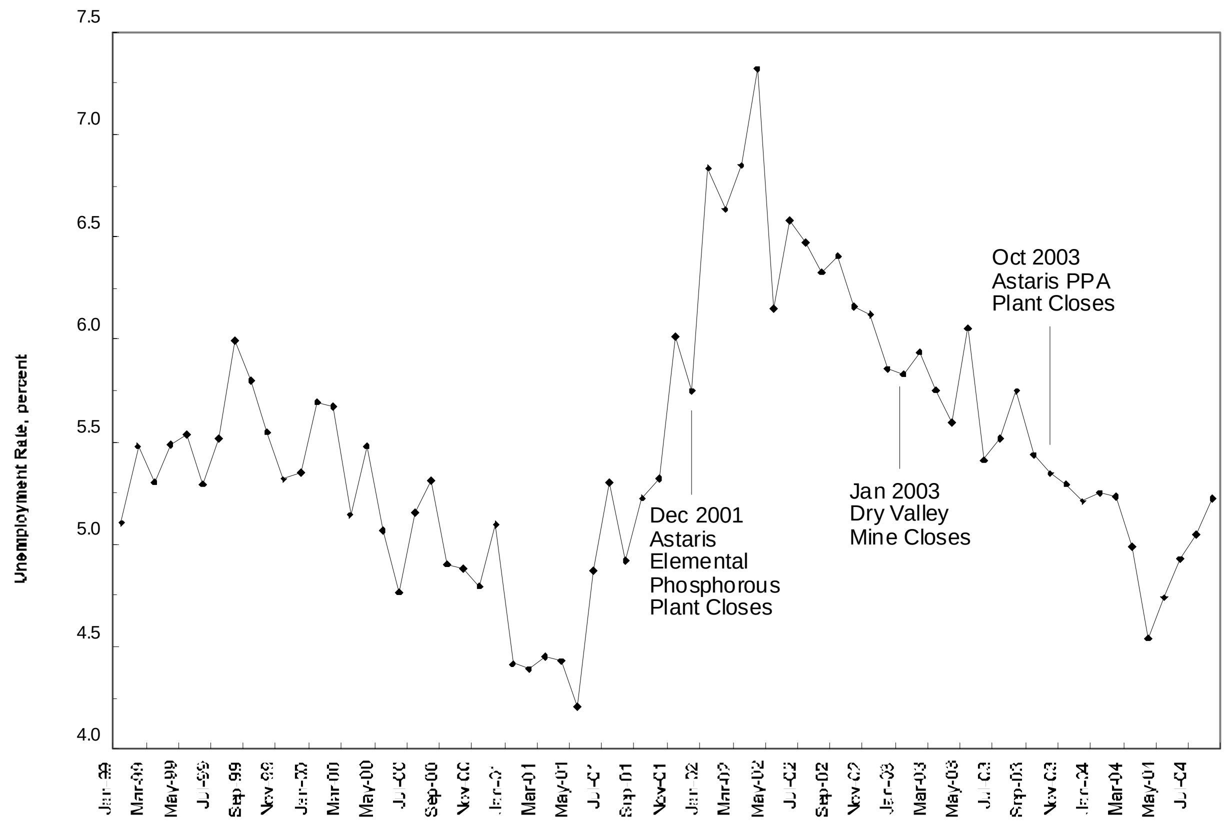

Figure 3.16-4 Unemployment Rate for Bannock, Caribou, and Power Counties, Idaho
Source: Idaho Department of Commerce and Labor, 2004.

The local economic conditions resulted in a population decrease in the three Idaho Counties from 2002 to 2003, with a population decline of 371 persons. The natural increase in population of 815 persons was overshadowed by a net out migration of 1,197 persons. The combined population of the three counties decreased by 0.4 percent, while the Idaho state population increased by 1.7 percent (U.S. Census Bureau 2004b).

3.16.10 Local Environment & Smoky Canyon Mine

The local environment in the Study Area is forested, rural, and agricultural lands, with small communities located outside the Forest boundary in Idaho and Wyoming. The Crow Creek Valley is the residential area closest to Panels F and G with large parcels of privately-owned land, and is approximately two miles southeast of Panel G. The Crow Creek Valley is the site of several ranches and vacation homes. Although a sizable portion of the Crow Creek Valley is privately-owned, the surrounding area is public land administered by the CNTF. Recreation and land use in the area is described in **Section 3.10**.

Property Values

During the public scoping period for this EIS, several commentors were concerned with what potential effects of approving the mine expansion would have on property values in the Crow Creek area. In subsequent discussions, Simplot employees expressed concern with what potential effects of not approving the mine expansion would have on property values in the Afton area, where the majority of Simplot employees live.

Because the government is not purchasing, transferring, or patenting any land for this Project, no official land appraisal is required. Property values throughout the area of interest have generally been increasing steadily over the last decade or more.

Characteristics/amenities that influence property values are subjective, since they ultimately rely on the personal preference of the purchaser and the seller; these may include: noise (**Section 3.2**), air quality (**Section 3.2**), water resources (**Section 3.3**), scenic values (**Section 3.12**), and access and traffic (**Section 3.15**). Proximity to commerce and industry also reflect on the perceived quality of life and therefore influence property value. Actions that diminish the desired characteristics/amenities such as added noise, traffic, visual impacts, and air/water pollution can have a negative effect on property values. Actions that increase characteristics/amenities, such as providing jobs and improving accessibility, can have a positive effect on property values.

Characteristics/amenities that are generally considered to make the Crow Creek area desirable include scenic values, peace and quiet (rural atmosphere), Crow Creek frontage, access to the CNF, and outdoor recreational opportunities (hiking, hunting, fishing, etc). Factors that may have a subjective effect on Crow Creek property values include: noise and visual impacts from nearby mining activities (Alternatives 2 and 3), direct and indirect effects of added traffic on the Crow Creek road (Alternative 7), potential effects of water pollution on fisheries in Crow Creek and its tributaries, and changes to current non-motorized access from the Crow Creek area into the CNF (primarily Panel F and Alternatives 2, 3, and 6). These effects are described in **Section 4.16**.

Heritage Values

Heritage resources include archaeological and historic sites and properties as well as historic livestock trailing and ranching. These are described in **Sections 3.9**, **3.13,** and **3.14**.

3.17 Environmental Justice

Environmental Justice is the pursuit of equal justice and equal protection for all people under the environmental statutes and regulations. It includes an assurance that some communities are not unjustly exposed to high and adverse environmental impacts. The requirements of Executive Order (EO) 12898 direct agencies to "analyze the environmental effects, including human health, economic and social effects of federal actions, including effects on minority communities and low income communities, when such analysis is required by NEPA". The definition of Minority communities includes American Indians.

EO 12898 directs agencies to consider patterns of subsistence hunting or fishing when a federal action may affect fish, vegetation, or wildlife, since that action may then also affect subsistence patterns of consumption and indicate the potential for disproportionately high and adverse human health or environmental affects on low-income populations, minority populations, or Indian tribes. Risks associated with the consumption of water, fish, wildlife, and other natural resources possibly impacted by the Project must be analyzed to determine human health or environmental affects.

The communities in closest proximity to the Smoky Canyon Mine include Afton and Fairview, Wyoming, and a loose community of ranchers along Crow Creek Road. In general, the area is rural. USFS (2003b) notes: "few minorities reside within the Study Area, and no communities are considered low income. While there are individual households that are either minority or low-income, the communities as a whole are not." Also, see Social and Economic Resources, **Section 3.16**.

Members of the Shoshone-Bannock Tribe, based in Fort Hall, Idaho, have Treaty Rights (Fort Bridger Treaty of 1868) to utilize federal lands in the Study Area for hunting, fishing, and gathering, subject to provisions of the Endangered Species Act. The Shoshone-Bannock Tribes represent both a population (readily identifiable collection of persons) and a community (readily identifiable social group who reside in a specific locality, share government, and have a common cultural and historical heritage) that could be affected under Environmental Justice. Consultation with the Shoshone-Bannock Tribal Council is being conducted for this Project (See **Section 3.14**). According to the Shoshone-Bannock, the Tribes currently utilize the Project Area on a regular basis to exercise their Treaty Rights including hunting, fishing, gathering, and ceremonial or traditional activities.