hydrologic impacts from tension cracks in the canyon bottom will be dictated by: 1) the degree of saturation of rocks underneath the stream channel, 2) the geometry of tension cracks, and 3) the extent to which fractures fill with native sediments.

The degree of saturation of the Castlegate Sandstone underlying the creek bottom is important because this parameter will determine the amount of additional water that the formation could accommodate if tension cracks were to divert surface water into the bedrock. If the entire thickness of the Castlegate Sandstone is saturated, then no surface water could be accommodated by the bedrock under the creek and the effects of tension cracks on the creek and colluvial groundwater systems would be negligible. However, Mayo and Associates (1997b) believe that the Castlegate Sandstone underlying the creek is saturated to only a limited depth. Saturation is suggested by the fact that along the entire stretch of upper Box Canyon, flow in the creek is gaining, and flow in the creek is perennial. That the depth of saturation is limited is suggested by the lack of water in a water monitoring well (89-16-1W), which is screened in the Castlegate Sandstone at an elevation below the bottom of the canyon and is located only 1,000 feet downdip of the creek.

The geometry of tension cracks (meaning the aperture, length, depth, and interconnectedness with other tension cracks) will determine the additional volume of storage in the bedrock underlying the canyon. Away from the canyon walls or the surface, the well-cemented nature of the Castlegate Sandstone will prevent the formation from receiving and transmitting much water; thus water that may be intercepted by fractures will be almost exclusively transmitted by and stored within fractures.

As was observed in the adjacent Quitchupah Lease, native sediments fill tension cracks and greatly limit the amount of water that can be intercepted by and stored within a given tension crack. Mayo and Associates (1997b) determined that the permeability of stream sediments is up to 0.026 cm per second. Although fairly permeable, the introduction of native sediments will greatly reduce the permeability compared to that of a fracture without sediment infill (i.e., conduit flow). In perennial drainages, this process will occur at a greater rate than it does in ephemeral drainages on the plateau because of the active and ongoing sediment transport. Sediment transport is greatest during runoff and thunderstorm events, and tension cracks should fill more rapidly during these times. During low flow or baseflow conditions (<20 gpm in the East Fork), sediment transport is slight, therefore crack infilling would take substantially longer.

Mayo and Associates (1997b) conclude that if tension fractures occur in the Castlegate Sandstone in the bottom of the canyons, streamflow and water from colluvial groundwater systems may be temporarily diverted into the bedrock underlying the canyon. Once fractures fill with sediments and water, movement of water in the fracture will be essentially static and streamflow and colluvial groundwater systems would no longer be directly effected. It is not expected that tension cracks will extend downward into the Blackhawk formation.

Tension cracks are also possible in the upper Blackhawk Formation. Because the formation consists of interbedded shale, mudstone, and sandstone layers, tension cracking should be less severe in the Blackhawk Formation than in the Castlegate Sandstone. If tension cracks form, they will most likely form in the sandstone horizons of the formation. Shale layers have the ability to translate stress laterally and should not experience tension cracks, and may help, to some degree, mitigate tension crack formation in the sandstones. The consequence of tension cracks in the Blackhawk Formation is the possible diversion of streamflow into sandstone horizons. Because the East Fork of Box Canyon is a natural groundwater discharge location, it is possible that the sandstone horizons that are exposed in East Fork Box Canyon are saturated and would not accommodate significant quantities of surface water. The thickness of sandstone channels in the upper Blackhawk Formation is about 50 feet (Marley et al., 1979). What this means is that the maximum vertical distance that water could travel is 50 feet. Any intercepted water would then likely be translated horizontally down gradient, which in East Box Canyon is also downstream so that discharge would occur where the bottom of the sandstone channel outcrops in the stream channel.

Potential Impacts to Groundwater Quality of Seeps and Springs

Mayo and Associates (1997a) found that the water quality of springs overlying the adjacent SUFCO Mine do not show effects attributable to coal mining. Chemical hydrographs of these springs indicate that the major ion chemistry of these springs has remained essentially constant over the entire period of record, and inspection of the trace element chemistry reveals no adverse impacts to water quality. Therefore, it is anticipated that water quality of spring discharge in the Project Area will not be affected by the proposed actions.

The quality of groundwater discharge can be impacted if mining-related fracturing creates new flow pathways along which there are acid- or toxic-forming materials or abundant soluble minerals (e.g., gypsum and halite). Acid- and toxic-forming materials have not been identified in mine overburden (Canyon Fuel 1998). Water quality impacts to groundwater discharge are not expected as a result of underground coal mining of the Project Area.

Potential Rate of Mine Water Discharge

Currently the SUFCO Mine discharges a portion of the groundwater that is intercepted by mining to North Fork Quitchupah Creek (the remaining portion evaporates or is shipped with the coal). The long-term mean mine discharge to North Fork Quitchupah Creek is 980 gpm. Discharge varies between 460 gpm to 1,760 gpm (Mayo and Associates 1997a).

A comparison of the mine discharge hydrograph with coal production indicates that mine discharge rates are related to coal production. This indicates that mining is intercepting localized "pockets" of groundwater that occur in sandstone paleochannels, and that mining is not encountering active groundwater flow systems. The average mine discharge was about 1,000 gpm between 1983 and 1994, when monthly coal production ranged from about 150,000 tons to 250,000 tons. From 1994 to 1996, the monthly rate of coal production increased to between

300,000 tons to 400,000 tons and the mine discharge rate increased to over 1,500 gpm (Mayo and Associates 1997a). Mine discharge data show that the rate of mine water discharge does not increase as the total area of the mine increases, but rather the rate of discharge is related to the amount of recently mined areas.

The anticipated production from the Pines Coal Lease Tract is 6 to 9 million metric tons per year (mmtpy) (500 to 750 thousand tons per month). Based on discharge rates and coal production at the adjacent SUFCO Mine, the anticipated discharge from mine workings in the Pines Coal Lease Tract is 1,800 to 2,700 gpm. This discharge rate would be the same regardless of who obtains the lease.

Potential Degradation of the Quality of Mine Water Discharge

The quality of water that passes through the mine environment or is exposed to waste rock from the mine may be degraded by chemical interactions with naturally occurring minerals and materials and equipment introduced into the mine. The proposed mine workings in the Project Area could be flooded by groundwater inflows once mining ceases if discharge to Box Canyon Creek is not approved by the appropriate State entities. In this case, water would be impounded in mine workings to the level of the Link Canyon discharge point. If discharge to Box Canyon is allowed, water would to drain via gravity, and mine workings would not flood except locally. If mine workings are flooded, groundwater passing through the mine environment may potentially encounter more naturally-occurring minerals in the walls, roof, and caved areas than if the mine did not flood. Similarly the risk of groundwater being impacted by equipment and materials is greater if water is impounded in the mine rather than being allowed to drain. Regardless of where mine water is discharged to the surface, a Utah Pollution Discharge Elimination System (UPDES) permit will be required by the State of Utah and will dictate that water quality standards be met.

Potential environmental impacts can occur if degraded water discharges from the mine workings either during active mining or after mining activities cease or if groundwater at waste rock disposal sites is degraded. These potential impacts are discussed below.

It is not anticipated that acid mine drainage will be a potential environmental impact resulting from mining in the Project Area. Acid mine drainage is caused by the oxidation and dissolution of sulfide minerals (principally pyrite and marcasite) when they are exposed to the atmosphere. Although these sulfide minerals are known to occur with the coal deposits in the Wasatch Plateau, acid mine drainage is rarely a problem in the coal field because any acid that is produced readily dissolves carbonate minerals (calcite and dolomite), which are abundant in the mine environment. Additionally, in the Project Area, the sulfur content of coal is very low, averaging 0.5 percent (Canyon Fuel 1997). The creation of acid and dissolution of carbonate minerals would result in mine discharge water that has elevated solute concentrations relative to groundwater that flows into the mine. Experience has shown; however, that despite the increase in solute concentrations, mine water discharge should still meet UPDES beneficial use standards.

The dissolution of gypsum or halite or other highly soluble minerals, which occur naturally in small quantities in the rocks adjacent to mine openings, may degrade the quality of the water discharging from the mine. The dissolution of gypsum increases the Ca^{2+}, SO_4^{2-}, and TDS concentrations of the water. The dissolution of halite increases sodium (Na^+), chloride (Cl^-), and TDS concentrations. These dissolution reactions affect water quality if they are present in significant quantities along new groundwater flow paths created by mining. This impact has not been noted at the existing SUFCO Mine.

Some materials used in mining operations, when brought into contact with groundwater, have the potential to adversely impact the quality of water discharged from the mine. Mayo and Associates (1993) determined that organic emulsion fluids used in longwall mining operations can cause increased Ca^{2+}, Mg^{2+}, and HCO_3^- contents of mine water. When fugitive emulsion fluid comes in contact with mine waters, the organic molecules in the fluid are readily oxidized by bacterial action resulting in the production of CO_2 gas. CO_2 gas reacts with water to form carbonic acid (H_2CO_3), which dissociates into H^+ (acid) and HCO_3^-. The liberated H^+ ions are rapidly consumed in reactions with naturally occurring carbonate minerals, resulting in increased Ca^{2+}, Mg^{2+}, and HCO_3^- concentrations in the mine water. Ca^{2+} and Mg^{2+} commonly exchange for Na^+ on clay particles or zeolite minerals with ion exchange capacity.

During the course of mining operations, many tons of ferrous metals are utilized. Some of the metal objects are removed after mining ceases and, as a necessity, others are left in place. The most significant permanent use of metal in mining operations is in roof-support. Thousands of metal roof-bolts are installed at regular spacings in the mine roof to prevent roof collapse. In some locations, wire mesh is also installed. For safety reasons, it is not possible to remove the roof-bolts or wire mesh after mining in an area has ceased. Additionally, metal is used in stoppings and man-doors, overcasts, cribbing, well casings, pipes, and miscellaneous items such as hangers and signs. There is the potential for the metal in these objects to oxidize (rust) as it comes in contact with water in the mine environment.

Oxidation of ferrous materials results in the release of iron into the water. The magnitude and rate of the potential oxidation is constrained by a complex variety of factors, including the temperature, electrical conductivity (Eh), and pH of the water, the pressure on the system, the presence or absence of bacteria, and the solute chemistry of the mine water. As a result, this potential impact is difficult to quantify. However, discharge water from the SUFCO Mine, which has been in continuous production since 1976, has not been degraded by elevated iron concentrations. Solute chemical analysis from the SUFCO Mine discharge (Mayo and Associates 1997a) between 1983 and 1995 indicate that the dissolved iron concentration has never exceeded 0.1 mg/l. The total iron concentration during this same period never exceeded 1.0 mg/l, and only once exceeded 0.1 mg/l. To what extent the iron concentration in mine discharge water may change after mining operations cease is difficult to determine. However, the concentration will likely remain low because dissolved iron is rapidly precipitated as iron hydroxides as the water comes in contact with the atmosphere and microbes at the surface. Water flowing in a surface

stream that is fully aerated should not contain more than a few micrograms per liter of uncomplexed iron at equilibrium in the pH range of about 6.5 to 8.5 (Hem 1985), which is in the range of water discharging from the SUFCO Mine. Thus, based on the quality of water discharging from the SUFCO Mine, degradation of surface water by iron is not expected.

Mining equipment may be abandoned underground as dictated by safety or economic considerations. However, it is FS policy to not allow any new solid waste disposal facilities on National Forest System lands and not to add to existing facilities. Mining equipment would be considered a solid waste. Mining equipment such as longwall mining machines, roof bolters, and continuous miners, is made of high quality steel alloy containing chromium. The metal is highly resistant to corrosion. Calculations of the corrosion potential of the steel used in longwall mining machines have been performed by the University of Utah Metallurgy Department (BLM 1998a). They determined that it would take thousands of years for the metal to corrode away, and that the metal would need to be ground to a fine particulate for chromium to be dissolved. The University of Utah (BLM 1998a) report indicated that the general conditions required to hasten the corrosion of this metal do not exist in the Utah coal mining environment.

Until June 1993, powdered gypsum was used for rock dust in the SUFCO Mine. Since that time, only dolomite (a carbonate mineral) rock dust has been used. The dissolution of gypsum rock dust resulted in increased Ca^{2+}, SO_4^{2-}, and TDS concentrations in mine water. However, carbonate rock dust has not resulted in degradation of mine water quality because the waters flowing into the mine openings are saturated with respect to carbonate minerals (Mayo and Associates 1993), and thus are unable to dissolve carbonate rock dust. Depending on the successful bidder, either carbonate or gypsum rock dust could be used in the Pines Coal Lease Tract. If gypsum is used, there may be increased concentrations of Ca^{2+}, SO_4^{2-}, and TDS in mine discharge water. However, it is unlikely that any operator would choose to use gypsum rock dust because the resulting increase in TDS makes it difficult to comply with the UPDES maximum TDS concentration limit.

Petroleum, oils, and lubricants are regularly used in mining operations. These materials may degrade discharge water quality if they are mishandled or abandoned underground and exposed to water passing through the mine. Any spills or losses from mishandling are expected to be minor. Releases of larger quantities would need to be reported to State agencies and mitigated.

Currently at the SUFCO Mine, waste rock is generated by coal mining operations, and sludge accumulates in sediment ponds. These materials are disposed of at a permitted waste rock disposal site near the SUFCO Mine surface facility (Canyon Fuel 1998). Spoil and slurry are not produced at the SUFCO Mine. While the RFDS does not indicate where waste rock generated by mining in the Project Area would be deposited, it is anticipated that if Canyon Fuel obtains the lease, disposal of waste rock and sludge at the waste rock site would continue. If another bidder obtained the lease and established a mine in Link Canyon, a waste rock site would possibly be

permitted on BLM land east of the plateau escarpment. Regardless of who obtains the lease, waste rock could also be disposed of underground in mined-out workings.

Materials that are disposed of at the SUFCO Mine waste rock site have been tested for acid- and toxic-forming potential. Data indicate that boron, sodium absorption ratio, and specific conductance exceed guidelines for the management of topsoil and overburden (Canyon Fuel 1998). Groundwater quality at the waste rock disposal site is monitored quarterly in shallow groundwater wells. These data (Canyon Fuel 1996c) indicate that groundwater at the waste rock site contains elevated concentrations of solutes (Ca^{2+}, Mg^{2+}, SO_4^{2-}, Na^{+}, and Cl^{-}) which are not consistent with the natural concentrations of these constituents in other groundwaters in the area. Baseline water quality data from the site are not available for comparison to these data in order to assess the magnitude to the possible impacts to water quality from waste rock. The factors responsible for the elevated concentration of solutes in groundwater at the waste rock site have not been identified. Monitoring data show that acid mine drainage is not a problem at the waste rock site. Thus, there is a potential for continued impacts to groundwater quality at the SUFCO Mine waste rock site if Canyon Fuel obtains the lease or elsewhere if another bidder obtains the lease.

Potential impacts to water rights

All of the springs with water rights are located at the head of Link Canyon and discharge from the Castlegate Sandstone. These springs overlie the abandoned Link Canyon Mine workings and will not be directly undermined by mining in the Pines Coal Lease Tract. The discharge from spring GW-21 is highly dependant on seasonal recharge indicating that this spring is not part of an areally extensive groundwater system that could be impacted by mining in other portions of the Project Area. Springs Pines 101 and 102 are probably not unlike GW-21 and should not be affected by mining in the Pines Coal Lease Tract. Therefore, mining in the Pines Coal Lease Tract should not affect water rights associated with springs in the area.

Potential impacts to water rights associated with surface water sources are discussed in the Final Surface Water Technical Report (JBR 1998b).

Potential for Transbasinal Diversions

Due to the dip of bedrock in the Project Area, the natural discharge locations for groundwater that may be encountered by mining is northwest of the Project Area. The discharge location of water that is directly encountered by mining is not known (groundwater does not naturally discharge from the mining horizon in Box Canyon). Some groundwater that may potentially be impacted by mining discharges from horizons above the mining horizon in Box Canyon. It is possible that some water that may be encountered by mining in the Project Area may naturally discharge to the Muddy Creek drainage above the confluence with Box Canyon. The RFDS states that, initially, groundwater encountered by mining in the Pines Coal Lease Tract would be discharged in Link Canyon. This would be a diversion of water from one sub-basin to another. If water is discharged to Box Canyon Creek or Muddy Creek, then there would be no transbasinal diversion of water.

The natural discharge rate of water from horizons that may be impacted by mining is not quantifiable, but is certainly small (on the order of several gpm). This is indicated by the radiocarbon ages of groundwaters encountered in the SUFCO Mine which are 7,500 years to 20,000 years, meaning that rate of flow through these systems is extremely slow, and consequently, discharge from these systems is meager. Mining accelerates the rate of groundwater discharge. What this means is that the rate of discharge from mine workings, 1,000 gpm to 1,500 gpm, would not be equal to the rate at which water may be diverted from the Muddy Creek drainage above the confluence with Box Canyon.

Specific details about the basins and sub-basins that water may be diverted from and discharged to are discussed in the Final Surface Water Technical Report (JBR 1998b).

3.2.2.3 Alternative C

The potential effects to groundwater resources under this alternative would be the same as those described under Alternative B, except that East Fork Box Canyon would not be undermined and the springs and perennial stream in the canyon would not be directly impacted by mining-related subsidence.

Under this alternative, SCLSs would be applied. SCLS #3 requires the lessee to collect adequate baseline data to quantify existing surface resources on and adjacent to the lease area. The collection of baseline data allows comparison of pre-mining resource conditions to conditions during and after mining so that mining-related impacts to surface resources can be quantified. This stipulation augments the baseline hydrologic data collection requirements of SMCRA.

SCLS #7 requires the lessee to establish a monitoring system to locate, measure, and quantify the progressive and final effects of underground mining on groundwater and other resources. This stipulation requires monitoring similar to that required under SMCRA except that the final effects of underground mining must be evaluated.

SCLS #9 would prevent subsidence of the perennial streams in East Fork Box Canyon and Box Canyon. As described under Alternative B, the potential for adverse impacts exists if longwall mining occurs under perennial streams. The application of SCLS #9 would assure that there are no impacts to perennial streamflow or other resources dependant on streamflow.

Unlike the water replacement required under Utah Code 40-10-18 and SMCRA, SCLS #17 would require that the lessee replace, at their expense and at the source, any surface water lost or adversely affected by mining operations, not just State-appropriated or culinary water. The application of SCLS #17 does not decrease the potential impacts to groundwater or surface water systems, but requires the mitigation of impacts to groundwater and surface water resources so that sufficient water of suitable quality is made available to prevent the cascading effects of adversely impacting surface water or groundwater.

SCLS #19 would require that all mine equipment and materials not needed for continued operations, roof support, and mine safety be removed from underground workings prior to abandonment of mine sections. Materials and equipment could, however, be left underground if it is demonstrated that removal would cause unacceptable risk to the safety of mine personnel. Although it is not anticipated that the corrosion of mining equipment should pose a substantial threat to groundwater quality, this stipulation would provide added assurance that water quality is not impacted by equipment and materials left underground.

3.2.2.4 Alternative D

The potential impacts to groundwater resources under this alternative would be the same as those described under Alternative B, except that SCLS #9 is not applied and subsidence of escarpments and perennial drainages in upper Box Canyon on the Quitchupah Lease and East Fork Box Canyon on the Pines Coal Lease Tract is allowed. The consequences of applying SCLS #3, #7, #17, and #19 have been discussed under Alternative C.

Potential impacts related to undermining East Fork Box Canyon were described under Alternative B. The potential effects to Box Canyon Creek are the same as those described above for East Fork Box Canyon with the exception that the entire stretch of Box Canyon Creek in the Permit Amendment Area flows on Castlegate Sandstone. If all streamflow in upper Box Canyon were diverted into bedrock by tension cracks near the northern lease boundary, the amount of flow that would be diverted is approximately 15 gpm during baseflow conditions. Several springs (GW-20, Pines 218 and Pines 219) would be subsided. These springs are supported by the Castlegate Sandstone. Potential impacts to Castlegate Sandstone Springs were described under Alternative B.

Diffuse groundwater discharge supports vegetation growing in bedding planes and fractures on lower canyon walls along much of upper Box Canyon. The potential impacts to this diffuse groundwater discharge are uncertain. This discharge may increase due to increased recharge to the Castlegate Sandstone resulting from fracturing on the plateau. Conversely, this discharge may be diminished or hindered by induced fractures that divert water from these discharge locations. If discharge is diminished or hindered, the vegetation that is supported by diffuse groundwater discharge from bedding planes or fractures could suffer.

3.2.3 Mitigation and Monitoring

Mining-related impacts to the natural discharge rates of springs in the Project Area are not expected. To verify this, spring discharge rates and stream discharge rates should be monitored regularly as required by SCLS #3 and #7 and Utah Coal Rules. Direct mitigation of diminution of groundwater discharge rates is not feasible but could be mitigated by the application of SCLS #17, which requires the lessee to replace any lost water at their expense and at the source.

The impacts of tension cracks in ephemeral drainages appear to mitigate naturally. Similarly, the impacts of tension cracks should mitigate naturally in perennial drainages. However, the

mitigation of impacts in perennial drainages could possibly be hastened by the repair of visible cracks with bentonite grout. However, this measure has not been successful in repairing ponds that have been drained by tension cracks, and may not be successful in mitigating damages to stream channel bottoms.

Impacts to groundwater quality to springs in the Project Area are not expected. Impacts to the receiving drainage of mine discharge water will occur. Monitoring of the groundwater quality of springs is required under Utah Coal Rules, and the quality of mine discharge water is regulated under an UPDES permit. These regulations will provide the monitoring of water quality necessary to verify that no adverse impacts will occur.

3.2.4 Cumulative Effects

Past, present, and future activities have had, are having, or will have negligible effects on the groundwater resources in the Project Area, and no adverse impacts to groundwater resources have been noted in the adjacent Quitchupah Lease. However, it has been noted that livestock use of spring sources has resulted in diminished spring discharge.

This environmental analysis has shown that direct impacts to groundwater resources resulting from underground coal mining in the Project Area would be negligible. However, under Alternative B and Alternative D, there is a potential for diversion of some surface water from perennial streams into bedrock. This impact is expected to be of short temporal duration, perhaps less than a year, but could last up to 3 years.

3.2.5 Residual Adverse Impacts

No residual adverse impacts to groundwater resources overlying the mine workings are anticipated. Although under Alternative B and Alternative D, there is a potential for diversion of some surface water resources into bedrock, this impact is expected to be of short temporal duration, perhaps less than a year, but could last up to 3 years.

No residual adverse impacts to groundwater quality are expected due to chemical interactions between groundwater and naturally occurring or introduced materials in the mine environment.

3.2.6 Irreversible/Irretrievable Commitment of Resources

Groundwater is generally considered a renewable resource, especially groundwater that occurs near surface in active groundwater systems. No irreversible or irretrievable commitment of groundwater resources that occur near-surface in active groundwater systems that supply baseflow to perennial creeks is anticipated. The interception and removal of water from deeper, inactive groundwater systems, which will occur under all action alternatives, can be considered an irretrievable commitment of that resource because that water cannot be readily replaced by natural groundwater recharge mechanisms.

No irreversible or irretrievable commitment of resources is anticipated due to chemical interactions between groundwater and naturally occurring or introduced materials in the mine environment.

3.2.7 Short Term Uses vs. Long Term Productivity

Underground coal mining in the Project Area (short term use) is not anticipated to impact the groundwater resources in the area in the long term.

3.3 SURFACE WATER

For the purposes of this document, the area of analysis for surface water resources includes the Project Area and some additional adjacent areas encompass the watersheds of Box Canyon, East Fork Box Canyon, and Link Canyon; the 8-mile segment of North Fork Quitchupah Creek/Quitchupah Creek between the existing mine discharge point and its confluence with Link Canyon stream; and the 3.5-mile segment of Muddy Creek between its confluence with Lower Box Canyon Creek and monitoring point 406. Surface waters include streams, stockponds, and springs. Springs are described in Section 3.2.

3.3.1 Affected Environment

The Pines Tract Project Area is located within the Colorado River Basin near the south end of the Wasatch Plateau. The Plateau trends north-south and divides the Colorado Basin from the Great Basin. The Wasatch Plateau is bounded by Sanpete Valley to the west and Castle Valley to the east. All surface drainage from the Project Area is ultimately tributary to Muddy Creek, which flows southeast across Castle Valley, and eventually combines with the Fremont River to form the Dirty Devil River. The Dirty Devil in turn joins the Colorado River.

The majority of the Project Area drains to the East Fork of Box Canyon (Figure 3-8). The Main Fork of Box Canyon and the East Fork of Box Canyon join, and flow through "The Box" near the northwest section of the Project Area. Box Canyon Creek enters Muddy Creek just outside of the northern project boundary. Muddy Creek flows southeast across the northern edge of the Project Area. The southernmost portion of the Project Area drains to Link Canyon, which is tributary to Quitchupah Creek. Most of the existing SUFCO Mine Permit Area drains southward into Quitchupah Creek via its North Fork. Quitchupah Creek flows southeastward into Ivie Creek, which in turn flows eastward into Muddy Creek. Therefore, either directly or indirectly, all surface flows from the Project Area eventually reach Muddy Creek.

For the purposes of this project, three separate reaches of the Main Fork of Box Canyon are discussed in detail. Called herein as the upper Main Fork Box Canyon, is the segment of the Main Fork that is within the Box Canyon Proposed Subsidence Area. The reach of the Main Fork within the Pines Coal Lease Tract and in the vicinity of the confluence with the East Fork is referred to here as the Confluence Area - Main Fork. The lowermost reach of the Main Fork, below which a potential mine discharge point is proposed, is referred to as Lower Box Canyon; it is outside of the Project Area. The entire East Fork of Box Canyon is within the Project Area and is simply called herein as the East Fork.

The headwaters of the Main Fork of Box Canyon, the East Fork, and Link Canyons are close to 8,800 feet above MSL. Elevations near the down stream reaches crossing the project boundary are 1,000 or more feet lower. This elevation difference influences the flow regimes and fluvial morphology of the streams within the Project Area.

EXPLANATION

PINES LEASE TRACT BOUNDARY

150-ACRE LEASE MODIFICATION AREA BOUNDARY

PERMIT AMENDMENT AREA BOUNDARY

STREAM FLOWING 1997

405
403
302
407
408
406
106
BOX CANYON
THE BOX
EAST FORK BOX CANYON
MUDDY CREEK
THE TROUGHS
SEVIER CO
EMERY CO
NORTH PINES #1
WEST PINE
NORTH PINES #2
THE PINES
SUFCO 090
JOE'S MILL PONDS
FS110
FS109
LINK CANYON
UNNAMED
SLAB POND
NATIONAL FOREST
VERDE'S POND
THE PINES
LINK CANYON TROUGHS
SUFCO MINE PERMIT AREA
LINK CANYON #2
MILLERS FORK
WASH

MANTI-LA SAL NATIONAL FOREST

PINES TRACT PROJECT

FIGURE 3-8
SURFACE WATER RESOURCES

SCALE	DATE DRAWN	LAST REVISED
1" = 2000'	4/20/98	8/20/98

POTENTIAL MINE WATER DISCHARGE POINT
STREAM MONITORING LOCATION
POND
TROUGHS
STREAM-PERENNIAL
STREAM
ROAD

N

2000 0 2000 FEET

CONTOUR INTERVAL 25 FEET

Regionally, precipitation is elevation-dependant. It ranges from averages of 12 inches annually near the lower levels of the Project Area to more than 20 inches annually near the top of the Plateau. Mayo and Associates (1997c) report that 40 years of snow course data from Blacks Fork (several miles west of the Project Area at an elevation of 9,200 feet) show an average annual snow depth of about 44 inches. Thiros and Cordy (1991) report that about one-half of the annual precipitation results from localized thunderstorms between mid-summer and late fall.

Within and near the Project Area, overall water yield to surface streams is estimated to be about 1.5 inches per year (USDA-FS 1988). Perennial streams typically peak in May and June as a result of snow melt runoff; but late summer thunderstorms can also produce high flows for short time periods (Thiros and Cordy 1991). Runoff events in ephemeral watercourses in the area most commonly occur in July, August, and September from intense thunderstorms.

Reaches of perennial stream flow within the Project Area, as identified by Mayo and Associates (1997c), based primarily upon a one-time observation in the fall of 1997, are shown on Figure 3-8. The USGS 7.5-inch quadrangle maps define a shorter reach of the Main Fork of Box Canyon, and a longer reach of the East Fork, as perennial. For the purposes of this document, lengths of streams measured off of the USGS mapping are presumed where discussions reference perennial stream reaches. In the Project Area, these lengths are:

Within the Pines Coal Lease Tract

East Fork - 7,000 feet
Confluence Area - Main Fork - 2,000 feet
Muddy Creek - 2,500 feet

Within the 150-Acre Lease Modification Area

No perennial stream reaches

Within the Proposed Box Canyon Subsidence Area (Permit Amendment Area)

Upper main fork Box Canyon - 2,000 feet

However, it is important to note that, for small streams especially, the lineal extent of perennially flowing channel reaches may not be readily defined. Due to changing weather patterns and human-induced alterations, perennial reaches often differ from those shown on standard topographic maps, and for the same reasons can differ from on-the-ground observations of flowing reaches made over a short time frame. Further, many small streams have reaches that flow only within the channel substrate for some portions of most years. These reaches may function from an ecosystem standpoint as perennial, even though they only flow on the surface and can transport sediments significantly less than the standard 90 percent-of-the-time definition of perennial. These considerations are especially noteworthy for the Main Fork Box Canyon and the East Fork because of their characteristics and because of issues associated with undermining perennial

streams. Decisions made based upon a designation of a perennial stream may legitimately be tied to a greater or lesser length of channel than those reported above.

Eight stock watering ponds in the Pines Coal Lease Tract are shown on Figure 3-8. One additional pond is located in the lease amendment area. Further, numerous springs and seeps have been identified in and near the Project Area. As a surface expression of groundwater, these springs provide water in support of ecological niches in the area, and also provide a component of the baseflow of the perennial streams in the area. Such springs typically have localized and isolated recharge areas, are highly responsive to seasonal precipitation, and are not hydraulically connected to deeper groundwater systems. Although these springs provide evidence of the close and direct connection between surface water and shallow groundwater in the area, and although they function as a surface water resource with ecosystem values, they are not fully discussed in this section. Rather, Section 3.2 provides a comprehensive discussion on seeps and springs within the Project Area.

Stream Channel Descriptions and Morphology

Muddy Creek is the source of domestic and irrigation water for the town of Emery. As it traverses across the northern edge of the Project Area, Muddy Creek flows in a narrow, deep (approximately 1,000 feet) canyon with steep cliffs. Below its confluence with lower Box Canyon Creek, the valley bottom is somewhat wider (averaging about 300 feet) and the channel's sinuosity increases. However, the channel is still entrenched, and is confined within a narrow valley bottom; its floodplain, though present, is not extensive. Muddy Creek's gradient, as measured from the USGS 7.5-minute topography, averages about 3 percent in the Project Area vicinity. The drainage area above the USGS Muddy Creek gaging station (located approximately 6 miles downstream from the Muddy's confluence with Box Canyon Creek) is 105 square miles.

Box Canyon, East Fork, and Link Canyon are multi-forked headwater streams. The main and East Forks of Box Canyon drain northward, while Link Canyon drains southward, from the top of the Plateau. Their channels are narrow, confined, and generally steep. Given their basin position, gradient, and flow regimes, floodplains of these streams are essentially un-developed within the Project Area.

Both upper Main Fork Box Canyon and the East Fork have small, stringer-type riparian corridors along the majority of their lengths; vegetation is predominantly limited to herbaceous species due to the frequency of runoff events, the mobility of the channel materials and proximity to bedrock. Field observations indicate that much of the riparian vegetation of these stream reaches depends upon shallow subsurface waters issuing from the stream side colluvium, rather than the in-channel, surface flows themselves. In Lower Box Canyon, near its confluence with Muddy Creek, riparian vegetation has transitioned to a more extensive, stable, and mature riparian community; shrub species are present in much greater numbers than in the upper stream reaches.

These two streams are fairly similar in character in regard to gradient, stream type, and water yield, and have both been the subject of numerous descriptive studies. Within the Project Area, the upper Main Fork Box Canyon flows through Castlegate Sandstone, as does the upper 2,500 feet of the perennial reach of East Fork. The lower 4,500 feet of East Fork, and the entire 2,000-foot reach of the Confluence Area - Main Fork, flow across the Blackhawk Formation.

The morphology of the Main Fork of Box Canyon appears to be primarily controlled by bedrock, although channel substrate often is comprised of a layer of sand or gravel overlying the bedrock. Agapito Associates, Inc. (1997) state "*In general, the stream flows on bedrock on what appears to be the natural dip (apparent dip) of the strata along the traverse of the canyon*". Colluvium comprises the lower canyon walls, and thin alluvial deposits are found along the canyon bottom (Mayo and Associates 1997b). The East Fork is similar in nature, although colluvial and alluvial deposits appear to be of greater extent and are perhaps more active.

A stream gradient survey along the upper Main Fork Box Canyon, done on 20-foot to 30-foot spacing, indicated that the Middle Fork and main reach of the stream slopes 2 percent to 3 percent, the Upper Right Fork slopes about 11 percent, and greater slopes are present to the north in the Main Fork (Mayo and Associates 1997b). OEA Research, Inc. (1994) evaluated both the Main Fork and the East Fork of Box Canyon Creek using the FS's Integrated Riparian Evaluation Level II Methodology. They measured an average gradient of 6.7 percent in the Main Fork, with a range of 3 percent to 17 percent; and in the East Fork, gradient averaged 9.5 percent, with a similar range as that measured in the Main Fork. Agapito Associates, Inc. (1998) estimate an average gradient of the East Fork of 10.4 percent, with ranges from 1 percent to 26 percent. These varying reports of gradient likely indicate varying scales of measurement, and/or focus of measurement. However, they serve to show the non-uniform and stepped nature of the channels due to bedrock and bedding influence. Even given the variation in measured gradients, all the Box Canyon stream reaches were typed (OEA 1994) as Rosgen Type A streams.

OEA Research, Inc. (1994) further noted that, for both forks of Box Canyon, the stream is confined within a narrow canyon bottom, and short drops, falls and boulder/bedrock fish barriers were common. Although more pools were noted in the Main Fork than in the East Fork, the steep gradients and low flows minimized pool quantity, size and quality. Areas of bank instability were noted over about 40 percent of the inventoried area of these streams.

Link Canyon Creek flows south out of the Project Area and, on an ephemeral basis, contributes flow to Quitchupah Creek about 6 miles downstream of the project boundary. Link Canyon has not been the subject of descriptive studies as were both forks of Box Canyon. However, cursory field observations indicate that it is typical of regional ephemeral streams: steep, non-uniform gradient within its upper reaches, but flattening once it exits the canyon mouth; morphology influenced by bedrock and large material from cliff spalling; sediment loads typically high during runoff events; and lack of a defined bankfull channel, but evidence of frequent high flows.

The North Fork of Quitchupah Creek is located to the south and west of the Project Area. It is the receiving stream for the current UPDES discharge point of mine waters from the existing SUFCO Mine. The North Fork of Quitchupah Creek enters Quitchupah Creek about 4 miles upstream from the Link Canyon/Quitchupah Creek confluence.

Water Quantity and Flow Regimes

Muddy Creek. Muddy Creek has been gaged by the USGS since 1947, at a site about six miles downstream of the Project Area, near the town of Emery. The creek supplies drinking water (after treatment) and irrigation water (untreated) to the town. Daily mean discharge reported for that station, from October 1949 through February 1997, is contained in The Pines Tract Data Adequacy (Mayo and Associates 1997d). Thiros and Cordy (1991) have assessed those gage records for Muddy Creek, and reported an overall average discharge of about 40 cubic feet per second (cfs). Variations in annual discharge were common during the almost 40 years of record they examined: a mean discharge of less than 9 cfs was reported in 1977 (a region-wide drought year), while the highest mean was found to be 85.4 cfs in 1983 (which was, region-wide, a much above normal precipitation year).

Mayo and Associates (1997d) measured stream flow in Muddy Creek in two locations in late August 1997. Muddy Creek at its confluence with Box Canyon Creek was flowing at 42 cfs and Muddy Creek about one-half mile downstream from the lease boundary was measured at a similar rate of 40 cfs.

Box Canyon. Box Canyon (both the main and the East Forks) originates within the Project Area. Within the Project Area, according to USGS topographic mapping, about 7,000 lineal feet of stream flows perennially in East Fork, about 2,000 feet in the Upper Main Fork, and another 2,000 feet in the Confluence Area - Main Fork. (The 7,000 feet of the Main Fork of Box Canyon between the two reaches described also flows perennially. That reach is outside of the Project Area, but within the analysis area.) Downstream of the Project Area, perennial flow continues to the confluence with Muddy Creek. These reaches of perennial flow are apparently sustained by groundwater discharges of both discrete springs and seepage from canyon walls. The small contributing watershed area and precipitation patterns do not provide for surface-sustained perennial flow in this drainage. Nor is an overall regional groundwater table present to sustain flow. Although the groundwater-surface water connection is a driving influence in the hydrology of the Box Canyon headwater forks, it is important to note that this interaction refers to localized and shallow groundwater circuit, not the deeper groundwater systems near the coal seam, as described in more detail in the Final Groundwater Technical Report (Mayo and Associates 1998). Thiros and Cordy (1991) note that both forks of Box Canyon flow perennially for a distance near where the base of the Castlegate Sandstone occurs.

The SUFCO Mine has been measuring flow in the Main Fork of Box Canyon since 1989. These data show both temporal and spatial flow variations, and were used in part by Mayo and Associates (1997b) to determine reaches of perennial flow. Both spring snow melt and localized

summer thunderstorms appear to contribute to seasonal flow variations in the Box Canyon channels. Average flow in Lower Box Canyon, as calculated by Thiros and Cordy (1991) for the entire Box Canyon watershed using regional regression relationships, is 1.7 cfs (about 760 gpm). This average indicates that Box Canyon contributes only a small portion of Muddy Creek's flow at the gage near Emery.

Mayo and Associates (1997b) also gathered information that suggests that the upper Main Fork Box Canyon generally gains flow in a downstream direction. They observed various sources for this gain, including bedding planes and fractures in the Castlegate Sandstone, and from the shallow groundwater traveling through the soil mantle/colluvium in the canyon bottom. Mayo and Associates also attribute the presence of a significant portion of the riparian corridor to groundwater discharge from the lower canyon walls rather than to the stream flow in the canyon bottom.

Mayo and Associates (1997d) measured a flow rate of 40 gpm in Lower Box Canyon on June 27, 1997. A week prior to that measurement, a series of flow measurements was made along the upper Main Fork Box Canyon, showing generally gaining conditions with flows ranging from 4.3 gpm to 18.4 gpm. On October 29, 1997, Mayo and Associates measured a flow rate of 39 gpm at station 407 in the Confluence Area - Main Fork (above the confluence), and a flow rate of 20 gpm at station 408 at the Mouth of the East Fork. On that same day, they measured a flow rate of 81 gpm at Lower Box Canyon. Based on those measurements, the flow at the confluence of the Main and East Forks supplies almost three-quarters of the total flow of Box Canyon at its mouth during baseflow conditions.

Link Canyon. Link Canyon Creek, an ephemerally flowing tributary to Quitchupah Creek, is near the southern project boundary. Water discharging from two old mine portals supports perennial flow and riparian vegetation for about 800 feet in Link Canyon (USDA-FS 1988).

Quitchupah Creek. The MRP for SUFCO's existing mine (Canyon Fuel 1991) provides estimates from various sources for the historic average annual flow of Quitchupah Creek near its confluence with Link Canyon. These estimates range from 2,820 acre-feet to 3,800 acre-feet. Average yield in North Fork Quitchupah as calculated by Thiros and Cordy (1991) using regional regression relationships is consistent with those estimates at 3.4 cfs (2,460 acre-feet).

The North Fork of Quitchupah Creek and some of its tributaries were the sites of a gain-loss study conducted in late 1995 by Mayo and Associates (1997c). Although that study noted some gaining flow reaches as the channel flowed through the upper Blackhawk Formation, and some areas of losing flow reaches through the lower Blackhawk Formation, no net effect on stream flow was noted. However, the strong interaction of near-surface groundwater and surface flow in the stream was apparent.

Since 1983, Canyon Fuel has been discharging excess intercepted groundwater from their underground workings, via a UPDES discharge point, into the North Fork of Quitchupah Creek. This discharge averaged approximately 1,000 gpm during the period of 1983 through 1994 (Mayo and Associates 1998). Between 1994 and 1996, discharge has averaged approximately 1,500 gpm (Mayo and Associates 1997c). Discharge rates tend to relate to coal production rates and are not seasonally affected.

Mayo and Associates (1997c) have studied the current and past influence of the mine water discharge on Quitchupah Creek. They note that flow in the North Fork of Quitchupah Creek above the mine discharge point averages about 2,650 gpm in spring (5.9 cfs) and about 290 gpm (0.6 cfs) in low, baseflow conditions in late fall. The average increase in flow due to mine discharge is therefore substantial, about 37 percent in spring and 337 percent in fall. The source of the increased water is from the Blackhawk Formation zones immediately above coal seams. This water is deeper groundwater and otherwise disconnected from the shallow groundwater zones that naturally support stream flows in the channel. Impacts on Quitchupah Creek's stream morphology and/or stability due to 15 years of increased flows have apparently not been documented.

Developed Water Sources. Two types of small, developed reservoirs are found within the Project Area — runoff fed ponds and spring fed ponds. The FS recognizes nine such ponds, as shown on Figure 3-8. Eight have range inventory numbers on file with the FS, and all nine are used to support livestock grazing. Water rights records indicate that such ponds typically have a maximum storage capacity of about one acre-foot. Therefore, for the purposes of this analysis, the nine ponds are assumed to have a total, combined capacity of about nine acre-feet. Only the two Joes Mill Ponds are considered as "reliable" water sources for livestock use (Sandy Remund, USDA-FS, personal communication, June 9, 1998). The other ponds supply water on a seasonal or transient basis depending upon weather patterns.

Two of these runoff collection ponds were described by Mayo and Associates (1997d). Both Verdes Pond and Slab Pond are located near the headwaters of the Main Fork of Box Canyon (Figure 3-8). Observations made in June, October and November 1997, indicated that Slab Pond was dry; in June 1997, Verdes Pond was observed to be nearly dry, and later in the year, it was observed to contain water at an average depth of 0.5 to 1.0 feet over a 20-foot diameter area. The Joes Mill Ponds are the only spring-fed ponds identified. They are in-series, in-channel ponds in East Fork Box Canyon that appear to hold water year-round. When visited in October and November of 1997, the source spring was dry, but water approximately 0.5 feet deep over a 15-20-foot diameter area resided in the pond. In late May 1998, the condition of the source spring was not noted, but water resided in both ponds and covered a greater surface area than that observed in the fall 1997.

Another spring-fed pond is identified by the FS within the Upper Box Canyon stream channel. This pond is a natural pond, without a range inventory number, and is monitored by the SUFCO

Mine as spring site 089 (see Figure 3-8). The pond holds water year-round and supports vegetation communities including the sensitive Link Canyon Columbine (see Section 3.5). The pond occurs under a rock overhang, forming a "grotto."

An unnamed pond and nearby trough, both apparently spring-fed, are indicated to have been constructed as range improvements near the head of Link Canyon, according to the Final Range Resources Technical Report (JBR 1998a). The trough also supplies reliable water for livestock use (Sandy Remund, USDA-FS, personal communication, June 9, 1998).

Two other ponds (North Pines #1 and North Pines #2) collect runoff water as it is available, and are located in Section 11, T 21 S, R 5 E.

The eight ponds named above are located within the Pines Coal Lease Tract. A ninth pond, known as West Pine, is located within the Lease Modification Area.

Water Quality

Surface water in the permit and adjacent areas (including Quitchupah Creek, Box Canyon Creek, and Muddy Creek) has been classified in the Utah Water Quality Standards as use designation Classes 2B, 3A and 4 waters (protected for secondary contact recreation (2B), cold water aquatic life (3A) and agricultural uses (4)). Although Muddy Creek is used as a domestic water source by the town of Emery, the creek is not classed as Class 1 or Class IC (protected for use as a raw water source for domestic water systems (1), or protected for domestic purposes with prior treatment by treatment processes as required by the Utah Department of Health (IC) in the Utah Water Quality Standards). Before it is used for domestic purposes, Muddy Creek water, withdrawn from the irrigation canal, undergoes full conventional treatment (flocculation, settlement, disinfection) (Darrel Leamaster, personal communication, 1998).

Because the portion of upper Muddy Creek within the MLS is a Category 1 - High Quality Water, it's water quality is of special significance, regardless of its beneficial use class. In particular, it's existing water quality must be maintained as stated under Utah Administrative Code (UAC) R317-2-3. New point source discharge permits are not allowed where the receiving water would be a Category 1 stream. Further, the Utah State Division of Water Quality has listed Muddy Creek as a 303(d) stream for sediment and dissolved solids. This would apply to the sections of Muddy Creek which are not Category 1.

As is typical of streams in the region, the concentration and type of dissolved solids vary both temporally and spatially in Quitchupah and Muddy Creeks. During spring snowmelt, solids concentrations are usually low (due to dilution), but during low baseflow conditions, an increase in TDS is usually noted. Further, regional streams also experience an increase in mineralization, and a change in type of dominant ions, as they flow down from the high elevation headwaters through the marine sediments common in the lowlands. Within the Project Area's geologic setting, surface waters change from predominantly calcium+magnesium/ carbonate+bicarbonate

type to a more sulfate-dominated type after crossing the lower Blackhawk Formation, the Star Point Sandstone and the Upper Mancos Shale.

Muddy Creek. Mayo and Associates (1997d) measured pH and conductivity in Muddy Creek in two locations in June 1997. Muddy Creek at its confluence with lower Box Canyon Creek had a pH of 8.4 and a conductance of 282μS/cm. Muddy Creek at the Emery Diversion had a pH of 8.8 and a conductance of 432μS/cm. Additional measurements made by Mayo and Associates (1997d) in late August 1997 showed pH of 8.5 and conductivity of 365μS/cm at Muddy Creek at its confluence with lower Box Canyon Creek, and pH of 8.5 and conductivity of 355μS/cm for Muddy Creek about one-half mile downstream from the lease boundary. Water quality analysis reported in Waddell et al. (1978) showed similar results for Muddy Creek, with calcium and bicarbonate the dominant cation and anion.

Similarly, the Utah Division of Water Resources (1977) reports a weighted average TDS concentration at the Emery Gage of 213 mg/l (an average annual yield of 86 tons per square mile).

Box Canyon Creek. Mayo and Associates (1997d) measured a pH of 7.5 and conductivity of 411μS/cm in the East Fork in June 1997. In August 1997, they measured a pH of 8.5 and a conductivity of 448μS/cm in Lower Box Canyon. Canyon Fuel (1991) reports averages for the Main Fork Box Canyon (measured between the upper Main Fork Box Canyon and the Confluence Area - Main Fork reaches) as 93 mg/l for TDS and 7.1 for pH.

Link Canyon Creek. Water quality information specific to Link Canyon is lacking, likely because of the ephemeral nature of flow in the canyon. However, as with other streams in the area, thunderstorm runoff would likely produce flows that are mineralized, moderate-to-high in TDS, and sediment-laden. Both concentration and type of major ions would likely change as the geology through which the flow passes changes, generally degrading in a downstream direction, and experiencing a dramatic difference as flow crosses the Mancos Shale area.

Quitchupah Creek. Water quality data from sample sites near the headwaters of Quitchupah Creek and from farther downstream below the mine discharge point were analyzed by Mayo and Associates (1997c). Those data can be found in Appendix A of that report (Mayo and Associates 1997c). The headwaters samples show that stream flow was of a calcium-bicarbonate type, which is consistent with information on upper Quitchupah Creek reported by others (UDOGM 1989). The UDOGM (1989) reports average annual TDS in Quitchupah's headwaters at 260 mg/l; in lower reaches of Quitchupah, TDS increases from natural sources to 2,000 mg/l. Although calcium and bicarbonate are still present in Quitchupah Creek samples at the confluence with the west fork several miles downstream, the water becomes more of a mixed type, and generally more mineralized with magnesium, sodium, and sulfates contributing more substantially to the dissolved solids makeup. A mine discharge point is located between the headwater and lower site; chemical makeup at the lower site likely reflects this discharge. However, these data are also consistent with known decreases in water quality after passage through Mancos Shale lands (UDOGM 1989).

The historical mine discharge is a calcium-bicarbonate-sulfate water with an average TDS concentration of 603 mg/l and an average pH of 7.4 (Canyon Fuel 1991). Sulfate concentrations in the mine-water discharge average 236 mg/l, an increase of about 3 times that reported for the upstream Quitchupah waters (Canyon Fuel 1991). However, since 1993, these increases in sulfate and TDS in the mine-water discharge as compared with adjacent surface and groundwater have decreased due to a change in rock dust use. Thiros and Cordy (1991) report that the discharge from the mine typically meets the State of Utah's primary drinking water standards.

According to monitoring records for the SUFCO Mine (Canyon Fuel 1991), at the mouth of the North Fork of Quitchupah Creek, the predominant ions are calcium, bicarbonate, and sulfate. The average historical TDS concentration at this location is 518 mg/l, with an average pH of 7.9. Alkalinity exceeds acidity by a factor of more than 20. As a general point of comparison, Canyon Fuel (1991) compared sampling results from the mine discharge and in Quitchupah Creek to primary and secondary drinking water standards. The mine discharge water typically meets primary drinking water standards. Exceedances of the secondary drinking water standards occurred for both sulfate and TDS. With the exception of the mine discharge, they attribute these exceedances to dissolution of marine salts in the sediments and outcropping rocks and reference relevant literature in support of that assessment.

Water Rights

Muddy Creek has been adjudicated by the Utah State Engineers Office. Muddy Creek Irrigation Company has decreed rights to 244 cfs from Muddy Creek (Mayo and Associates 1997b).

Mayo and Associates (1997d) inventoried water rights in the Pines Coal Lease Tract and adjacent areas. They identified 31 separate water rights on surface streams, and 7 rights on springs. All 38 of these rights are for stock watering by the FS. Surface water sources include Muddy Creek, Main Fork Box Canyon, and East Fork, well as several unnamed streams. Typically, these surface water rights for stock water do not give specific quantities of water; instead, they specify a stream reach and duration whereupon a given number of livestock may drink.

Some of these water rights appear to be associated with constructed ponds. However, water right/reservoir locations provided on the water right computer-generated records from the State Engineers office do not match with mapped pond locations, so it is not possible without further research to determine with specificity which ponds are associated with which water rights.

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

Under this alternative there would be no new impacts to surface waters. The existing groundwater/mine workings discharge of about 1,500 gpm from the SUFCO Mine operation to the North Fork of Quitchupah Creek would continue until those permitted reserves are exhausted.

3.3.2.2 Alternative B

Subsidence-Related Impacts

Overburden thicknesses and geologic settings, as well as specific mine plan scenarios, have a bearing on the type and level of impacts from subsidence that could occur. Overburden thickness in the upper 4,500 feet of perennially flowing East Fork range from 500 feet to 900+ feet. Within the majority of the perennially flowing upper East Fork stream reaches, where cover is thick and where, the Castlegate Sandstone provides at least partial protection from surface effects of subsidence (because of both its thickness and it massive character), impacts may be less severe than in areas where cover is thinner. Within the upper area; however, some impacts may be anticipated.

First, surface tension cracks would have some potential to affect perennial stream flows in the upper reaches of the East Fork. The temporary, transient wave cracks that occur parallel to the mine face as it passes a given location typically self-close quite soon (within a few months) after the longwall passes (Agapito Associates 1998). Tension cracks from permanent subsidence strain often occur parallel to, and near the edges of, the longwall panels; these cracks may or may not "heal" over time. Both types of cracks can occur either within the channel itself or in upland areas. Agapito Associates, Inc. indicate that where gateroads cross the stream course, there will be permanent cracking in the channel bottom. According to the RFDS, gateroads will likely cross the stream course at two locations. These areas will be at risk to losing flow to tension fractures.

According to Agapito Associates, Inc. (1997), the exact locations of cracks cannot be predicted, but predictions of expected size and duration can be made. Where cover depths are in the 900-foot range, the typical crack width is expected to be one inch or less, and time for formation is limited to about six months after undermining (Agapito Associates 1998). However, these types of surface tension cracks appear to be relatively short-lived, tending to "self-heal" at a measurable rate of near 1/16 inch per week (Dimick 1991). Although typical tension crack width may be one inch or less, Agapito (1998) notes that "tensile fractures as wide as 2 feet are possible", particularly within in the soil horizon, but would not be expected to be that wide within bedrock (again, based upon a 900-foot cover depth).

Therefore, depending upon the location, season, duration and extent, both temporary and permanent tension cracking within the upper reaches of the East Fork could affect its flows. The exact magnitude and duration of the effects depends upon various factors, at least some of which are not predictable or quantifiable (Mayo and Associates 1997b). However, given the assumptions cited above on crack width and healing rate, these effects would be estimated to generally and typically be limited to less than a six-month period for the temporary, transient wave type of cracks. Given the typical tension crack widths and time for initiation projected by Agapito (1997) and a typical average healing rate cited by Dimick (1991), even flow disruptions caused by the more permanent cracking would have the potential to cease within 1 year after undermining, but may take up to 3 years.

Although experience indicates that the cracks are likely to either self-close or be filled over time with sediments/debris, the potential may exist for permanent cracking that either does not infill, or takes much longer to do so than has been observed elsewhere. This potential may be low given: the narrowness of the predicted crack widths (intuitively, the smaller the crack width, the more easily it can be filled with available material and the less likely it is to extend for great depths); the noted availability of sediments and organic matter (which may increase after subsidence as canyon slopes experience instability); and the hydrogeologic characteristics of the channel substrate. If the channel cracks during periods of low flow, there is higher probability that all flow could be intercepted as the baseflows are less than 20 gpm, and would thus remove the sediment transport source. Additionally, at low or baseflow periods, the creeks carry minimal sediment that would be available for fracture filling. Cracks may also form in series, where numerous cracks develop over an area. This also presents a higher risk to intercepting stream flow.

The duration of reduced or lost streamflow within the upper reaches of the East Fork due to interception by tension cracks, would be expected to be a local consequence that may dewater segments of the stream reach. Reappearance of the "lost" flow would likely occur some distance down-channel due to the dip direction of the bedded substrate. As discussed in Section 3.2, the hydrogeologic characteristics of the underlying bedrock do not indicate that extensive volumes of intercepted water would be accepted by the substrate or drained into the mine. In addition to the re-surfacing of intercepted flow, a portion of perennial flow would continue to be resupplied though the colluvium downstream of a dewatered reach. As noted, much of the channel gains flow in a downstream direction due to contributions by discharge of shallow groundwater contained in the stream side colluvium. So, while reaches of stream may be dewatered, the colluvial contributions may continue functioning as a perennial system (at least within the upper reaches of the East Fork where substantial cover depths occur). Depending upon the extent and duration of flow losses, however, changes in stream temperature, channel wetted area, etc. could occur due to reduced flows and instigate ecosystem changes. This alternative carries no provisions for replacing water to maintain the ecosystem.

Along with the potential to intercept perennial flows, tension cracks can also affect rainfall runoff, either via overland flow or in ephemeral drainages (Mayo and Associates 1997b). However, runoff-conveyed organic debris and/or sediments have been observed to facilitate the self-healing described above, and such cracks within areas of thick cover would presumably represent only short term, if any, disruptions to stream flow patterns in the area. However, given the more extreme case of a 2-foot crack, its ability to heal and the time required to heal would be much greater. In addition, the broad depressions created by subsidence may locally retain runoff that would normally discharge from an area. Further, Mayo and Associates (1997d) notes that water entering cracks, whether from overland flow or runoff in ephemeral channels, would remain within the shallow groundwater system, and likely contribute to perennial baseflows in East Fork.

Changes in stream gradient could also be expected in channels that are undermined (Agapito Associates 1998). Within the upper reaches of the East Fork, where cover depths are substantial, Agapito Associates, Inc. (1998) predicted differential subsidence that may increase local gradient by up to 0.85 percent in some areas, and decrease local gradient by 0.96 percent in other areas. Prediction subsidence is not expected to cause flattening of the stream gradient sufficient to cause ponding. It is important to note that Agapito's analysis uses larger-scale gradient information derived from 40-foot topographic contours. A flattening of the gradient on that scale would still be expected to retain the non-uniform, stepped features of the stream on a small scale. However, if gradient changes serve to increase number or sizes of pools, secondary changes in water temperature, riparian fringe, and macro-invertebrates could also occur on a localized scale.

Cliff failures, rock fall and spalling could result in rock or woody debris placement within the channels, which could very locally constrict flow widths and alter gradient of specific channel features. This is observed to occur naturally in the East Fork of Box Canyon, so this impact may be simply an acceleration or increase in level of this feature of stream/side slope interactions, with some consequent increase in sediment and organic matter delivery. However, morphologically, the upper reach of the East Fork would not be expected to change overall due to these slight gradient or width alterations. Instead, the morphological adjustments would be on a small scale, affecting specific features such as a given pool, constriction, or run. The channel is currently a step-pool type channel with non-uniform grade and width; it would remain so even with the above-mentioned subsidence impacts. However, the pool/riffle ratio may locally be altered due to subsidence, in particular, by increasing the number of pools (and their sizes) (Mayo and Associates 1997a). Other changes in width or pattern could occur locally due to rock fall constrictions, etc. but the confined nature of the channels and their influence from bedrock would continue. In fact, this stream's type and morphology is probably the least likely to exhibit changes in morphology in response to direct subsidence (as long as the cover depth is in the 900-foot or more range).

However, the RFDS also includes full extraction mining under in lower East Fork and in confluence area-Main Fork. Overburden cover in these areas is 300 to 500 feet. Subsidence effects are greater in low cover areas (Section 3.1).

Comparisons can be made to two other locations in the Wasatch Plateau where perennial streams have been undermined by longwall mining. From 1992-1996, perennially flowing Burnout Creek was undermined by single-seam coal extraction of panels located essentially perpendicular to the stream channel (Mattson et al., 1995). Overburden thicknesses from the bottom of the stream channel ranged from about 600 to 800 feet. Burnout Creek flows across the Blackhawk Formation. The North Fork of the Right Fork of Miller Creek, another site of perennial stream undermining along the Plateau, also flows across the Blackhawk Formation. In contrast to Burnout Creek; however, that channel was separated from the mining zone by 300 feet to 500 feet of overburden (Slaughter et al., 1995). Channel segments ranged from perpendicular to diagonal to the orientation of the longwall panels.

The hydrologic consequences of longwall undermining were markedly different in these two channels: Burnout Creek experienced no notable decreases in flow rate (Mattson et al., 1995), while flow in the North Fork of the Right Fork of Miller Creek was completely intercepted by in-channel tension cracks up to seven feet wide (Slaughter et al., 1995). The thinner overburden, the bedrock-dominated channel with sparse alluvial development, and the nearby presence of faults are likely reasons that greater impacts were seen in the North Fork of the Right Fork of Miller Creek than in Burnout Creek. Burnout Creek has a well-developed alluvial system (approximately 15-feet deep) that is thought to have buffered the possible impacts from subsidence.

The lower reach of the East Fork and the Confluence Area - Main Fork have some similarities to Burnout Creek and the North Fork of the Right Fork of Miller Creek. These reaches flow across the Blackhawk Formation and have overburden depths ranging from 300 feet to 600 feet, essentially spanning the range of cover depths noted in the above two examples. In contrast, these stream reaches and their potential impacts are not completely analogous to the North Fork of the Right Fork of Miller Creek because multiple seams would not be mined, and no known faults are present in the vicinity. Nor are they completely analogous to Burnout Creek because they lack the alluvial development.

However, there is no doubt that these perennial stream reaches would be a greater risk of interception and loss of water over a larger segment of stream than in the upper reach of East Fork where overburden thickness is greater. Further, given the shallow overburden thicknesses in this area, and the likely expected vertical extent of fracturing above the longwall panels (estimated at 330 feet in Section 3.2.2.2), the potential for intercepted stream flow to reissue a short distance downstream is lessened. Instead, there would be the potential for the intercepted streamflow to be conveyed to the mined-out horizon and not available for re-issuance, thereby dewatering the creek. Given the flow rates reported above, approximately 75 percent of the flow supplied to the mouth of Box Canyon could be lost on a long term basis. The longer reaches where dewatering could be permanent combined with reaches where flow is significantly diminished on a permanent basis could adversely affect the functioning of the stream and its related ecosystem.

Also, although this area was not modeled by Agapito Associates, Inc. (1998), it can be inferred from their report that subsidence would likely be greater than 7 feet in these lower cover areas. Stream gradient changes could occur to a greater extent than was predicted for the upper reaches, and the greater differential settlement within the much deeper canyon segment could instigate more rock falls and slope instabilities.

Further, given the shallower cover depths and the nature of the geologic materials, undermining using room-and-pillar technique may result in more than just surface deformation due to subsidence. Instead, as evidenced at mines in the eastern United States and in Wyoming, there could be a risk of a complete overburden collapse (chimney failure) should an operator be forced to mine under certain cover conditions (Rex Goodrich, Agapito Associates, Inc., personal

communication, July 21, 1998). If that were to occur, the stream flows would certainly be intercepted on a permanent basis, and the upper reaches would be disconnected from the lower reaches.

Regardless of the direct undermining implications to East Fork and the Confluence Area - Main Box Canyon Creek and related ecosystems, and the indirect implications of undermining those areas on the lower reaches of Box Canyon, there would be minimal effect on the flow regime in Muddy Creek, or its source as a domestic supply, given the very small percentage of surface flow contributed by the East Fork Box Canyon watershed. Nor would changes in these areas be expected to affect water quality in Muddy Creek, other than perhaps some localized sediment loading in an already-sediment laden stream.

Subsidence and related tension cracking also have the potential to drain one or more of the stock ponds in the Project Area. Agapito (1998) considers that all of these ponds are at risk; however, it is not possible to predict the extent or duration of impacts. Two stock ponds in the area affected by the existing SUFCO Mine, with similar depths of overburden under the ponds as in the Project Area (900 feet to 1,000 feet), were impacted by subsidence-caused tension cracks (Mayo and Associates 1997b). The SUFCO Mine has repaired both of these ponds (Johnson Pond and Rock Pond), using bentonite to seal the cracks. The bentonite has been only marginally successful, as Rock Pond is still not holding water. It may be anticipated that any subsidence-caused flow depletions in stock ponds in the Project Area may similarly undergo repair measures. However, it must be assumed that at least some cracking may require repeated sealing with bentonite to be successful. Therefore, at least on a temporary basis; the duration of draining would be based upon the time required for self-healing, or for the operator to mitigate the problem. At worst, the ability of a pond to hold its former volume of water may be compromised for up to 3 years. Also, on a long term basis, or perhaps permanently, storage capacity could change in a given pond due to differential subsidence, and/or runoff that currently feeds a pond could be diverted or intercepted due to subsidence. (In one area in the existing Quitchupah Lease, subsidence-caused depressions have captured and retained water that formerly supplied a pond.) For ponds where water rights are held, water would have to be replaced as required by UAC 40-18-10 and 43 CFR Part 816.41(h).

Water Quality/Mine Water Discharge Impacts

The current mine water discharge of about 1,500 gpm to north fork of Quitchupah Creek at an approved UPDES discharge point would continue throughout the mining within the Project Area if Canyon Fuel were to receive the lease. Because the discharge rate is expected to be the same and the discharge point would be the same, there would be no change in impact. If another company mined the Pines Coal Lease Tract, Canyon Fuel would continue discharging into Quitchupah Creek until their existing reserves are diminished, in year 2012.

Further, the RFDS assumes additional discharge points would be needed in Link Canyon and/or to the north of the Project Area as it is mined. Any such additional discharge points would

require UPDES discharge permits similar to that currently held for the Quitchupah Creek discharge. The development scenario indicates that, if possible, a 2- to 3-year discharge at Link Canyon would first be utilized, followed by a longer term discharge downdip at Box Canyon/Muddy Creek. If the Box Canyon discharge point could not be permitted, the Link Canyon discharge would continue throughout the life of the mine. Implications of discharging at these potential discharge locations are described below.

Because Link Canyon currently experiences flow only ephemerally, its character would be expected to change as flow becomes continuous at a base flow of about 1,000 gpm for the 2- to 3-year life of the discharge (or up to a period equal to the mine life, if a lower Box Canyon Creek/Muddy Creek discharge is not permitted). Detailed information on Link Canyon is not available at this time, so only general impacts can be discussed. These could include greater sediment transport with associated channel scouring and reshaping, development of an adjacent riparian corridor after the channel equilibrates to the new flow regime, and a change in the water quality of the existing reach where mine discharge and spring discharge currently occur.

At some point in the future, the lessee of the Pines Coal Lease Tract may attempt to permit a discharge point in lower Box Canyon. After flowing down about 1,000 feet of lower Box Canyon, this discharge would enter Muddy Creek. While such a permit would not currently be granted because Muddy Creek (the portion within the National Forest boundary) is a Category I stream subject to the State Anti-Degradation policy, it may be possible to obtain State of Utah approval for such a discharge by first approaching the Water Quality Board with a request to change the stream's category to Category 2. A discharge permit has the potential to be approved in a Category 2 area; however Muddy Creek would still be under the High Quality Water and Anti-Degradation status. This means that any mine discharge would definitely have to be of equal quality to Muddy Creek at its receiving location, regardless of beneficial uses, water quality standards, etc. Further, Muddy Creek's listing as a 303(d) stream for sediment and TDS parameters may hinder (but not necessarily prevent) permitting efforts. Given these constraints and conditions, water quality of Muddy Creek and/or its use as a domestic supply for the Town of Emery, would not be impacted by any future mine discharges should they become permitted.

Assuming a flow rate similar to that currently discharged from the Quitchupah discharge point (1500 gpm), average annual flows in lower Box Canyon and Muddy Creek would be increased by 200 and 8 percent, respectively. In typical low flow periods, stream flow in lower Box Canyon and Muddy Creek would be increased by 500+ and 67 percent, respectively. From these numbers, it is obvious that a much greater impact would be felt in lower Box Canyon than in Muddy Creek. Because the lower portion of Box Canyon is outside of the Pines Coal Lease Tract and the Project Area, information to assess the level of impact is not available. However, even though the channel is influenced by bedrock, substantial changes in the lower Box Canyon channel characteristics could occur, including alterations of pool morphology, reduction in numbers of pools, increased bed and bank scour due to increased velocity and stream power, and washout of small falls. There would also be loss of mature riparian vegetation and fishery resources. Change

may also occur in Muddy Creek at the confluence of Muddy Creek and Box Canyon. Discharge of relevantly sediment-free water (once the increased flows have moved available sediments out of lower Box Canyon) to Muddy Creek would be expected to mobilize in-channel sediments, perhaps locally altering channel cross section.

In order to determine the effects of these flow rate changes on Muddy Creek, detailed flow and sediment modeling would be necessary. However, a few general statements can be made. It would not be expected that the increase in flows would have a dramatic effect on Muddy Creek during its storm flows, flooded areas, or peak runoff events. Instead, it would be more likely to have an effect during lower base flows and average flows, with the specifics depending primarily upon channel substrate, riparian vegetation, and channel cross section. The types of effects could include mobilizing more sediments, altering the shape of the active channel, destabilizing banks with subsequent side slope (terrace) collapses, and consequent widening or incising. As the increased discharge continued however over a period of years, the channel would tend to adjust to the new flow regime and begin to reach a new equilibrium condition.

Although Muddy Creek water is of much better quality than the quality of the mine water discharge (particularly in regard to mineralization), there would be no water quality changes to Muddy Creek as a result of a permitted mine discharge point in lower Box Canyon/Muddy Creek. This is because of Utah Division of Water Quality regulations that state that the discharge would have to meet the quality of the receiving stream. Therefore, should either Canyon Fuel or another operator be successful in changing the stream Category from 1 to 2, and apply for a discharge permit, they would have to demonstrate a treatment method that could render the mine discharge water equal to Muddy Creek water in regard to quality. Because of this requirement to maintain Muddy Creek's water quality, there would be no potential to directly degrade the town of Emery's water source. Treatment considerations would apply both to natural concentrations of minerals, etc. in the streamflow, and to any human-caused pollutants that may enter the groundwater due to mine operations. However, the indirect effect of increased sediment transport capacity, particularly during low flows, could have an impact on the amount of treatment required, depending upon how much sediment naturally settles out in transport via the low velocity canal to the treatment plant.

Further, should a new mining-related surface facility be needed in Link Canyon, there could be an increased potential of erosion from disturbed areas, and an increased potential for pollutants such as hydrocarbons to be inadvertently released. However, UDOGM permits would require sediment-control measures, containment means, etc. to minimize these types of impacts and prevent them from continuing offsite.

The potential for the sulfide minerals present within the SUFCO Mine area to acidify groundwater and affect Quitchupah Creek below the mine discharge point has been determined to be negligible, primarily due to the abundance of neutralizing carbonate minerals and the low sulfur content of the coal (Mayo and Associates 1997c). Further, Mayo and Associates did not identify other

potentials for acid- or toxic-forming materials to contribute to a decline in Quitchupah Creek water as a result of the UPDES Discharge Point. It is expected that, should a discharge point be permitted in lower Box Canyon Creek/Muddy Creek, required water quality treatment would not have to deal with this issue.

Given the noted natural decreases in quality in both Muddy Creek and Quitchupah Creek in their downstream reaches due to contact with marine shales, impacts to water quality in the Colorado River would not occur. Localized potential impacts to special status species found in the Colorado or its tributaries as a result of potential changes to discharge rates is described in Section 3.7.

Transbasinal diversion are inconsequential since all the surface drainages are part of the Muddy Creek basin. According to Mayo and Associates, groundwater in the deeper formations moves very slowly and provides meager contribution to Muddy Creek. Regardless of discharge location, mine water discharge would increase the quantity of water in the Muddy drainage.

Sediment Impacts

Sediment yields in the stream channels may increase locally due to subsidence. Subsidence cracks that intersect ephemeral drainages with steep gradients could, for a short period of time (in the range of 1 year), increase the sediment yield of the stream. However, this sediment increase would cause the crack to be quickly filled, recreating pre-subsidence stream channel conditions. Upland contributions of sediments would not be expected to change due to subsidence or other indirect effects of underground mining. Thus, the potential impact to sediment yield as a result of mining and/or subsiding under the Project Area would be minor and of short duration.

However, should an operator other than Canyon Fuel obtain the lease and construct new surface facilities in Link Canyon, there could be an increase in sediment in the surface waters downstream from disturbed areas. UDOGM permits would require sediment-control measures to minimize this impact.

Water Right Impacts

Any loss of water rights caused by subsidence would have to be replaced. Therefore, there would be no impacts to water rights holders.

3.3.2.3 Alternative C

SCLSs would be implemented under this alternative to provide greater protection to certain resources. SCLS #3, #7, #9, and #17 relate specifically to water resources. SCLS #3 and #7 require baseline study and operational monitoring to describe surface hydrology and impact to it. SCLS #9 prohibits escarpment failure and damage or flow alteration of perennial streams without specific FS approval to do so. SCLS #17 requires replacement of impacted waters at the source.

Under this alternative, impacts would be the same as those listed for Alternative B with the exception that impacts related to subsiding escarpments and perennial streams would not occur.

Subsidence-Related Impacts
Subsidence-related impacts to rainfall runoff, overland flow and ephemeral drainages would be the same as for Alternative B. Impacts to stock watering ponds would be the same as described for Alternative B, except the North Pines pond is within 300 feet of areas protected from mining and would not be in an area of subsidence. All of these subsidence-related impacts would be the same regardless of who develops the leases.

Mine Water Discharge Impacts
Impacts would be the same as under Alternative B.

Sediment Impacts
This would be the same as under Alternative B.

Water Right Impacts
This would be the same as under Alternative B, except that in addition to replacing any lost, adjudicated water, SCLS #17 would require that replacement of any identified protected water occur at the source. SCLSs #3 and #7 would provide the necessary information to document the need for water replacement.

3.3.2.4 Alternative D
Because mining would be allowed to subside escarpments and stream areas, impacts would be the same as for Alternative B, except that undermining of the Upper Main Fork of Box Canyon, as well as the East Fork and the Confluence Area - Main Fork Box Canyon, could occur. SCLSs #3, #7, and #17 would be in place.

Subsidence-Related Impacts
Impacts to the East Fork, the Confluence Area - Main Fork Box Canyon, and the upland areas would be the same as described for Alternative B. Potential impacts to the morphology and flows in the upper Main Fork Box Canyon would be generally the same as described for the East Fork under Alternative B, as summarized below.

Additionally, subsidence of upper Main Fork Box Canyon would occur. The overburden in the upper Main Fork Box Canyon ranges from 800 feet to 900 feet. Impacts would be expected to be similar to those discussed for upper East Fork under Alternative B. Up to 2,000 feet of perennial stream may be subsided. Gradient is predicted to be reduced to nearly flat over a few-hundred-foot reach, decrease from 3.6 percent to 2.8 percent for a distance of about 130 feet, and increase by about 0.8 percent in another area (Agapito Associates 1997). Implications of this gradient change would be the same as described for the upper reaches of the East Fork in Alternative B.

Further, the upper Main Fork Box Canyon would also be subject to surface tension cracks from both transient wave movement and permanent subsidence strain. Permanent cracking is likely where gateroads cross the stream channel. According to projected mine plans, gateroads would

pass under Box Canyon in two locations. This would have some potential to affect perennial stream flows. Cracking could intercept and redirect streamflows for some distance until it's possible reappearance some distance downstream, leaving segments dry. Cracks could be present for up to 3 years, depending on channel conditions and sediment transport. While reaches of the upper Main Fork Box Canyon may be dewatered, the colluvial contributions to flow may continue functioning as a perennial system. Depending upon the extent and duration of flow losses; however, changes in flow temperature, channel wetted area, etc. could occur due to reduced flows and instigate ecosystem changes.

As described for the East Fork, these likely short term or long term alterations may have implications to the upper Main Fork of Box Canyon Creek and related ecosystems, but they would not have much affect on flow regime in Muddy Creek, or its source as a domestic supply, given the very small percentage of surface flow contributed by Box Canyon Creek.

Impacts to stock watering ponds would be the same as for Alternative B. SCLS #17 would require replacement of water at the source if a loss occurred. All other impacts would be as discussed for Alternative B.

Mine Water Discharge Impacts
Impacts would be the same as under Alternative B.

Sediment Impacts
This would be the same as under Alternative B.

Water Right Impacts
This would be the same as under Alternative B.

3.3.3 Mitigation and Monitoring

As noted above, the operator would continue to repair stock ponds that may experience decreases in storage potential due to subsidence-caused tension cracking. Further, depending upon the location and accessibility, repair of cracking in stream bottoms may also be warranted. However, for much of the channel reaches, access conditions may preclude attempts at repair. Also, given the uncertainty regarding effectiveness, continued attempts may be necessary.

A detailed water rights investigation should be done to resolve discrepancies in locations of water sources for which rights are held by the FS.

The hydrologic monitoring plan recommended by Mayo and Associates (1997b) for the Main Fork of Box Canyon should be implemented. A similar plan should also be implemented on the East Fork of Box Canyon within the Project Area. These plans would include flow measurements, channel profile surveys and visual inspections.

Consideration should be given to piping a potential discharge directly to Muddy Creek, rather than discharging to lower Box Canyon Creek. This may necessitate siting the breakout location more toward the east.

Muddy Creek and lower Box Canyon should be subject to modeling and monitoring to aid in prediction of effects of a mine water discharge.

3.3.4 Cumulative Effects

Cumulative impacts to surface water would primarily be of two types: sediment loading/erosion impacts, and alteration of flows in stream channels.

The past and existing disturbances associated with the Ricci Mine in Muddy Canyon and the Link Canyon Mine likely contribute a greater-than-background amount of sediment to Muddy Creek and Link Canyon streams, respectively. These sources are essentially uncontrolled at this time. The existing SUFCO Mine also likely generates sediment from mining the Quitchupah Lease, but that source is, for all practical purposes, negligible due to controls required by their mining permit. Any new mine facilities developed under these alternatives would similarly generate sediment, but operators would be required to control it on-site. If new surface facilities were installed in Link Canyon, some of the existing disturbances and consequent sediment loading from the old mine may inadvertently be eliminated or controlled. However, other sediment sources from the new mining activities would be potentially available in both Muddy Creek and Link Canyon due primarily to channel erosion as channel adjustments are made to accommodate mine discharge water flowing in those channels, and in the tributary Box Canyon streams as subsidence-related adjustments take place.

Changes to the hydrologic regime of streams would also be a cumulative impact. Currently, and for a number of years, the SUFCO Mine discharges about 1,000 gpm to 1,500 gpm of intercepted groundwater from the Quitchupah Lease to the North Fork of Quitchupah Creek. The old Link Canyon workings also discharge, although at a much lower rate, drained mine water, to Link Canyon. With the SUFCO Mine, and additional 1,500 gpm would be discharged, either to Link Canyon or to Lower Box Canyon Creek/Muddy Creek. In the future, a new mine at the Muddy Tract may also potentially discharge intercepted water somewhere within the Muddy Creek watershed, and could potentially alter flow regimes, increase sediment transport rates, change channel characteristics, and/or result in a local trans-basin diversion.

Under Alternatives B and D, changes to the flow regimes in the Main and East Fork of Box Canyon could occur if subsidence-caused tension cracks intercept flow. Further, the planned pumping and usage of flows in either fork of Box Canyon for livestock watering on the plateau surface would reduce stream flows during the duration that pumping occurs. If pumping occurred simultaneously with subsidence, Box Canyon Creek could be rendered dry over a long reach, with consequent impacts to its ecosystem.

Stock watering ponds have been and continue to be impacted by mining on the Quitchupah Lease. If those impacts were to continue at the same time stock pond impacts occur on the Project Area, additional impacts to livestock could occur.

3.3.5 Residual Adverse Impacts

Adverse impacts to surface water that would remain subsequent to mining of the Project Area include:

1. The long-term or indefinite drainage of mine flows into Lower Box Canyon Creek/Muddy Creek which may continue at a lower rate after mining ceases (assuming that a discharge permit could be obtained for this area;

2. Alternatively, the long-term or indefinite retention or diversion of small amounts of groundwater flow, preventing it from entering the Muddy Creek system should a discharge permit not be granted;

3. Under alternatives B and D, the risk of continued effects of flow depletion in localized stretches of perennial streams should the predicted healing of tension cracks not occur, or bentonite repair be impossible or ineffective;

4. Under alternatives B and D, the permanent loss of up to 75 percent of the baseflow to Lower Box Canyon should surface waters be intercepted to mine level at the Confluence Area - Main Fork Box Canyon and the East Fork's lowermost reaches; and

5. The loss of functioning of stock ponds should bentonite or other repair measures require repeated applications to be effective.

3.3.6 Irreversible/Irretrievable Commitment of Resources

No surface water would directly be committed for use in this project. However, the interception and discharge, in greater and faster amounts than normal, of groundwater that may supply a small portion of the Muddy Creek's baseflow would result in an irreversible and irretrievable release of that water. Although potentially in effect for a long period of time, this impact would be of little consequence to the hydrologic regime of Muddy Creek because the groundwater intercepted by the mine normally provides only a very small portion of Muddy Creek's flow.

Further, under Alternative B, the interception of flows to the mined-out levels due to subsidence over low cover areas of the Confluence Area - Main Fork Box Canyon and the East Fork's lowermost reaches would be an irreversible loss of down gradient surface water.

3.3.7 Short Term Uses vs. Long Term Productivity

Not relevant to surface water issues for this project.

3.4 SOILS

3.4.1 Affected Environment

The analysis area for soils includes the Pines Coal Lease Tract, the Permit Amendment Area, the Lease Modification Area, and the Link Canyon drainage. The soils of the National Forest lands within the analysis area have been mapped by the FS on an Order III level. There are five Families of upland soils, mostly coarse-grained soils. The hydric soils have not been mapped but exist as small inclusions at the surface hydrologic expressions. The soils within the major drainages have not been mapped but generally are poorly developed sands and loamy sands over bedrock.

The soils on the BLM lands in the Link Canyon drainage, an alternative mine entrance site, have been mapped preliminarily at the Order III level by the Natural Resources Conservation Service (NRCS). The soils within the upper Link Canyon area at the proposed mine site are dominated (70 percent) by rock outcrop so provide little opportunity for salvage and subsequent use in reclamation. The soils in the lower canyon at the site of the probable access road alignment are shallow poor quality soils. Due to the steep terrain and lack of vegetative cover, the soils in the canyon are generally eroded and subject to continued erosion from surface water.

The soils data for the Project Area within the FS lands have been drawn from the "Soil Survey of the MSL, Manti Division, Utah. Parts of Carbon, Emery Sanpete, Sevier, and Utah Counties (Soil Survey Area 645)", Draft of March 1997 by Daniel Larsen, Forest Soil Scientist.

The distribution of soils in the Project Area is shown on Figure 3-9.

The soils mapped for the National Forest lands include:

Map Unit Name

20 Strych - Pathead - Podo Families - Rockland complex, 30 percent to 80 percent slopes
24 Rabbitex - Repp - Reva Families complex, 5 percent to 30 percent slopes
35 Detra Family, 5 percent to 15 percent slopes
57 Falcon Family - Rock outcrop complex, 3 percent to 10 percent slopes
107 Scout - Doney - Curecanti Families complex, 20 percent to 70 percent slopes

Soil Map Unit No. 20

Map Unit Name: Strych - Pathead - Podo Families - Rubbleland Complex, 30 percent to 80 percent Slopes

Map Unit Setting

Landform: steeply sloping escarpments and canyon slopes
Geology (parent material): colluvium from interbedded sandstone, siltstone, and shale
Broad vegetative type: pinyon-juniper
Elevation range: 5,000 feet to 8,000 feet

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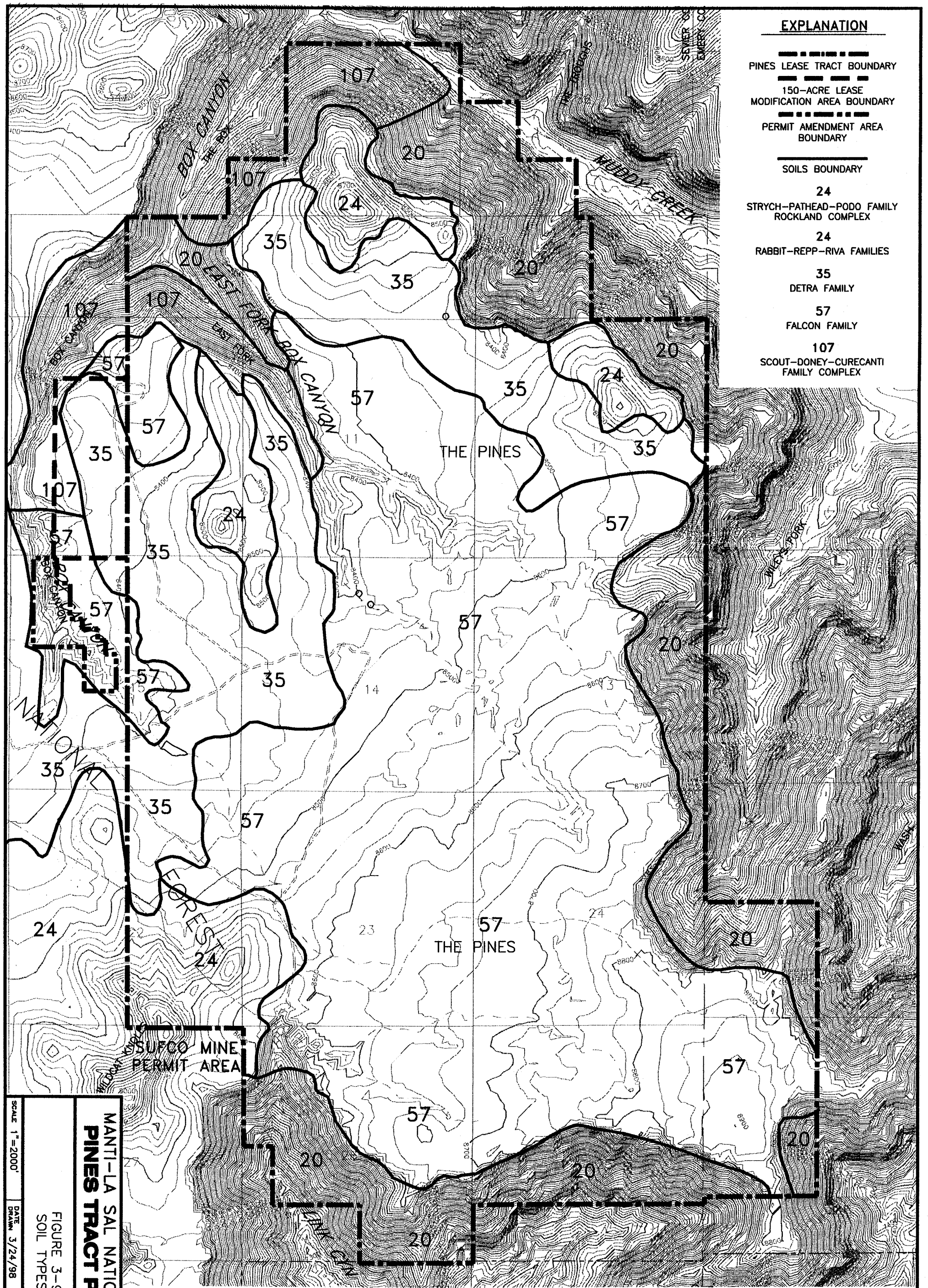


MANTI-LA SAL NATIONAL FOREST

PINES TRACT PROJECT

FIGURE 3-9
SOIL TYPES

SCALE	DATE DRAWN	LAST REVISED
1"=2000'	3/24/98	8/20/98

Climatic factors (mean annual):
Precipitation: 14 inches to 18 inches
Air temperature: 40°F to 49°F.
Freeze-free period: 60 days to 100 days

Composition
30 percent: Strych Family Soils
30 percent: Pathead Family Soils
15 percent: Podo Family Soils
15 percent: Rockland Complex
10 percent: contrasting inclusions of rock outcrops and finer textured soils

Management Considerations
This unit is limited by steep slopes, stoniness, high summer temperatures, and low available water.

Soil Map Unit No. 24
Map Unit Name: Rabbitex - Repp - Families Complex, 5 percent to 30 percent Slopes
Map Unit Setting
Landform: complex ridges and benches
Geology (parent material): limestone, shale and sandstone
Broad vegetative type: mountain brush, sagebrush, limber pine
Elevation range: 8,200 feet to 8,800 feet
Climatic factors (mean annual):
Precipitation: 15 inches to 20 inches
Air temperature: 40°F to 45°F.
Freeze-free period: 60 days to 100 days

Composition
45 percent: Rabbitex Family Soils
35 percent: Repp Family Soils
20 percent: contrasting inclusions of cumulic haploborolls, rock outcrop, colder (cryic) soils, and clayey soils

Management Considerations
These soils are high in calcium carbonate and are relatively droughty.

Soil Map Unit No. 35
Map Unit Name: Detra Family, 5 percent to 15 percent Slopes
Map Unit Setting
Landform: benches, basins and adjacent toeslopes
Geology (parent material): alluvium, shale, sandstone and limestone

Broad vegetative type: sagebrush
Elevation range: 9,000 feet to 8,900 feet
Climatic factors (mean annual):
Precipitation: 16 inches to 20 inches
Air temperature: 40°F to 44°F.
Freeze-free period: 90 days to 100 days

Composition
80 percent: Detra Family Soils
20 percent: contrasting inclusions of soils less than 40 inches to bedrock and soils with greater than 35 percent clay

Management Considerations
These soils have moderately high alkalinity.

Soil Map Unit No. 57
Map Unit Name: Falcon Family - Rock Outcrop Complex, 3 percent to 10 percent Slopes
Map Unit Setting
Landform: gently sloping to sloping road sandstone tablelands
Geology (parent material): flat laying sandstone of Price River Formation
Broad vegetative type: ponderosa pine
Elevation range: 8,400 feet to 6,800 feet
Climatic factors (mean annual):
Precipitation: 16 inches to 20 inches
Air temperature: 40°F to 44°F.
Freeze-free period: 60 days to 100 days

Composition
55 percent: Falcon Family Soils
30 percent: sandstone rock outcrop
15 percent: contrasting inclusions of deeper, more stony, and sandier soils

Management Considerations
This unit is limited by shallow depth to bedrock and droughty conditions.

Soil Map Unit No. 107
Map Unit Name: Scout - Doney - Curecanti Families Complex, 20 percent to 70 percent Slopes
Map Unit Setting
Landform: steeply sloping, dissected canyon and mountain slopes
Geology (parent material): sandstone and shale
Broad vegetative type: mountain brush, douglas fir

is unknown; however, they have generally been identified in the Forest Plan, by the Level II Riparian Inventory (USDA-FS 1993), and by field reconnaissance. Wetland and riparian vegetation has been estimated to represent less than 1 percent of the total acreage within the Pines Tract Project Area (JBR 1998a). Recent studies in the semi-arid West comparing riparian areas with adjacent uplands showed that riparian zones support up to 400 percent more plant biomass, up to 200 percent more species richness, and contribute to large increases in density and species richness for birds when compared with upland areas (Clary and Medin, 1998).

For the purpose of this analysis, it has been assumed that an average size of 0.25 acres of wetlands/riparian habitat is associated with each spring within the analysis area. This estimate has been based on local experience (USDA-FS 1997). The Project Area contains approximately 40 known springs. Assuming this, approximately 10 acres of wetlands/riparian habitat associated with springs are located throughout the Project Area. Assuming approximately 0.25 acres of wetland/riparian habitat occurs adjacent to stock ponds, and the Project Area contains 9 stock ponds, approximately 2.25 acres of wetlands/riparian habitat exists.

In 1993, a Level II Riparian Inventory was conducted along portions of East Fork of Box Canyon and Box Canyon (USDA-FS 1993). The riparian community associated with the East Fork of Box Canyon was estimated to range in width from 1 foot to 2 feet on either side of the stream channel to as much as 30 feet to 40 feet on either side of the channel. For the purposes of this analysis, approximately 20 feet of wetland/riparian habitat was assumed to exist on either side of East Fork of Box Canyon and Box Canyon. Assuming this and based on the extent of riparian areas identified on Figure 3-11, approximately 10.1 acres of wetland/riparian habitat is associated with East Fork of Box Canyon and approximately 1.8 acres is associated with Box Canyon.

Within Link Canyon, discharges from a spring located at the head of the canyon as well as discharges from the old Link Canyon portal support a small wetland/riparian area. Wetland/riparian acreage within Link Canyon has been estimated to encompass approximately 0.007 acre. Therefore, based on these estimates, approximately 24.16 acres of wetlands/riparian areas exists within the Project Area.

Areas immediately adjacent to springs, seeps, areas along streams, and stock ponds (as shown on Figure 3-11) are likely to exhibit either wetland characteristics (hydrology, hydric soils, and/or hydrophytic vegetation) or riparian vegetation. Vegetation associated with wetland/riparian areas include sedges (*Carex spp.*), rushes (*Juncus spp.*), and horsetails (*Equisetum arvense*). Within the Project Area, narrow stringers of riparian vegetation exists within the canyons; Box Canyon, East Fork Box Canyon, Muddy Creek Canyon, and Link Canyon. Riparian vegetation consists of herbaceous species, shrubs, and scattered trees.

Conifer Timber

Approximately 30.5 percent, or 2,780 acres of the analysis area supports coniferous timber species. This type includes open stands of ponderosa pine (*Pinus ponderosa*) and the more densely stocked stands of Douglas fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*). Aspen (*Populus tremuloides*) occurs in these stands, usually as an overstory remnant that is being replaced by the conifers, although this species also occurs in the understory of some open stands. Mahogany is also a common associate of the conifer timber type.

Aspen/Deciduous Forest

Aspen occurs throughout the analysis area as an associate species in the conifer timber, riparian, and mixed vegetation types. It also occurs in sufficient quantity on approximately 85 acres, or 0.09 percent, of the area to be considered an individual vegetation type. The type includes snowberry and woods rose as the major understory species.

Pinyon/Juniper Woodland

This plant community consists of an overstory of pinyon pine *(Pinus edulis)* and Utah juniper *(Juniperus osteospermis)*, a scattered shrub understory of serviceberry *(Amelanchier utahensis),* and a sparse herbaceous groundcover of perennial grasses such as Indian ricegrass and Salina wildrye, *(Elymus salina)* and forbs. The pinyon-juniper woodland is located in Link Canyon from the talus slopes downgradient to SR-10. It occupies about 1,600 acres, or 17.6 percent, of the analysis area.

Barren Ground

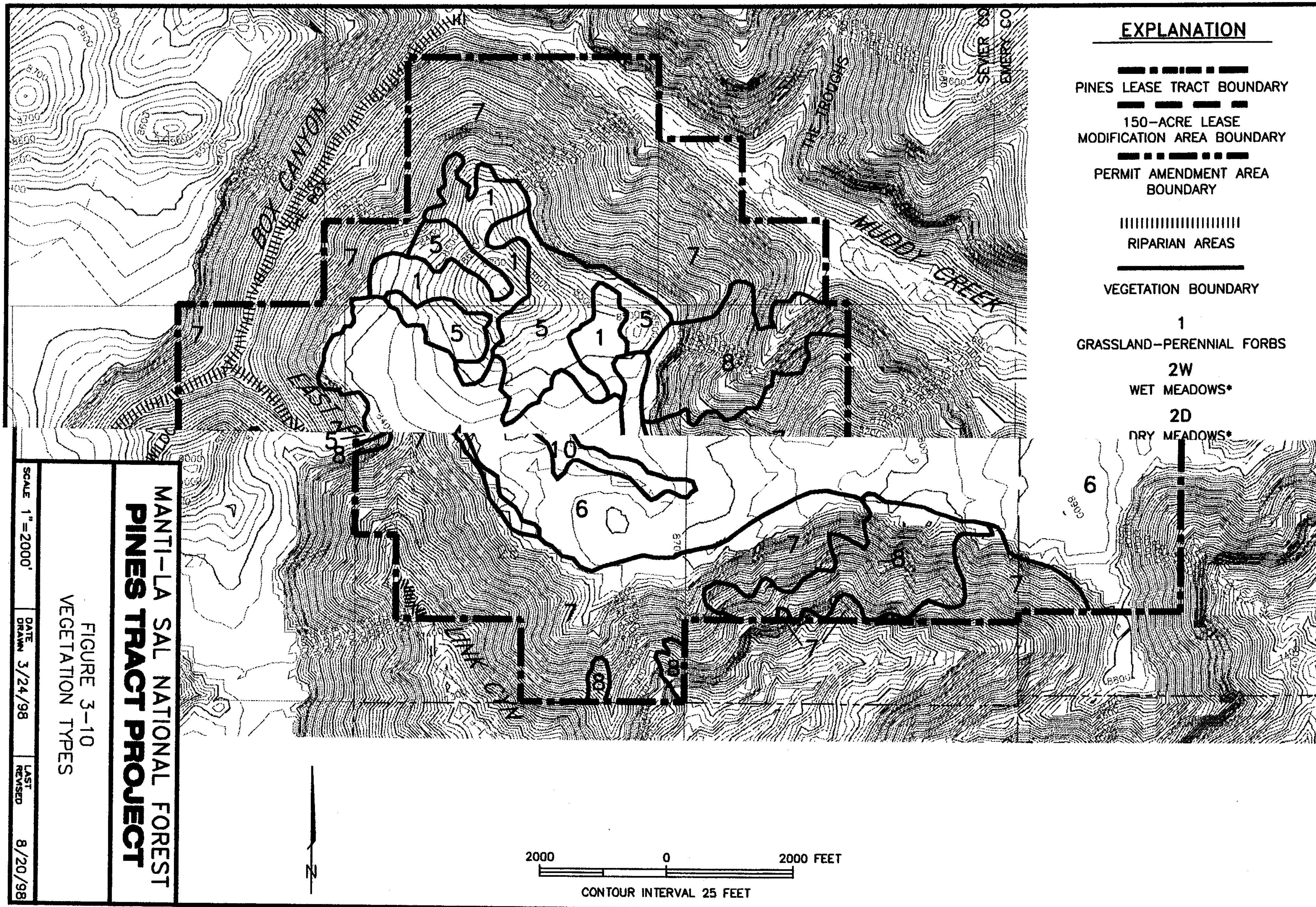
Barren ground is generally associated with talus slopes, steep escarpment faces, and rock outcrops. This category includes species limited to the surface cracks and escarpment shelves where soil can accumulate and plant life can be supported. Indian ricegrass, mountain mahogany, Utah juniper, and a variety of forbs and shrubs occur widely scattered on these harsh sites. Barren ground accounts for approximately 321 acres, or 3.5 percent, of the analysis area.

Riparian/Wetland

Jurisdictional wetlands are defined by the United States Army Corps of Engineers (Army Corps), and the Environmental Protection Agency (EPA) as:

> *... those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 230.3 and 33 CFR 328.3).*

Wetlands within analysis area have not been formally delineated per the requirements of the Army Corps 1987 Wetland Delineation Manual nor have any detailed field studies been performed. Therefore, the total acreage of existing wetlands/riparian areas occurring within the Project Area



MANTI-LA SAL NATIONAL FOREST
PINES TRACT PROJECT

FIGURE 3-10
VEGETATION TYPES

SCALE 1"=2000'
DATE DRAWN 3/24/98
LAST REVISED 8/20/98

3.5 VEGETATION

3.5.1 Affected Environment

The analysis area consists of the Pines Coal Lease Tract, the Lease Modification Area, the Permit Amendment Area, Link Canyon and lower Box Canyon. The analysis area supports nine vegetation communities: grassland-perennial forbs, sagebrush, mountain brush (browse shrub), conifer timber, aspen/deciduous forest, barren ground, riparian, pinyon/juniper woodland, and mixed (Figure 3-10). The vegetation on the analysis area has been modified by several actions. Timber sales of ponderosa pine occurred on approximately 400 and 900 acres in 1981 and 1982, respectively. These areas were subsequently spot planted to reforest the site. During the late 1980s and early 1990s, approximately 400 acres of sagebrush were burned to favor herbaceous vegetation for the improvement of elk winter range.

Grassland-Perennial Forbs

The grassland-perennial forbs vegetation community is limited to approximately 282 acres of the analysis area (approximately 3.1 percent). Major grass species include mountain brome (*Bromus carinatus*), bluegrass (*Poa secunda*), Salina wildrye (*Elymus salinus*), bluebunch wheatgrass (*Agropyron spicatum*), western wheatgrass (*A. smithii*), and Indian ricegrass (*Oryzopsis hymenoides*).

Sagebrush

The sagebrush vegetation type is found on the upper elevation benches. Mountain big sagebrush (*Artemisia tridentata vaseyana*) and black sagebrush (*A. nova*) are the dominant shrub species, depending on soil type. Salina wildrye, bluebunch wheatgrass, and western wheatgrass are the major understory grasses. This is an extensive type within the analysis area, accounting for 2,080 acres, or 22.9 percent. Approximately half of this acreage has been treated to reduce the sagebrush component and increase the grass component. Following brush treatment, the areas were seeded with smooth brome (*Bromus inermis*) and crested wheatgrass (*Agropyron cristatum*).

Mountain Brush

The mountain brush vegetation community occurs in the northern portions of the analysis area and accounts for 153 acres, or approximately 1.6 percent. Composition of this type is highly variable by site but can include one or more of the following as dominant species: oak (*Quercus gambelii*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), alder-leaf mountain mahogany (*C. montanus*), serviceberry (*Amelanchier* spp.), and/or sagebrush. Other shrubs that may be present include manzanita (*Arctostaphylos* spp.), snowberry (*Symphoricarpos* spp.), and woods rose (*Rosa woodsii*).

short-term as reclamation would be initiated shortly after completion of the wells much in the same manner as the coal exploration drilling activities. No oil and gas activities are currently anticipated.

The pond to be constructed in East Fork Box Canyon would disturb approximately 1 acre of loamy sands in the drainage.

The cumulative effect upon soil resources would be 140.5 acres of short-term disturbance that would be fully reclaimed, 19.17 acres of long-term disturbance that would be fully reclaimed at the end of mine life, one acre of long-term disturbance that would not be reclaimed in the foreseeable future, and 38 acres of shallow soils in Link Canyon that would be committed to the access road in Link Canyon and would not be reclaimed in the foreseeable future.

The above scenario would apply to Alternatives B, C, and D.

3.4.5 Residual Adverse Impacts

The 50 acres dedicated to construction of the access road that would become a public road would commit those shallow soils (Gerst, Lazear, Pinon soils) for the long-term beyond mine life.

3.4.6 Irreversible/Irretrievable Commitment of Resources

The 50 acres dedicated to construction of the access road that would become a public road would commit those shallow soils (Gerst, Lazear, Pinon soils) for the long-term beyond mine life. Since the road would exist past the foreseeable future this would be an irreversible commitment of soils resources.

3.4.7 Short Term Uses vs. Long Term Productivity

The mining of coal would not significantly reduce the productivity of the soils in the Project Area except for the permanent access road. The soil disturbance would be confined to the surface horizons that would be reclaimed under UDOGM regulations and SCLS #15, so long-term productivity would be restored. The exception is the disturbance to soils in Link Canyon, where the entire soil solum would be displaced and revegetated as a mix of soil materials.

disturbance to soils due to surface fracturing in the uplands would be minimal and short-term (1 year to 3 years, with some rehabilitation assistance from the operator) in most cases.

No specific impacts are identified for the lease modification area except the overall fracturing of the surface soils due to subsidence.

3.4.2.3 Alternative C

The impacts under Alternative C would be the same as those described in Alternative B except there would be no subsidence within 300 feet of the escarpment, so fewer large fractures in the soil surface would be expected. The disturbance to soils due to surface fracturing in the uplands away from the escarpments would be minimal and short-term.

SCLS #15 would require the reclamation of all disturbed areas, returning these sites to their pre-mining land use.

3.4.2.4 Alternative D

Implementation of Alternative D would result in the same impacts as Alternative C, except there would be additional subsidence around the escarpments resulting in fracturing in the shallow and discontinuous soil adjacent to and within the escarpment area. Some additional fracturing around the escarpments of the Permit Amendment Area could be evident.

3.4.3 Mitigation and Monitoring

Current mitigation practices for subsidence fracturing is to fill the fractures that remain after a season of natural filling with bentonite mud until the natural surface and shallow groundwater flow patterns are restored. This practice would restore the small areas of saturated soils and maintain the hydrologic balance.

The reclamation requirements under SMCRA to permit coal mining would include the preparation of a suitable seedbed by fertilizing and mulching to enhance the native topsoil materials. The fill material (70 percent rock fragments, 30 percent soil materials) used for mine development would be ripped, fertilized, mulched and seeded for revegetation of the surfaces. The reclaimed coal mine disturbance in Link Canyon would be subject to standards for bond release based on indigenous plant communities, post-mining land use, and a 10-year monitoring schedule. The SCLS #15 also requires the removal of all surface structures and reclaiming the disturbed acreage.

3.4.4 Cumulative Effects

A proposed breakout in Link Canyon and construction of a 69-kilovolt (kV) powerline up Link Canyon would result in 0.17 acres of long-term disturbance and 22.5 acres of short-term disturbance to the sparse soil resources in Link Canyon (Appendix B).

Potential oil/gas exploration drilling would disturb about 78 acres of soils in the analysis area, mostly in the coarse-grained soils of the uplands (Appendix B). These disturbances would be

The scenario to develop a mine portal in Link Canyon would disturb about 62 acres of the Rabbitex-Repp Association at the mine portal site and 38 acres of the Lazear-Gerst-Pinon Complex and other soils on the access road alignment. The Rabbitex soil is a clay loam with a salvage depth of 36 inches, the Repp soil is a sandy clay loam with a salvage depth of 16 inches. According to the overburden suitability standards of UDOGM, these soils would be rated as fair for revegetation. The steep slopes of rock outcrop would prohibit the salvage of any of the scattered Rabbitex or Repp soil materials for topsoil. The fill in the drainage for the mine development would be 70 percent rock fragments, revegetation of the mine site would depend upon modification of the fill material to support revegetation. Of the 62 acres of disturbance for mine development, approximately 19 acres of Rabbitex and Repp Family soils scattered amongst the rock outcrops would be disturbed and about 60,000 cubic yards (cy) of these soil materials would be included in the fill.

The 2,500 feet of discharge pipe would either be on the surface, within the existing road or within the fill for the pad and the access road so little additional disturbance to soils is anticipated.

The Lazear soil is a gravelly loam with a salvage depth of 14 inches maximum; the Gerst soil is gravelly loam with a salvage depth of 11 to 13 inches; the Pinon soil is a gravelly loam with a salvage depth of 10 inches. These soils are rated as poor to fair suitability for revegetation. It is assumed the new access and haul road would be dedicated as a public road at the conclusion of mining so the soils disturbed during construction and operation of the road would not be reclaimed in the foreseeable future.

The loss of hydrologic function of hydric soils (18.6 acres) due to alteration of the surface and shallow groundwater flows by subsidence-induced fractures would be short-termed. Most of the fractures would be filled by natural sedimentation and/or swelling of the clays in the rock stratas, thus, restoring the natural hydrologic function. The short-term loss would be quickly restored naturally and should not irreversibly affect riparian or wetland vegetation communities.

Surface fractures in the ephemeral and perennial drainage channels would not permanently impact the loamy sands of the sparse riparian and wetlands areas because most of the saturation is due to shallow groundwater flows in the sands from the slopes not from the channel flows.

The breakout in Link Canyon would occur in a disturbed area, the breakout near Box Canyon would occur on the rubbleland of the escarpment face. Consequently no impacts to soil resources would be anticipated.

The direct impacts would be 40 acres of short-term disturbance to soils due to coal exploration drilling, long-term disturbance to 19 acres of reclaimable soils in Link Canyon, and irreversible loss of 38 acres of soils on BLM lands due to construction of a permanent road. The indirect impacts would be linked to subsidence where shallow groundwater and surface water hydrology may be altered by fracturing, resulting in the drying of some small inclusions of hydric soils. The

3.4.2 Environmental Consequences

Soils, to most effectively serve their physical, chemical and biological roles in the ecosystem need to be undisturbed. Soil material may be salvaged for use in reclamation to re-establish vegetative cover, but would not completely regain the natural level of function in the ecosystem for several centuries. Thus, the evaluation criteria for impact to soil resources is the presence or absence of disturbance of the physical, chemical and biological functions.

3.4.2.1 No Action Alternative

No direct or indirect disturbance to soil resources would occur. The continued mining in the adjacent Quitchupah Lease could indirectly impact soils resources as the result of subsidence cracking the soil profile.

3.4.2.2 Alternative B

The underground mining of coal within the analysis area would not directly impact soil resources except for the coal exploration activity. Indirectly through subsidence, the small inclusions of hydric soils at the seep and spring sites may possibly be dewatered if the subsidence action should alter surface and shallow groundwater flows that saturate these small areas of soil.

The subsidence due to underground mining could produce fractures in the rock and soil at the surface. The fractures within 300 feet of the escarpment could extend to six inches in width, and those beyond 300 feet would be much smaller about 1-2.5 inches according to modeling of subsidence by Agapito Associates, Inc. (1998). The small fractures would be easily filled by soil movement and raveling within the coarse-grained soils. A few soil fractures that are aligned with the surface drainages could become enlarged through erosion due to water flows and serve as channels for surface drainage. Soil fractures in roads and other disturbed areas could also persist and become eroded due to surface water flows. For most of the soil fractures, the remaining slight linear depression, as the scar of the fracture, would serve as a miniature moisture retention basin. The larger fractures along the escarpment would be mostly in areas of little or no soil of the rubbleland portion of the Strych-Pathead-Podo-Rubbleland Complex (Map Unit 20) and could persist for several years. Isolated instances of larger fractures (2.5 feet wide and 5 feet deep) on the Quitchupah Lease indicate the possibility of a few larger fractures on the soil surface of the Pines Coal Lease Tract. The larger fractures may persist for a longer period of time and create some erosional features.

The coal exploration drilling could disturb approximately 40 acres, mostly Detra and Falcon Family soils on the lease. The activity would be short-lived (one season) and revegetation would proceed in the proper season immediately following cessation of drilling. The Detra and Falcon Family soils are suitable for revegetation, and secondary plant succession should be established within a short period of time (3 years to 6 years). Experience with reclaiming drill pads on the adjacent Quitchupah Lease has shown good reclamation that is compete within 5 years.

Elevation range: 7,000 feet to 9,000 feet
Climatic factors (mean annual):
Precipitation: 16 inches to 25 inches
Air temperature: 38°F to 45°F.
Freeze-free period: 80 days to 100 days

Composition
35 percent: Scout Family Soils
25 percent: Doney Family Soils
25 percent: Curecanti Family Soils
15 percent: contrasting inclusions of rock outcrops, shallow soils, and more sandy or more clayey soils

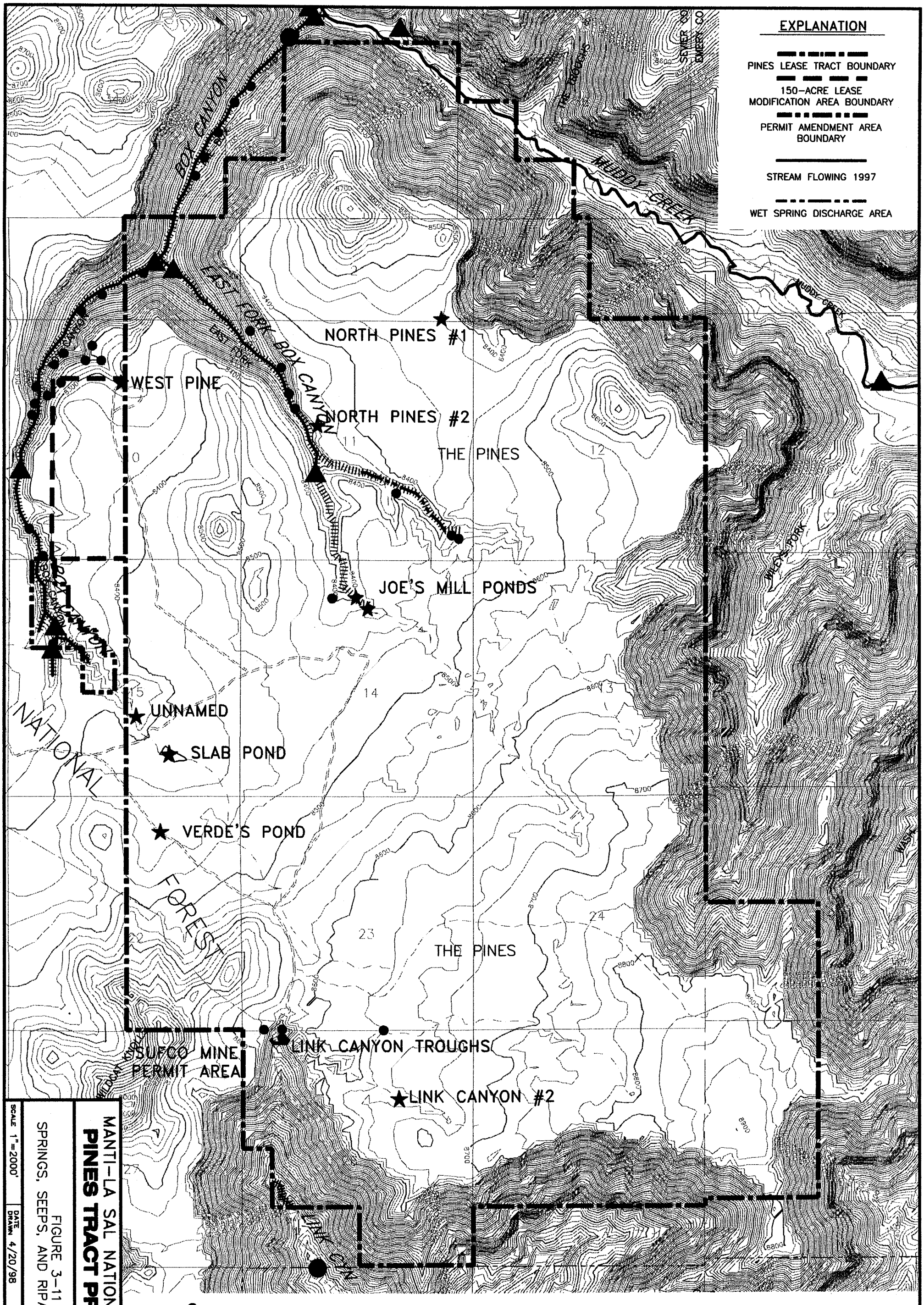
Management Considerations
This unit is limited to use by steep slopes and relatively dry condition. Soil erosion hazard is high if the soil if exposed through disturbance.

Soils on BLM Lands (Lazear-Gerst-Pinon Complex)
The mapping is incomplete; therefore, the acres of each soil is unknown at this time. A brief description is given for each soil since impacts would be irreversible due to paving of road and retention in public ownership.

Gerst Family Soil
The Gerst family consists of shallow, well drained, moderately slowly permeable soils on the sides of mesas, benches, terraces, and canyons. These soils formed in residuum and colluvium derived dominantly from shale and sandstone. Slope is 3 to 70 percent. Elevation is 5,200 feet to 8,000 feet. Average annual precipitation ranges from 8 to 14 inches, and average annual air temperatures ranges from 45 to 50 degrees F.

Lazear Soil Family
The Lazear series consists of shallow, well drained soils that formed in residuum derived from interbedded shales, limestone, and sandstone. Lazear soils are on hills, mesas, and ridges. Slopes range from 0 to 65 percent. Mean annual precipitation is about 12 inches and the mean annual temperature is about 53 degrees F.

Pinon Soil Family
The Pinon series consists of shallow, well drained, moderately slowly permeable soils that formed in alluvium and residuum derived from limestone. These soils are on knolls, ridges, mesas and hillslopes with slopes ranging from 1 to 30 percent. Mean annual precipitation is about 13 inches; mean annual temperature is about 53 degrees F.



MANTI-LA SAL NATIONAL FOREST

PINES TRACT PROJECT

FIGURE 3-11
SPRINGS, SEEPS, AND RIPARIAN AREAS

SCALE	DATE DRAWN	LAST REVISED
1"=2000'	4/20/98	8/20/98

Drier areas of the riparian communities include Kentucky bluegrass (*Poa pratensis*), Dunnhead sedge (*Carex phaeocephala*), and rush (*Juncus balticus*). Wetter areas of the riparian community are comprised of water sedge (*Carex aquatilus*) and Nebraska sedge (*Carex nebraskensis*) (USDA-FS 1993). Willow (*Salix spp.*), woods rose, rabbitbrush (*Chrysothamnus spp.*), shrubby cinquefoil (*Potentilla fruticosa*), and river birch (*Betula occidentalis*) are common woody species found in the narrow stringers of riparian vegetation within the canyons. In addition, willows (*Salix boothii* and *Salix drummondii*), blue spruce (*Picea pungens*), and individual aspen trees are scattered throughout the riparian zone. Some areas occasionally support a small stand of aspens.

Seeps that occur on the escarpments support a unique fern riparian type. The ferns are rooted within the crevices of the rocks where the water emerges or seeps down the surface of the escarpment. In addition to the ferns, mosses are common, and at least one site in Link Canyon supports a population of the Link Trail columbine (*Aquiliegia flavescens* var. *rubicunda*). This species is present in Box Canyon (see Section 3.7 of this document).

Mixed

This vegetation type consists a mixed conifer type (Douglas fir, white fir, and ponderosa pine) interspersed with aspen, and an understory of currant (*Ribes* sp.), snowberry, and manzanita. This type is primarily associated with the escarpments. On the escarpments above Muddy Creek, the vegetation is scattered Douglas fir-conifer type. Aspen are scattered throughout the canyons. Curlleaf mountain mahogany and manzanita occur all along the east and north edges of the canyon rims. Pinyon pine (*Pinus edulis*) and Utah juniper with a grass understory occurs in the Link Canyon area. Curlleaf and alder-leaf mountain mahogany also occur as overstory species in this vegetation type. Salina wildrye, bluebunch wheatgrass, and western wheatgrass are common understory grasses, and shrub species include sagebrush, Mormon tea (*Ephedra viridis*), serviceberry, woods rose, snowberry, and Oregon grape (*Mahonia repens*). The Mixed category type accounts for approximately 1,680 acres, or 22.5 percent, of the Project Area.

3.5.2 Environmental Consequences

3.5.2.1 No Action Alternative

Under this alternative, lands in the Project Area would continue to be managed as directed by the Forest Management Plan and the Emery C&H Allotment Management Plan (AMP) (USDA-FS 1992a). The allotment would be managed for livestock through the implementation of a rest rotation deferred system with the development of range improvement projects. Range improvement projects would include strip or mosaic treatments of sagebrush to improve livestock forage and elk winter range and installation of cattle guards to facilitate livestock distribution and management. The latter would eliminate gates being left open and livestock drifting into pastures that are to be rested or grazed at another time.

Changes in vegetation under this alternative would result from actions taken to meet allotment management goals for livestock and wildlife.

No impacts associated with coal mining would occur under this alternative.

3.5.2.2 Alternative B

The overall lowering of the land surface due to subsidence would not affect the overall health and distribution of the terrestrial plant communities present. Fracturing could divert water from saturated areas at springs and along streams that support wetlands and riparian habitats. These areas included the springs, seeps, and perennial streams located near and within the East Fork of Box Canyon and areas immediately associated with other springs and stock ponds. Assuming worst-case scenario, approximately 18.6 acres of wetland/riparian areas have the potential to be impacted.

Final technical reports related to geology, topography, subsidence and groundwater (Agapito Associates 1998; Mayo and Associates 1998) indicate that impacts to groundwater may be minor and occur temporarily. Based on observations made with the Quitchupah Lease, natural and mining-induced discontinuities causing groundwater diversions usually fill and seal quickly with sediments, although some surface cracking has persisted and not been successfully rehabilitated. Impacts to wetlands/riparian areas, should they occur, would likely be short-term and temporary. Depending upon the time subsidence and changes in the immediate area's hydrology occurs, impacts to wetland/riparian areas have been estimated to occur for one growing season, but a few sites may be extended to three seasons.

Should temporary decreases in surface water or groundwater that support wetlands/riparian areas occur, the existing wetland vegetative root matter supported by hydric soils, the existing seed source, and the short growing season would contribute to sustaining wetlands into the next growing season. Wetlands are seasonal resources, and would be expected to return to full vigor when the groundwater recharges and during the next growing season.

Conversely, implementation of the proposed project, specifically initial groundwater discharges to Link Canyon and then to Muddy Creek, have the potential to create a nominal amount of new adjacent wetland and riparian habitat. Discharges to Link Canyon would only be temporary, estimated at 3 years. This minimal amount of time would likely not be long enough to contribute to the establishment of wetland/riparian areas. If wetland/riparian areas are established, the water source would be eliminated at the end of the 3-year period, and areas established would not be hydrologically supported beyond that time. Based on existing flows in Muddy Creek, the additional discharge or flow amount would be considered nominal. An insignificant amount, if any at all, of wetland/riparian habitat has the potential to be created. In drought years the groundwater discharge to Muddy Creek has the potential to sustain existing wetland/riparian habitat, which otherwise may have been affected due to reduced drought-related flows.

Subsidence-induced ground movements elsewhere in the analysis area could affect ephemeral surface flows. Reduction or elimination of ephemeral flows to riparian areas, such as those draining to the East Fork of Box Canyon and Box Canyon could result in less surface water

available to the riparian zones. Because the riparian areas are dependent on perennial spring flow, rather than seasonal or ephemeral runoff, the diversion of the ephemeral flows would not eliminate the riparian vegetation. Some shrinkage of riparian zones would be expected due to lack of seasonal recharge to riparian soils.

Wetland and riparian habitats would not be maintained in the event that groundwater or surface waters are significantly and adversely impacted by mining operations. Under this Alternative, jurisdictional wetlands would only be protected in accordance with Army Corps Section 404 regulations.

The floor of East Fork Box Canyon is built up from colluvium that has accumulated against the face of the escarpment. The groundwater that seeps through the sedimentary rocks maintains a moist soil condition in these colluvial deposits well above the level attributed to the creek flow. This zone, often as much as 20 feet above the creek level, supports riparian species. Therefore, the diversion of the surface flow of the perennial waters in East Fork Box Canyon would not impact these "perched" riparian zones that are recharged from groundwater seeping into the canyon above the creek level.

There is the potential that wetlands/riparian areas could be affected as a result of surface disturbance (i.e., exploratory drilling). Stock ponds and springs in the Project Area could be affected as a result of subsidence-induced changes in the groundwater and surface water flow regimes. Effects to the water resources can translate to effects to vegetation. Approximately 18.9 acres of wetlands/riparian areas could be affected. Impacts would be temporary, until cracks are either naturally or artificially sealed. Depending upon the season, potential impacts are expected to be short-term, likely occurring for one growing season, but up to 3 years in some cases. This alternative includes application of several SCLS that have direct bearing on the vegetative resource, and will be discussed below.

Modeling and analysis of the escarpments in East Fork Box Canyon and Link Canyon suggest that mass failure is not likely in these areas due to the geologic formations present and the thickness of the formations overlying the coal seam. Some spalling could occur, which depending on the location, could impact the unique fern microsites. However, the spalling would leave a freshly exposed escarpment face, which would likely support similar fern vegetation in the long term.

Full extraction mining of the north and east side of the Pines Coal Lease Tract could cause additional spalling and escarpment failure. The impacts to vegetation would occur in the Mixed vegetation type. The majority of the failure would occur during the mining activity, although natural forces would continue to weaken fractures created by the mining activity over the long term. Vegetation at the site of the failure and on the talus slopes below the escarpment would be impacted. A new escarpment face would be created, permitting the long-term (decades or more) recovery of the vegetation, with a shorter term recovery expected on the talus slopes.

No impacts to vegetation would be anticipated from the partial extraction or no extraction scenarios for this portion of the Pines Coal Lease Tract.

The only surface disturbance would be the approximately 40 acres of access road and drill pads for exploration, and less than one acre for the breakouts for ventilation/escapeway portals in the escarpment of Muddy Canyon (approximately 800 square feet of disturbance) and a foot path associated with air escapeway portal.

The exploration activity is not likely to occur entirely within timbered areas but rather in the upland vegetation types. Assuming that it does, less than 2 percent of the conifer type would be impacted. The breakouts above Muddy Canyon would impact less than one acre of the Douglas fir-conifer vegetation of the Mixed type.

If another company is the successful bidder, the construction of the new mine and associated access road reconstruction would result in an additional 100 acres of new surface disturbance in Link Canyon. Such disturbance has the potential to impact a small existing wetland/riparian area within the canyon. The wetland/riparian area within Link Canyon has been estimated to be approximately 0.007 acre. Depending upon the location of the new mine within Link Canyon, impacts to wetland/riparian habitat could be permanent. The 150 acres of surface disturbance would be primarily within the pinyon-juniper woodlands community.

Under this alternative, monitoring of potential impacts to the vegetation would not occur and impacts would not be quantified. Timber removal needed for clearing of any sites for mine facilities development would not be done in accordance with the regulations of the surface management agency. Monitoring effects to key wildlife habitat from surface uses outside of the mine development area would not occur. Support facilities, structures, equipment, and similar developments would not be removed from the lease area and the disturbed areas associated with these facilities would not be stabilized and rehabilitated. Riparian habitats would not be maintained in the event that surface waters are adversely impacted by the mining operations.

3.5.2.3 Alternative C

Potential impacts to vegetation resources would be the same as for Alternative B, except that under this alternative, subsidence related impacts to wetlands/riparian areas within the East Fork of Box Canyon as described in Alternative B would not occur. Also, there would be no subsidence effects in the upper Main Fork of Box Canyon, and thus no affects to wetland/riparian zones. Impacts to wetland/riparian zones could still occur in the immediate vicinity of ponds under this alternative.

Since this alternative assumes protection of escarpments, vegetation below the exterior escarpments on the north and east sides of the Pines Coal Lease Tract, and the interior escarpments in the East Fork of Box Canyon and Box Canyon would not be effected by cliff spalling or escarpment failure. Similarly, the escarpment seeps that support the unique fern

vegetation would not be effected. No impacts to vegetation would be anticipated from use of partial extraction mining methods in the Project Area.

The amount of surface disturbance anticipated and potential effects would be the same as described for Alternative B.

If another company obtains the Pines Coal Lease Tract, additional surface disturbance resulting from the need to construct new mine facilities in Link Canyon would be the same as described for Alternative B.

The SCLSs being applied would eliminate or reduce the potential for impacts to vegetation resource. SCLS #3 would require that adequate baseline data be obtained to locate, quantify and demonstrate the interrelationship of geology, topography, surface hydrology, vegetation, and wildlife. These data would be incorporated into future monitoring of potential impacts. SCLS #5 imposes limitations on the design of new facilities to reduce potential for environmental impacts (i.e., wetland/riparian areas). The long-term monitoring required under SCLS #7 would be used to locate, measure, and quantify the progressive and final effects of underground mining activities on hydrophytic vegetation and ground/surface waters. If vegetative changes are identified, then appropriate measures could be imposed to reduce impacts to wetlands/riparian areas. SCLS #9 would also require that mining operations be conducted to prevent subsidence that would damage or alter the flow of perennial streams or damage escarpments. SCLS #10 would require that the ventilation breakout in lower Box/Muddy Canyon be constructed from inside the mine to prevent damage to other resources. Any removal of timber needed to clear sites for construction activities would be done in accordance with regulations of SCLS #11. Surface disturbance would be further limited by SCLS #12, which states that coal would be extracted only by underground methods. Stabilization and rehabilitation of sites supporting ancillary facilities, structures and equipment and similar developments would be required following final termination of use under SCLS #15. SCLS #17 provides measures for Lessee to replace all reductions in water at the source, which would maintain wetlands and riparian habitat if impacts were incurred. Because damage or alteration of flow of perennial streams would be avoided under this alternative, and other SCLSs would be applied, impacts to associated and adjacent wetland/riparian vegetation would not occur.

3.5.2.4 Alternative D

Implementation of Alternative D would allow mining that would subside in areas designated as "specifically approved locations," including under perennial streams and escarpment areas in the Project Area (i.e., Box Canyon, East Fork of Box Canyon, and the Muddy Creek and Wiley's Fork escarpments). Under this alternative, impacts to vegetation and wetland/riparian areas would be similar to those discussed under Alternatives B and C. However, there is the added potential for wetland/riparian impacts to occur within both Box Canyon and the East Fork of Box Canyon. Up to about 24.16 acres of wetland/riparian areas could be effected. Vegetation below the interior escarpments in Box Canyon and the East Fork of Box Canyon, as well as below the exterior escarpments in Muddy Creek and Wiley's Fork are potentially at risk to be damaged by cliff

spalling and escarpment failure. Impacts to wetland/riparian areas in Link Canyon and Muddy Creek are the same as discussed for Alternative B.

Subsiding Box Canyon and the East Fork of Box Canyon would increase the potential for subsidence impacts to the vegetation associated with the escarpment seeps. Modeling and analysis of the escarpments in these canyons suggests that mass failure is not likely due to geologic formations present and thickness of the formations overlying the coal seam. Some spalling could occur, which, depending on the location, could impact the unique fern microsites. However, spalling would leave a freshly exposed surface, which would likely support similar fern vegetation in the long term. The analysis of groundwater resources concludes that groundwater discharge that supports riparian communities and unique fern vegetation associated with escarpment seeps could either be enhanced or interrupted. Therefore, if water delivery is enhanced, the vegetation will be unaffected. Conversely, flow interruption could cause vegetation to stress or be eliminated. Subsiding the perennial portions of Box Canyon could affect the riparian corridor of the canyon bottom. Typically, the riparian vegetation occurs in a "strip" above the level of the stream channel, and appears to be supported more from flow through colluvial materials than from stream flow. Adverse effects are not likely, but may occur if sources supporting the colluvial groundwater flow are interrupted. Effects on subsiding the East Fork of Box Canyon would be the same as described for Alternative B.

Subsiding the Muddy Creek and Wiley's Fork escarpments on the north and east portions of the Pines Coal Lease Tract, respectively, could result in cliff spalling and escarpment failure. Potential impacts to vegetation would occur in the mixed vegetation type. The majority of the failure would occur during the mining activity, although natural forces would continue to weaken fractures created by the mining activity over the long term. Vegetation at the site of the failure on the talus slope slopes below the escarpments may be effected. A new escarpment face could be created, permitting long term (decades or more) recovery of the vegetation, with a shorter term recovery on the talus slopes.

Anticipated surface disturbance would be the same as described under Alternatives B and C. Application of SCLSs would be the same as described for Alternative C, except that SCLS #9 would be excepted.

3.5.3 Mitigation and Monitoring

SCLSs #3, #7, #11, #15, and #17 are directly related to mitigation and monitoring of the vegetation resource. Stipulations #3 and #7 require the collection of baseline information and the monitoring of progressive and final effects of underground mining activities on surface hydrology and vegetation. Stipulation #11 requires that any timber removal required for development of facilities be conducted in accordance with the Forest regulations. Stipulation #15 requires that facilities, structures, equipment, and other similar developments be removed from the lease area within 2 years after final use of the facilities, and that the disturbed areas associated with those facilities be stabilized and rehabilitated, including re-establishment of drainages to a condition that

supports the pre-mining land use. Stipulation #17 requires that any surface water identified for protection, that may be lost or adversely affected by mining operations, be replaced by the Lessee with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat and ecosystem.

All wetlands should be delineated in accordance with the Army Corps 1987 Delineation Manual and their jurisdictional boundaries verified by the Army Corps. Wetland areas should be monitored, as described in the Final Groundwater Technical Report (Mayo and Associates 1998) and in accordance with SCLSs #3, #7, and #9. Should impacts to these areas be exhibited during the course of longwall mining within the Project Area, the operator should be required to obtain a permit from the Army Corps per Section 404 of the Clean Water Act.

Previous mining experience in the local area and studies conducted to date indicate that the probability of occurrence of negative subsidence impacts to vegetation and wetland areas is relatively low. However, monitoring of perceived sensitive spring areas should be performed. Sensitive areas to be monitored include springs within portions of Box Canyon, East Fork of Box Canyon, Link Canyon, and Muddy Creek. In the event that negative impacts are observed, specific mitigation actions should be taken. Mitigation actions could include the establishment of buffers corridors for protection of sensitive sites and/or sealing tension cracks with bentonite.

The development of a new mine in Link Canyon (including the reconstruction of the access road) should, to the best extent possible, avoid wetlands/riparian areas (estimated to encompass approximately 0.007 acre). Should wetlands/riparian areas be impacted, they should be mitigated through replacement. Such replacement of wetlands would be coordinated with the Army Corps and implemented with a wetland mitigation plan. SCLS #5 would assist in protection of sensitive areas.

To assure no impacts to wetland/riparian areas, all reasonably foreseeable mineral exploration activities, including the development of exploration access roads and drill sites, should maintain a 100-foot buffer from all wetland/riparian areas.

3.5.4 Cumulative Effects

The cumulative effects to vegetation in the vicinity of the Project Area consist of the residual effects from past actions, current effects from present actions, and anticipated affects from reasonably foreseeable future actions.

The past actions (Appendix B) include coal mining in Muddy Canyon (Ricci Coal Mine, 1941-1953), Link Canyon (Link Canyon Coal Mine, 1940-1952), coal exploration (1900s to present), oil and gas exploration drilling (1981-1982), timber sales (East Fork Box Creek, 1981; Link Canyon, 1982). The residual effects of the coal mining and coal exploration are limited to small areas of disturbance associated with the portals and roads. The residual impacts from the oil and gas exploration and geophysical surveys is essentially non-existent. The timber sales impacted

approximately 1,300 acres. Regeneration and reforestation have been successful in reestablishing the timber resources. The livestock improvements have been primarily water developments. The residual impacts have been a change in vegetation from upland vegetation to ponds and riparian vegetation.

The present actions include coal mining of the Quitchupah Lease (1941-present), and continued range improvements. The impacts include approximately 70 acres of surface disturbance to vegetation for mine related facilities, some short-term subsidence effects, and small acreages of disturbance associated with the range improvements.

The future actions include the development of the Pines Coal Lease Tract (1998-2026), a powerline and substation in Link Canyon (1998-1999), and the development of the Muddy Coal Lease Tract in the future (Appendix B). The anticipated effects include impacts that have been analyzed above for the development of the Pines Coal Lease Tract, and the surface disturbance associated with a proposed powerline and substation in Link Canyon.

The surface disturbance associated with the breakout would include 0.17 acres at the breakout mostly in rock outcrop area with a scattering of pinyon-juniper woodlands. The construction of the powerline would disturb 22.5 acres of pinyon-juniper woodlands.

The cumulative impacts would be 140.5 acres short-term disturbance, 19.17 acres of long-term disturbance, and 38 acres permanently lost to road construction. The cumulative effects would more pronounced under Alternatives B and D mostly due to the potential for subsidence under perennial streams adversely affecting riparian zones and wetlands.

Although the residual, current, and anticipated effects to vegetation have or could change the nature of the landscape, the lands are in functioning condition and are meeting the land use plan goals for the area.

3.5.5 Residual Adverse Impacts

No residual adverse impacts to the vegetation resource are anticipated from any of the alternatives analyzed above. The impacts from exploration would be short-term until the disturbed sites are successfully reclaimed. Surface disturbance from the mine development would last until the mining is completed, the surface facilities removed, and the site reclaimed. The exception would be the road in Link Canyon, if developed, would likely remain, creating minimal acreage of permanent vegetation and wetland/riparian loss.

3.5.6 Irreversible/Irretrievable Commitment of Resources

The development of the Link Canyon road, if needed, would represent the only irreversible and irretrievable commitment of the vegetation resource. It is likely that this road would remain after the cessation of mining; and therefore represent a permanent loss of vegetation. Thirty-eight acres

of upland vegetation and 0.007 acres of wetland would be permanently removed under this scenario.

3.5.7 Short Term Uses vs. Long Term Productivity

Approximately 140 acres of vegetation could be impacted by surface disturbance under the alternatives analyzed above. In addition, a maximum of 24 acres of riparian vegetation could be impacted as a result of mining-induced ground movements. These impacts would be short-term (3 years to 6 years at a given disturbance site) and temporally distributed over the life of the mine. The sites would be reclaimed, or in the case of ground movement effects, revegetated by natural means. The long-term productivity of the vegetation resource would not be reduced.

3.6 WILDLIFE

3.6.1 Affected Environment

The analysis area for the wildlife resource encompasses the Pines Coal Lease Tract, the Lease Modification Area, the Permit Amendment Area, Muddy Canyon, and Link Canyon.

Mammals

The wildlife analysis area has the potential to provide habitat for approximately 80 species of mammals. This includes the highly visible species, such as elk and mule deer, and the lesser known or visible species such as bats and many of the members of the rodent family.

Mule deer and elk are Forest Management Indicator species. Both species use portions of the Pines Tract Project Area as winter range. Elk winter range use occurs on relatively snow-free open areas, such as the grassland and sagebrush vegetation types, wind-swept ridge tops, and the conifer and aspen timber types (Figure 3-12). Elk move out of the analysis area to spring calving and summer areas elsewhere. The Link Canyon/Wildcat Knolls area is the major corridor for this migration. Approximately 800 head of elk winter in the Pines and Wildcat pastures.

Mule deer use the south-facing slopes, mountain shrub communities, and canyon areas. Like elk, they move out of the area in spring to heavier cover for fawning and areas of greater herbaceous and shrub cover for summer.

Approximately 2,000 acres of General Big Game Winter Range occurs within the analysis area. The escarpments on the north, east, and south portions of the Pines Coal Lease Tract provide this habitat. Approximately 190,460 acres of the MLS are classified as General Big Game Winter Range. The FS management guidelines for General Gig Game Winter Ranges include emphasis on providing winter forage, and increasing plant species composition and a variety of age classes of browse species. Investments in compatible resource activities may occur; however they need to be designed and constructed to benefit wildlife. Permanent roads and special uses are permitted, and temporary, short-term roads must be rehabilitated for wildlife use within one season after completed use. Motorized traffic is managed as appropriate during primary use periods to prevent unacceptable stress on big game animals.

Bats

Bats are summer residents of the forested areas and around the escarpment. A 1997 survey for Townsend's big-eared bats (*Corynorhinus townsendii*) and spotted bats (*Euderma maculatum*) in Box, Muddy and Link canyons did not find any big-eared bats but did detect spotted bats in the canyons.

EXPLANATION

PINES LEASE TRACT BOUNDARY

150-ACRE LEASE MODIFICATION AREA BOUNDARY

PERMIT AMENDMENT AREA BOUNDARY

FOREST MANAGEMENT UNIT BOUNDARY

MMA
LEASABLE MINERAL DEVELOPMENT

RNG
TIMBER/WOOD FIBER AND FORAGE

TBR
WOOD FIBER PRODUCTION AND HARVEST

GWR
GENERAL BIG GAME WINTER RANGE

KWR
KEY BIG GAME WINTER RANGE

MANTI-LA SAL NATIONAL FOREST

PINES TRACT PROJECT

FIGURE 3-12
FOREST MANAGEMENT UNITS

SCALE	DATE DRAWN	LAST REVISION
1"=2000'	6/11/98	8/20/98

N

2000 0 2000 FEET

CONTOUR INTERVAL 25 FEET

Birds

The eight vegetation types provide a variety of habitats. Based on range and habitat requirements, approximately 130 species of birds may occur within the analysis area. While each vegetation type offers important habitat components, the riparian areas are the most heavily utilized habitat by birds in southeastern Utah. The riparian areas are important during migration as they are often the only habitats within the arid west that approximate the density, diversity, and structure of more mesic habitats found outside the intermountain region. The abundance of insects make riparian areas important foraging habitats for species that nest in the grass or shrublands adjacent to the riparian areas.

The timbered areas and escarpments provide nesting habitat for several raptors. Historical records and a 1997 aerial survey have documented six golden eagle (*Aquila chrysaetos*) nests within the analysis area. During the 1997 aerial survey, the status of two nests were listed as tended, three were old/dilapidated, and one historic nest was not found. In addition, nine golden eagle nests occur on escarpments adjacent to the analysis area. Of these, four were listed as tended, three were old/dilapidated, one was inactive, and one was not found during the 1997 aerial survey. The 1997 aerial survey also identified one active peregrine falcon (*Falco peregrinus*) nest adjacent to the analysis area and two falcon scrapes listed as tended within the analysis area. One northern goshawk (*Accipiter gentilis*) nest is known to occur in the conifer timber above Link Canyon. This nest is located in a tree and away from the escarpment. Several other raptors, such as red-tailed hawk (*Buteo jamaicensia*), American kestrel (*Falco sparverius*), and sharp-shinned hawk (*Accipiter striatus*) may nest in the aspen or conifer stands, or forage within the various vegetation types of the analysis area.

Sage grouse (*Centrocercus urophasianus*) were abundant on the analysis area historically, but populations have declined. Some of this decline can be attributed to maturation of the sagebrush vegetation and the limited amount of brood habitat (springs and riparian areas). Sage grouse were transplanted in 1987; the population has been monitored on the leks since 1991 and has fluctuated between 15-20 cocks and 14-28 hens.

The encroachment of the aspen stands by coniferous trees has resulted in a number of snags used by cavity nesting species. The timbered areas also provide unique foraging sites and foods (e.g., conifer seeds, larvae of wood boring insects, juniper berries), as well as different structure for nesting sites. Both mountain bluebirds (*Sialia currocoides*) and western bluebirds (*S. mexicana*) may nest within the analysis area. Approximately 100 bluebird nest boxes were installed by the USFWS in the early 1990s.

Amphibians

Amphibian dependence on water limits their distribution on the analysis area. Perennial water is only available in the Box Canyon and East Fork of Box Canyon drainages, and in the few springs and seeps on the lease tract. Ephemeral water sources occur in the minor drainages and

intermittent springs and stock ponds. These sites are used as breeding sites and areas where the young develop.

Eight of southeastern Utah's 13 amphibian species have potential to inhabit the analysis area: four toads, three frogs, and one salamander.

Reptiles

The vegetation types of the analysis area represent habitat for several reptile species. Although not dependent on water like amphibians, some species are more common in riparian areas and most species require a humid micro-environment to prevent desiccation of the eggs. Wetland areas are often used for egg deposition.

Seventeen of the 36 species of reptiles that occur in southeastern Utah are likely to occur within the habitats found in the analysis area: 5 lizards and 12 snakes, although 6 of the snakes are considered uncommon or rare.

Fish

The limited amount of perennial water within the analysis area reduces the potential for many species of fish to be present. However, lower Box Canyon, as a tributary of Muddy Creek does contain fish presumably the same species as is found in Muddy Creek. Therefore, the impacts to fisheries will be evaluated on the basis of change to water quality and quantity that could reach lower Box Canyon and Muddy Creek.

Four fish species endemic to the main stem of the Colorado River are listed as endangered. The four endangered fish species are the humpback chub *(Gila cypha)*, the bonytail chub *(Gila elegans)*, the Colorado squawfish *(Ptchocheilus lucius)*, and the razorback sucker *(Xyrauchen texanus)*. All four of these species populations have been greatly reduced in the upper Colorado River Basin. While Muddy Creek does eventually drain into the Colorado River, none of the streams in the analysis area represent habitat for these species, and none of the four endangered Colorado River fish occur in the analysis area.

Macroinvertebrates

No macroinvertebrate inventory has been conducted of the water sources within the analysis area; therefore the analysis is generic in nature. Macroinvertebrates are a Forest management indicator species. The species of macroinvertebrates at each water source is dependent on several habitat factors, such as water temperature, water quality, perennial or ephemeral flow, amount of flow, and bottom substrate. Generally, water of cool temperatures, good water quality, perennial flow, substantial flow, and variety of bottom substrates would have greater diversity and abundance of macroinvertebrates than water with high temperatures, ephemeral flow, low flow, and silty bottom substrate. Consequently, the macroinvertebrate diversity and abundance would be expected to be greater at the perennial springs and in the perennial flows of Box Canyon and the East Fork Box

Canyon than the diversity and abundance found in the stock ponds, ephemeral springs/low flow springs, and ephemeral drainages (e.g., Link Canyon).

3.6.2 Environmental Consequences

3.6.2.1 No Action Alternative

Mammals. Under this alternative, winter range for elk and mule deer could improve. The vegetation treatments could alter habitats for some species, resulting in population declines, but these species would continue to inhabit the analysis area. As vegetation matured, species previously affected would have their habitat return. Bat use may increase with the improvements in vegetation which in turn would presumably harbor a greater insect population.

Birds. As described for the mammals, some species will benefit from the vegetation treatments planned for this area and some species could undergo temporary decline in populations. Sage grouse could benefit by the treatments in the long term. Nesting habitat and upland forage could be improved by creating a younger age class of sagebrush and increasing the herbaceous component of the sagebrush vegetation type.

Amphibians. Negligible impacts to amphibians and their habitat would occur under this alternative.

Reptiles. Negligible impacts to reptiles and their habitat would occur under this alternative.

Fish. Negligible impacts to fish and their habitat would occur under this alternative.

Macroinvertebrates. Negligible impacts to macroinvertebrates and their habitat would occur under this alternative.

3.6.2.2 Alternative B

This alternative would include the standard BLM terms and conditions, and the Mine Permit conditions, however it would not include the SCLS for the protection of non-coal resources. Under this alternative, protection of key wildlife habitat from surface uses outside of the mine development area would not occur. Riparian habitats would not be maintained in the event that surface waters are adversely impacted by the mining operations. Within the analysis area, baseline studies to monitor wildlife habitat and to detect impacts related to mining activities would not be established. The mining operator would not be responsible for replacing any surface waters except for appropriated water that support the ecosystems affected by the mining activities.

Approximately 40 acres of surface disturbance due to the additional exploration roads and drill sites would be constructed, used, and reclaimed.

The potential exists for mining-induced subsidence to disrupt ground and surface water flows, which could reduce available water for wildlife and impact riparian habitats. Perennial waters of

East Fork of Box Creek and two stock ponds in this area could be impacted by tension cracks. Nine springs have been identified (JBR 1998b) in the East Fork Box Canyon. Subsidence-induced tension cracks could divert surface water to the groundwater on a short-term basis (1 year to 2 years), as discussed in Sections 3.1 and 3.3. Therefore, some temporary (1 year to 3 years) loss of riparian vegetation could occur.

Under this alternative subsidence-induced ground movements could adversely impact up to 21 springs and eight ponds. However, impacts to springs are considered unlikely (Section 3.2). Potential loss of water from ponds would not occur simultaneously and any loss due to cracking is expected to be healed or repaired within 3 years.

Potential for escarpment failure exists in Muddy Canyon, Wiley's Fork, and in the East Fork of Box Canyon under this alternative. The escarpments represent nesting habitat for raptors, roosting habitat for bats, and general winter range for big game species in the analysis area.

Exploration activities would create approximately 40 acres of surface disturbance. These types of surface disturbances temporarily remove habitat and temporarily increase human presence. The type and amount of habitat impacted would depend on the exact location of the facilities. There would also be additional breakouts for ventilation/escapeway portals in the escarpment of Muddy Canyon (approximately 800 square feet of disturbance), and a foot path associated with this escapeway portal.

Impacts to specific species or groups of species are identified below.

Mammals. Loss of surface water could be an impact to elk and deer, but the area is primarily winter range, and water is not a critical factor during this time of the year. The failure of the escarpment areas and the removal of the associated habitat could reduce the amount of winter range for deer and elk. Essentially all the big game winter range within the analysis area is located on the escarpments. However, failures would be expected to impact only a few acres of habitat per failure. Loss of this habitat would be insignificant. Escarpment failure could create barriers to migration routes for big game species.

If Canyon Fuel obtains the lease, it would continue to use the facilities and haul routes established for the Quitchupah Lease. Therefore, no change in mortality rate due to haul truck interactions is anticipated. However, the period over which hauling would occur would be extended by an additional 20 years.

The potential loss of riparian habitat and surface waters under this alternative could reduce the acreage of a habitat type currently limited in availability, and further decrease the distribution of water within the analysis area. This could have an overall impact of lowering the quality of habitat for many species, especially those species with territories or home ranges that are small in relation to the distribution of water sources. Bats use riparian areas extensively for foraging

due to the abundance of insects. Loss of riparian vegetation from East Fork Box Canyon could reduce the foraging habitat for these species.

The 40 acres of surface disturbance associated with exploration activities could also create a temporary loss of habitat. The species impacted, the time frame over which the impact would last, annually for the like of the mine), and the extent of the population impacted would depend on the location of the exploration activities. The grassland and shrub dominated vegetation would recover quickly from these activities. Disturbance in the forested areas would require many years to replace the trees to a mature state.

Birds. Any reduction in the amount of riparian habitat or surface water availability could be a loss of sage grouse brood habitat. A variety of riparian obligate species could also be impacted if this alternative were implemented. Riparian habitat represents a critical component of their habitat. For example, yellow warblers are found primarily on the edges of mixed deciduous and coniferous woodlands adjacent to riparian habitats or in the willow and aspen stands found in riparian areas. Loss of the low, shrubby vegetation associated with the riparian area could preclude this species from inhabiting the area.

Removal of vegetation as a result of the exploration activities would occur in small patches for drill sites, or as linear clearings for access roads. These impacts are not likely to impact an entire bird territory. Disruption of the nest site, either from direct removal of the vegetation or from increased human activity, could lead to nest abandonment. Similarly, exploration activities conducted on or near a sage grouse lek could result in the birds abandoning the lek. Removal of the goshawk nest tree or activity near the nest site during the nesting cycle could also cause nest abandonment. This would also apply to any other raptor species that may nest within the analysis area for which nest sites have not been identified.

Under this alternative, measures to prevent subsidence of escarpments would not be in place and nesting habitat for cliff-nesting species, such as golden eagles, could be modified or existing nest sites could be eliminated. Two golden eagle nests active in 1997 could be subject to escarpment failure. Consultation with the USFWS would be required where potential impacts to eagle nests could occur. One peregrine falcon nest and two unidentified falcon scrapes may also be in potential impact areas.

No raptor nests known to be active in 1997 occur in the area of disturbance in Link Canyon. A golden eagle nest that had been identified in earlier surveys, but not relocated in the 1997 survey, was located on the escarpment less than 1,000 feet from the probable location of a new mine. If the nest site were to be actively used again, disturbance from installing the discharge pipeline would not likely to cause nest abandonment.

Habitat for the western blue bird could be both lost or created. Removal of snags or trees with cavities during exploration activities could impact blue bird nesting habitat. Potential changes in

flow to riparian areas could cause some aspen stands to die, creating snags and potential nest sites for this species. Long term aspen losses could result in a loss of nesting habitat as the stand degenerates and snags are toppled.

Amphibians. Loss of riparian habitat and surface waters could reduce the amount of habitat available to these species. Because amphibians are dependent on water for at least part of their life cycle, a decline in the number and species of amphibians would be expected under this alternative if there is substantial loss of flow. These impacts would last until the tension cracks fill with sediment, and ponds and drainages once again maintain surface waters. This would occur over 1 year to 2 years for small cracks and perhaps decades for the larger cracks. The amphibians would likely return to these ponds shortly after the water is available because the ponds are located within drainages, and seasonal flows would provide an opportunity for amphibians to locate these renewed water sources.

Discharge to Link Canyon for 2 years to 3 years could result in increased use of this drainage by amphibians. The creation of quiet pools as well as flowing water could create habitat for breeding and non-breeding activities.

Reptiles. Although some species depend on moist soil conditions for protection of their eggs, minimal impacts to reptiles would result from implementation of this alternative. Some habitat removal could result from the exploration activities and impacts would last until vegetation is re-established (1 year to 6 years).

Fish. The magnitude of the impacts to fish would depend on the amount of surface water intercepted in the tension cracks and the subsequent reduction of flow in Muddy Creek. Sediment from escarpment failure at the north and northeast portions of the lease tract could create impacts to water quality in Muddy Creek. Large volumes of sediment from mass failures could create a major fish kill for a mile or more downstream. The eventual discharge of mine water to lower Box Canyon could alter the channel characteristics degrading fish habitat. In Muddy Creek the change in flow is slight, so impacts to the channel are considered insignificant. Water quality would not be an issue due to the State's anti-degradation rules.

For the four species of Colorado River fish no impact is anticipated. Both because impacts to hydrology are expected to be low, and because the Project Area represents a small percentage of the Colorado River drainage area, the May Effect - Not Likely to Adversely Affect determination made as a result of the 1996 Consultation remains warranted.

Macroinvertebrates. Macroinvertebrates are dependent on seasonal and perennial waters. Reduction in flow in East Fork Box Canyon could alter the habitat and change the species composition. Elimination of flow at springs or the drainages, even for 1 year to 3 years, could eliminate the macroinvertebrate populations. Macroinvertebrate populations would not be expected

to return to pre-impact conditions until both water flow and habitat conditions are restored. Such a recovery may require a period of up to several years.

Discharge to Link Canyon for 2 years to 3 years could result in new habitat being created for macroinvertebrates. The quality of the water, flow rates, micro-sites, and water temperature would influence the species composition of the new habitat.

If another company obtains the Pines Coal Lease Tract, the new mine facilities and the upgrade of the existing Link Canyon dirt road (approximately 6 miles) for coal haulage would result in approximately 100 acres of additional surface disturbance in Link Canyon. The increased surface disturbance would be primarily within the pinyon-juniper community, but some riparian habitat (0.07 acre) could also be impacted by the road improvement.

Additional impacts to specific species or groups of species under this scenario are identified below.

Mammals. The impact from additional surface disturbance would last for the life of mine and for 5 years after until secondary succession occurs and vegetation re-establishes. This would remove approximately five percent of the general big game winter range within the analysis area. Development of a mine at Link Canyon would be within known winter range for elk. The increased human and vehicular traffic could cause elk to avoid the area, effectively eliminating the use of approximately 600 acres (Link Canyon area) of winter range. This displacement could also increase the pressure on other winter range.

Direct impacts to elk from the increased traffic associated with the haul road could also occur; the number of vehicular incidents is likely to increase, especially during the migration periods. The haul road could also be an impediment to seasonal elk migration between the winter range in Link Canyon and the Wildcat Knolls area.

Birds. The increased acreage of habitat disturbance associated with the mine development would increase the loss of pinyon-juniper woodlands and small riparian habitats. The disturbance could remove about two percent of the nesting habitat for some species, including raptors. No raptor nests known to be active in 1997 occur in the area of disturbance in Link Canyon. The increased activity level at the mine site and coal haulage is likely to prevent this site from being used again during the life of mine.

Amphibians. No additional impacts expected under this scenario would have similar impacts to amphibians.

Reptiles. The additional surface disturbance from this scenario would remove more upland habitat that could impact some reptiles.

Fish. No additional impacts are expected under this scenario.

Macroinvertebrates. No additional impacts are expected under this scenario.

3.6.2.3 Alternative C

Under this alternative, several SCLSs that have direct bearing on wildlife resources would be implemented. These stipulations would eliminate or reduce the potential for impacts to the wildlife resources. SCLSs #3 and #7 would require that adequate baseline data be obtained to locate, quantify, and demonstrate the interrelationship of the geology, topography, surface hydrology, vegetation, and wildlife and monitoring plans be implemented. These data would be incorporated into future monitoring of potential impacts. The future monitoring would be established to locate, measure, and quantify the progressive and final effects of underground mining activities. SCLS #9 would also require that the mining operations be conducted in such a manner so as to prevent surface subsidence that would cause potential escarpment failure, and prevent damage or alter the flow of perennial streams. Any removal of timber required to clear sites for construction activities would be conducted in accordance with regulations of the SCLS #11. Surface disturbance would be further limited by SCLS #12 that coal would only be extracted by underground mining methods. Stabilization and rehabilitation of sites supporting ancillary facilities, structures, equipment, and similar developments would be required following final termination of use of these facilities (SCLS #15). The Lessee would be responsible for replacing any surface water identified for protection, that may be lost or adversely affected by the mining operation. The water from an alternate source would be in sufficient quantity and quality to maintain existing riparian habitat, fishery habitat, and wildlife use (SCLS #17). Power lines used in conjunction with the mining of coal from this lease would be constructed so as to provide adequate protection for raptors and other large birds. When feasible, power lines would be located at least 100 yards from public roads (SCLS #4). Seasonal restrictions on specific surface uses could be implemented to protect big-game wintering areas, sage grouse strutting areas, and other key wildlife habitat and/or activities (SCLS #14).

This alternative assumes that mining would occur throughout the lease areas except under Box Canyon and the East Fork of Box Canyon, and within 300 feet of the escarpments. Approximately 40 acres of surface disturbance due to the additional exploration roads and drill sites would occur. These types of surface disturbances would temporarily remove vegetation.

Subsidence-induced ground movements could impact up to nine ponds in the analysis area (JBR 1998a). The loss of water from these ponds would not occur at the same time. Natural sealing and repair of the cracks is likely, and the loss of water may be for 1 year to 3 years. No subsidence effects on streams would occur; therefore, no reduction in riparian habitat along Box Canyon and East Fork of Box Canyon would result.

Impacts to specific species or groups of species under this alternative are identified below.

Mammals. Impacts would be the same as Alternative B except that subsidence impacts would be confined to the upland plateau areas and no escarpment failure is anticipated. The escarpments account for almost all of the general big game winter range; therefore no habitat loss is anticipated. Migration routes would not be impacted.

Bat roosting habitat would not be impacted under this alternative.

Birds. The impacts would be the same as Alternative B. The required replacement of surface waters to maintain water availability and habitats would minimize the long-term impacts to a variety of riparian obligate species, including sage grouse. Approximately 2,024 acres of sagebrush habitat occurs within the analysis area. The disturbance for exploration would account for approximately two percent of the acreage if all 40 acres occurred in the sagebrush type.

Escarpment failure is not anticipated under this alternative; therefore the cliff-nesting species such as golden eagles and falcons would not be impacted by this alternative.

Mining-induced subsidence impacts to timber would be minimal over most of the analysis area and no measurable impacts to western blue birds or other cavity nesting species are likely to occur.

Amphibians, Reptiles, Fish, and Macroinvertebrates. The impacts would be the same as Alternative B. Replacement water would mitigate habitat loss in drainages or ponds, as water would be replaced. Although some species depend on moist soil conditions for protection of their eggs, minimal impacts to reptiles would result from implementation of this alternative. The impacts would be the same as Alternative B. The impacts would be the same as Alternative B except that the stipulations for protection of perennial waters and the replacement of surface waters lost to mining would minimize the impacts under this alternative.

Assuming another company obtains the Pines Coal Lease Tract, and the need for developing a new mine facility in Link Canyon disturbs 100 additional acres, impacts would be as for Alternative B except that SCLS #14 would be implemented to curtail specific surface uses (haulage) outside the mine development area during specific periods of the year (migration periods) in order to protect big game wintering areas and other key activities (migration).

3.6.2.4 Alternative D

Under this alternative, impacts to the wildlife resources would be similar to those described for Alternative B and C, except that there could be potential for increased subsidence-induced impacts to riparian vegetation in Box Canyon and East Fork Box Canyon, and there could be increased potential for escarpment failure in these same areas. Escarpment failures could also occur in Muddy Creek and Wiley's Fork. Surface disturbance would be the same as Alternatives B and C.

Assuming Canyon Fuel is the successful bidder, the following impacts could occur.

Mammals. The impacts to mule deer, elk, and other mammal species would be similar to those described for Alternatives B and C. The potential for escarpment failure could increase the potential for impacts to general big game winter range on the southern, eastern, and northern portions of the analysis area.

The potential for increased escarpment failure could increase the potential for disruption of bat roosting habitat; however, following the failure, a fresh escarpment face would be exposed. The crevices within the new escarpment could provide similar bat roosting habitat.

Birds. The impacts to the avian community would be similar to those described for Alternative C. The increased potential for escarpment failure under this alternative in Box Canyon and East Fork Box Canyon has the potential to impact one golden eagle nest that was tended in 1997 and one nest that was listed as old/dilapidated. Escarpment failure of the Muddy Canyon area could have potential to impact two golden eagle nests that were tended in 1997, one site of an old/dilapidated nest, and the site of a former nest that was not relocated in 1997. Escarpment failure of the Link Canyon area could have potential to impact one golden eagle nest that was tended in 1997, one golden eagle nest that was old/dilapidated in 1997, and one falcon scrape that was tended in 1997. Escarpment failure on the east side of the Pines Coal Lease Tract (Wiley's Fork) could impact two old/dilapidated golden eagle nests.

Although escarpment failure has potential to impact existing nesting sites, it should also be noted that a new escarpment face is exposed. Therefore, the potential exists for new nest sites to be created.

Amphibians. The impacts to amphibians would be similar to those impacts described for Alternative C, except the potential to impact additional perennial waters sources could exist under this alternative. Therefore, the magnitude of impacts to amphibians has potential to be greater under this alternative. The stipulation requiring the replacement of impacted waters could offset these impacts if the water is distributed to the existing drainage, pond, or spring site, rather than in a trough.

Reptiles. Impacts to reptiles under this alternative would be similar to those described for Alternative C.

Fish. Impacts to fish under this alternative would be similar to those described for Alternative B and C, except that more perennial flows have potential to be disrupted. This could change the quantity of water reaching Muddy Creek for a short time, until the cracks fill and seal. The subsidence and hydrology studies indicate that these would be short-term impacts and the flow reduction would be small compared to total flow in Muddy Creek. The stipulation requiring the

replacement of impacted waters would offset these impacts if the water is distributed to the existing drainage, pond, or spring site, rather than in a trough.

Macroinvertebrates. The impacts would be the same as those described for Alternative B except for the impacts to flows in Box Canyon. Macroinvertebrates populations could be reduced in portions of the drainage due to interrupted flows.

If another company obtains the Pines Coal Lease Tract, the anticipated impacts would be the same as those described in Alternatives B and C for additional surface disturbance.

3.6.3 Mitigation and Monitoring

No Action Alternative

No impacts were identified for this alternative. No mitigation or monitoring beyond the activities planned for the Emery C&H Allotment are necessary for this alternative.

Alternative B

This alternative was presented for analysis purposes only. This alternative is intended to provide the basis for including the SCLS for the protection of non-coal resources on the Forest. It is not a selectable alternative. Therefore, no mitigation or monitoring have been developed for this alternative.

Alternative C

Impacts identified under this alternative were minimal and of short duration. SCLS for protection of noncoal resources prevent major impacts from occurring or require monitoring of impacts and implementation of specific mitigation.

If a company other than Canyon Fuel were to be the successful bidder, seasonal restrictions should be implemented to reduce human activity impacts during the period which elk use the Link Canyon area for winter range. Alternatively, mine employees should receive training about the effects of human disturbance to elk during winter and their activities be restricted to the mine site and access roads.

The haul road should include design features to facilitate elk movement and public safety. These should include land ramps to allow elk and deer access to crossing points where vehicle traffic would have a clear view of animals crossing the road. These ramps should have perennial grasses seeded on and near the ramp to entice elk to these crossing points.

Alternative D

Under this alternative, SCLS #9 would not be implemented and subsidence of areas with perennial flow would be permitted. Based on the hydrological studies and subsidence studies, exception from SCLS #9 would not cause an incremental increase in impacts to wildlife resources. No additional monitoring or mitigation would be required.

However, if mining is to be conducted from Link Canyon, and new facilities are to be constructed and the Link Canyon Road is upgraded to provide for coal haulage, then additional mitigation should be implemented for elk as described for Alternative C.

3.6.4 Cumulative Effects

The cumulative effects to wildlife in the vicinity of the Project Area consist of the residual effects from past actions, current effects from present actions, and anticipated affects from reasonably foreseeable future actions.

The residual effects of past coal mining and coal exploration are limited to small areas of disturbance or lost habitat associated with the portals and roads. The residual impacts from past oil and gas exploration on current wildlife habitat is essentially non-existent. Areas of past timber sales have been reforested and restored as habitat.

The livestock improvements have been primarily water developments. The residual impacts have been a change in vegetation from upland vegetation to ponds and riparian vegetation. The wildlife habitat improvement projects resulted in the conversion of approximately 400 acres of sagebrush to grassland habitat, with some subsequent loss of sage grouse nesting habitat.

The future actions include the development of the Pines Coal Lease Tract (1998-2026), a powerline and substation in Link Canyon (1998-1999), and the development of the Muddy Coal Lease Tract in the future. The anticipated effects include impacts that have been analyzed above for the development of the Pines Coal Lease Tract, and the surface disturbance associated with a proposed powerline and substation (less than 5 acres of disturbance) in Link Canyon. The construction of the powerline would disturb 22.5 acres of pinyon-juniper habitat, which is common throughout the area. The powerline would be constructed with appropriate raptor protection features and should not result in adverse effects to raptors.

Although the residual, current, and anticipated effects to wildlife have or could change the nature of the available habitats, the lands are in functioning condition and are meeting the land use plan goals for the area. The cumulative effects to wildlife have and will continue to favor some species over other through changes in habitat. These impacts are temporal as well as spatial due to the dynamic nature of the vegetation. The potential for changes in distribution and availability of water that could occur from implementation of the proposed coal mining project would likely have the greatest impact on wildlife due to the limited water availability on the upland areas. However, these losses are anticipated to be short-term and would be similar in to natural variation in water availability due to droughts, annual variation in snowpack, and evapotranspiration.

3.6.5 Residual Adverse Impacts

No residual adverse impacts to the wildlife resources are anticipated from any of the selectable alternatives analyzed above. The impacts from exploration would be short-term until the disturbed sites are successfully reclaimed. Surface disturbance from the mine development would last until

the mining is completed, the surface facilities removed, and the site reclaimed. The exception would be the road in Link Canyon, if developed, would likely remain, creating minimal acreage of permanent habitat loss and increased public access.

3.6.6 Irreversible/Irretrievable Commitment of Resources

The development of the Link Canyon road, if needed, would represent the only irreversible and irretrievable commitment of wildlife habitat. It is likely that this road would remain after the cessation of mining; and therefore represent a permanent loss of habitat. Less than 50 acres of vegetation would be permanently removed under this scenario, which represent less than 3 percent of the General Big Game Winter Range within the analysis area. Nesting habitat in pinyon-juniper woodland would also be lost on the 50 acres.

3.6.7 Short Term Uses vs. Long Term Productivity

Approximately 140 acres of various habitat types could be impacted by surface disturbance under the alternatives analyzed above. In addition, a maximum of 24 acres of riparian vegetation could be impacted as a result of mining-induced ground movements. These impacts would be short-term (less than 3 years at a given disturbance site) and temporally distributed over the life of the mine. The sites would be reclaimed, or in the case of ground movement effects, revegetated by natural means. The long-term productivity of the area as wildlife habitat would not be reduced.

3.7 SPECIAL STATUS SPECIES

3.7.1 Affected Environment

The area of analysis for special status species encompasses the Pines Tract Project Area, and portions of Box Canyon, Muddy Creek, Link Canyon, and Wiley's Fork. As required by the Endangered Species Act of 1973, as amended (ESA), a Biological Assessment (BA) has been prepared under separate cover. The BA evaluates the potential effects of a proposed action on Federally listed threatened, endangered, proposed and candidate species, and determines whether any such species and habitat are likely to be adversely affected by the action. Biological Assessments are conducted for major Federal construction projects requiring the preparation of an EIS. The species accounts and discussion of potential impacts on these species resulting from the Proposed Action and Alternatives, as discussed below, are reiterations of information contained in the BA.

The FS requires a Biological Evaluation (BE) for the assessment/summary of the effects of a proposed action on FS Sensitive Species. Soils, vegetation, and wildlife habitats in the Project Area were described in previous sections. A BE has been prepared under separate cover. Required consultation with the USFWS on the BA and unsuitability criteria has been implemented, and a reply is pending.

Threatened, Endangered, Proposed, and Candidate Species

The USFWS, the Utah Natural Heritage Program (administered by the UDWR and the Nature Conservancy), and the FS maintain occurrence records of listed and Sensitive Species. These agencies were contacted in order to determine which Federally listed species may occur in the Project Area. Dedicated surveys were then conducted to search for these and any other listed or Sensitive Species in the Project Area. The discussion presented below summarizes this information and evaluates the likelihood for these species to occur in the area, based on habitats present, known occurrences, and the results of dedicated surveys for these species. If a species is known to occur in the area, or has the potential to occur, the potential impacts resulting from the project on that species are discussed.

Based upon contacts with the above agencies, it was determined that the BA should address threatened and endangered, proposed, and candidate species shown in Table 3.2.

A literature search reviewed the preferred habitats, elevational ranges, and occurrence records for each of these species. Based upon this information, a determination was made regarding the potential for each species to occur within the area of the Project Area, or to be directly or indirectly affected by the proposed action (i.e., for the species to occur within the Action Area). The basis for these determinations is presented in the following discussion. In the case of species which clearly do not occur in the area of the proposed action and have no potential to be directly or indirectly impacted by the proposed action or alternatives (e.g., plant species occurring only at high elevations), a "No Effect" determination was made.

Table 3.2 Federally Listed Threatened, Endangered, Proposed, and Candidate Species Potentially Occurring within the Pines Tract Project Area

Common Name	Specific Name	Federal Status
Jones Cycladenia	*Cycladenis humilis* var. *jonesii*	T
Maguire Daisy	*Erigeron maguirei*	T
Last Chance Townsendia	*Townsendia aprica*	T
Barneby Reed-Mustard	*Schoenocrambe barnebyi*	E
San Rafael Cactus (Despain Footcactus)	*Pediocactus despainii*	E
Winkler Cactus (Winkler Footcactus)	*Pediocactus winkleri*	P
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E
Heliotrope Milkvetch	*Astragalus montii*	T
Humpback Chub	*Gila cypha*	E
Bonytail Chub	*Gila elegans*	E
Colorado Squawfish	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Peregrine Falcon	*Falco peregrinus*	E
Southwest Willow Flycatcher	*Empidonax traillii extimus*	E
Mountain Plover	*Charadrius montanus*	C
Black-footed Ferret	*Mustela nigripes*	E
Utah Prairie Dog	*Cynomys parvidens*	T

T = Threatened
E = Endangered
P = Proposed
C = Candidate

In the case of species which occur or may occur in the Project Area, and species which may be directly or indirectly affected by the proposed action or alternatives, a further evaluation of potential impacts was prepared.

Plants. Several of the listed plant species which have the potential to occur in the Project Area are restricted to, or most commonly occur on, particular soil or habitat types. Soils in the area are generally derived as residuum from the underlying geologic rock type. In the case of the Project Area, soils are derived from underlying sandstones and shales. All underlying rock units on the tract are sedimentary.

Jones Cycladenia (*Cycladenia humilis* var. *jonesii*)
Threatened
Welsh et al. (1987) refer to this species as a "gypsophile" (occurring on gypsum-derived soils), found on "semibarren tracts on geological formations with poor water relationships." The species occurs in Eriogonum-Ephedra mixed desert shrub, and juniper communities at 4,400 to 6,000 feet. As Welsh suggests, the species is found in gypsiferous, saline soils of the Cutler, Summerville and Chinle formations. Flowering occurs in May and June.

This species occurs at lower elevations than those found in the lease area (4,400 to 6,000 feet vs. 6,300 to 8,900 feet in the Project Area) and on formations and soil types which do not occur in the area. The FS has no records of this species occurring on the MLS. This species would not be expected to occur in the Project Area.

Maguire Daisy (*Erigeron maguirei*)
Threatened
This perennial daisy grows in canyon bottoms in Wingate and Navajo formations, at elevations of 5,380 to 5,700 feet (Welsh et al., 1987). Atwood et al. (1991) cite a higher elevational range, of between 5,600 and 7,200 feet. Cronquist et al. (1994) state that the species grows in cliff crevices and the sandy bottoms of washes. Flowering occurs in June and July. The species has two described varieties. The typical *E. m.* var. *maguirei* occurs in cool, moist mesic wash bottoms and dry, partially shaded slopes of eroded sandstone cliffs in the Wingate, Chinle and Navajo sandstone formations. The variety *E. m.* var. *harrisonii* is found in dry, rocky, sandy canyon bottoms in the Navajo and Wingate Sandstone formations (Atwood et al., 1991).

The upper elevational range of this species, as reported by Cronquist (7,200 feet), is within to just below the lowest elevations of the Project Area (7,000 on Muddy Creek; 6,300 feet in the Link Canyon area). Potential habitat for this species (cliff crevices and the sandy bottoms of washes) does occur within the lease area, but the geologic formations from which the species has been reported (Wingate, Chinle and Navajo sandstone formations) are not found in the area. The FS has no records of these species on the MLS. This species is believed to be absent from the Project Area.

Last Chance Townsendia (*Townsendia aprica*)
Threatened
This species grows in salt desert shrub and pinyon juniper habitats on clay or clay-silt exposures of the Arapien and the Blue Gate member of the Mancos Shale, at elevations between 6,100 to 8,000 feet (Welsh et al., 1987; Atwood et al., 1991). Flowering occurs in April and May.

This species is known from locations well to the east of the Project Area. Neither the Arapien nor the Blue Gate member of the Mancos Shale occurs in the lease area. The FS has no records of these species on the MLS. This species is not expected to occur in the Project Area.

Barneby Reed-Mustard (*Schoenocrambe barnebyi*)
Endangered
Welsh et al. (1987) report that the Barneby reed-mustard occurs in mixed shadscale, Eriogonum and Ephedra communities in the Chinle Formation between approximately 5,600 and 5,700 feet. Flowering occurs in May.

This species occurs at elevations below those found in the lease area (5,600 to 5,700 feet vs. 6,300 to 8,900 feet in the lease area), and on soils derived from the Chinle Formation. This formation does not occur in the lease area. The FS has no records of this species on the MLS. The species is not expected to occur within the Project Area.

Despain Footcactus (*Pediocactus despainii*)
Endangered
Also known as the San Rafael cactus, this species is generally solitary, though it may occur in colonies. Habitat for this cactus is open pinyon-juniper communities on limestone gravels, at an elevation of approximately 6,000 to 6,200 feet (Welsh et al., 1987; Atwood et al., 1991). Flowering occurs from late April to early May.

The Despain footcactus occurs at elevations below that found in the lease area (6,000 to 6,200 feet vs. 6,300 to 8,900 feet in the lease area. The FS has no records of this species within the Pines Tract Project Area and this species is not expected to occur within the area.

Winkler Cactus (*Pediocactus winkleri*)
Potentially Endangered
This diminutive species, also known as the Winkler footcactus, is also usually solitary. The species occurs in salt desert shrub communities at 4,800 to 5,200 feet, in fine textured, poor-quality saline substrates (Welsh et al., 1987). Flowering occurs in late March to mid-May.

Like the previous cactus species, the Winkler cactus generally occurs at elevations below that found in the Project Area. This species has been found very near the lower boundary of the MLS. The species would not be expected at the higher elevations found in the Project Area.

Wright Fishhook Cactus (*Sclerocactus wrightae*)
Endangered
Habitat for this species is salt desert shrub and shrub-grass to juniper communities on the Mancos Shale (Blue Gate, Tununk, Emery and Ferron members), Dakota, Morrison, Summerville and Entrada formations, at elevations of between 4,800 to 6,100 feet (Welsh et al., 1987). Flowering occurs in April to May.

Although it has been found in soils derived from the Mancos Shale, this species is also reported to occur at elevations below those in the Project Area (4,800 to 6,100 feet vs. 6,300 to 8,900 feet in the Project Area). Therefore, the Wright fishhook cactus is not expected to occur within the Project Area.

Heliotrope Milkvetch (*Astragalus montii*)
Threatened
Welsh et al. (1987) state that the heliotrope milkvetch is known only from the Flagstaff Limestone on the Wasatch Plateau, at an elevation of approximately 11,000 feet. Atwood et al. (1991) cite the habitat for this species as being alpine areas in a mixed grass-forb community on windblown ridges and snowdrift sites, at elevations of 10,500 to 11,000 feet. Flowering occurs in July to August.

This species does occur on the MLS, but at elevations approximately 1,600 feet higher than those found in the Project Area. As an alpine species, it is not expected to occur in the (non-alpine) Project Area.

Wildlife.

Mammals
Black-footed Ferret (*Mustela nigripes*)
Endangered
The historic range of the black-footed ferret nearly coincides with the historic range of prairie dogs (*Cynomys*) (Hall and Kelson 1959). Black-footed ferrets utilize prairie dogs both as a staple food item and as a source of burrows for shelter and denning (Hillman and Clark 1980). While prairie dogs represent the major prey for ferrets, other species are also taken, particularly if prairie dogs are not available (Hillman and Clark 1980).

Only a single historic record of a black-footed ferret occurrence in southeastern Utah was found referred to in the literature. Since the Project Area does not support prairie dogs (see below), black-footed ferrets would not be expected to occur in the area.

Utah Prairie Dog (*Cynomys parvidens*)
Threatened
The Utah prairie dog is a burrowing, colonial species which feeds on forbs and grasses. Colony densities vary with habitat quality. Pizzimenti and Collier (1975) state that colony density can vary from one to 30 per acre. Areas of lush vegetation, provided the vegetation is not too tall, tend to support higher densities.

Pizzimenti and Collier (1975) estimate that the species has experienced an 87 percent decline in occupied range (as determined by the number of sections occupied) in the past 50 years (as of 1975). The current range of the Utah prairie dog is limited to southern Utah. As of the date of Pizzimenti and Collier's species account, the Utah prairie dog was reported to occur in substantial numbers at three locations: the Awapa Plateau, along the East Fork of the Sevier River, and in eastern Iron County. Smaller populations occur at several locations. The Utah prairie dog was listed as endangered in 1968, dropped from the list in 1970, then relisted due to a substantial decline in numbers between 1970 to 1972.

No populations of Utah prairie dogs occur on the Project Area.

Birds
Bald Eagle (*Haliaeetus leucocephalus*)
Threatened
The bald eagle is also known as the American eagle, black eagle, fishing eagle, gray eagle, Washington eagle, white-headed eagle, and white-headed sea eagle (Terres 1980).

During the breeding season, bald eagles are closely associated with water occurring 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 (Call 1978). Due to the large size of their nests, bald eagles usually build these structures in a tree which is the largest or stoutest in the immediate vicinity (Call 1978). Breeding territories, including the nest tree and favored nearby perches, are defended against other eagles. Alternate nests are also common within the territory. Breeding territories are typically 250 to 500 acres in size (Swenson et al., 1986).

During winter, bald eagles concentrate wherever food is available. Areas of open water, where fish and waterfowl can be caught, are common wintering sites. Root (1988) notes that Christmas Bird Count data show concentrations of bald eagles occur near rivers, particularly near wildlife refuges where eagles prey on waterfowl, and near power plants, where cooling water discharges tend to keep some waters open (ice-free). Upland areas are also used in winter, where eagles feed on small mammals and deer carrion. Communal winter roosts are common and located in forested stands that provide protection from the weather.

Bald eagles can live away from water and in the absence of fish. In such cases, they feed on carrion or hunt terrestrial prey. Black-tailed jackrabbits taken as carrion can be quite important in these situations (Ryser 1985).

No bald eagle nests have been found on the MLS. Most sightings have been made in the Joes Valley Reservoir and Huntington Canyon areas, the closest of which (Joes Valley Reservoir) is approximately 17 miles north of the Project Area (FS Files). A bald eagle nest has been reported in the vicinity of Castle Dale, approximately 20 miles northeast of the Project Area boundary. No roost sites have been found in the Project Area, and bald eagles are not expected to occur in the area except as transient birds.

American Peregrine Falcon (*Falco peregrinus anatum*)
Endangered
The peregrine falcon is also known as duck hawk, great-footed hawk, Peale's falcon, rock peregrine, and wandering falcon (Terres 1980).

The peregrine falcon is a wide ranging species which utilizes a variety of habitats. Peregrines usually nest on large rock cliffs in open country; preferred sites overlook water and allow an extensive view of the surrounding terrain (Herron et al., 1985). In the Rocky Mountain Southwest, the walls of canyons and gorges are often used for nest sites (Call 1978). Reintroduced birds regularly nest on man-made structures such as towers and high-rise buildings (USDA-FS 1991). Peregrine falcons use riparian areas for hunting (McCarthy et al., 1986) and often hunt birds that frequent undergrowth or occupy coniferous forest habitats (Craig 1986).

The most frequently used nesting cliffs exceed 100 feet in height, are often at the top of a high talus slope, and have ledges or caves with gravelly or sandy floors. Peregrines nest directly on this material in a shallow depression or scrape (Call 1978).

An area approximately ten miles in radius around the nest comprises the typical hunting area, with 80 percent of hunting done within one mile of the nest. If an adequate food supply exists, some birds may remain on breeding territories through the winter (USDA-FS 1991).

A peregrine falcon eyrie is known to exist within approximately one-half mile of the Project Area. Since most foraging occurs within one mile of the nest, nearby portions of the Project Area are probably used as foraging habitat by this nesting pair.

Southwest Willow Flycatcher (*Empidonax traillii extimus*)
Endangered
The southwestern willow flycatcher utilizes dense riparian habitats in Arizona, New Mexico, southern California and extreme southern Nevada and Utah. The species may also occur in southwestern Colorado and extreme northwestern Mexico (Endangered Species Technical Bulletin 1993b). Habitat for this species includes dense growths of willow and structurally similar

vegetation. A cottonwood overstory is often present, and occupied habitats usually include surface water. In Colorado, the species is reported to breed in "extensive foothill and mountain riparian thickets (mostly willows), usually in areas distant from trees" (Andrews and Righter 1992).

Southwestern willow flycatcher numbers have declined seriously due to modification or loss of riparian habitats and nest parasitism by brown-headed cowbirds (*Molothrus ater*).

The FS notes that the proposed rule to list the species (Federal Register, July 23, 1993) indicates that the Ferron/Price Ranger District is outside the range of this species. During surveys in June of 1998; however, willow flycatchers were found on the Wasatch Plateau north of the Project Area; however, it has not been determined if this was the Southwestern willow flycatcher. The FS reviewed habitats in the Project Area and determined that while some habitat does exist in the area, this habitat is not suitable as willow flycatcher nesting habitat.

Mountain Plover (*Charadrius montanus*)
Candidate
The mountain plover nests primarily east of the Rocky Mountains in shortgrass prairie habitat, and winters from California to Texas (Grawl and Webster 1976). Important habitat components apparently include short or sparse vegetation, providing high horizontal visibility, level ground and perhaps rocks, cow chips or other ground features, which may be utilized as camouflaging features.

Day (1994) reports finding small numbers of nests in Duchesne County in northeastern Utah. This is the only Utah nesting reported in an extensive account of the species by Knopf (1996, in Poole et al.). The species may pass though the Project Area as a migrant, but would not be expected to linger in the area, as appropriate habitat is absent.

Fish
Four fish species endemic to the main stem of the Colorado River are listed as endangered by the USFWS. Because of their similar geographic area of occurrence and the low probability of impacts from the Project Area, these four species are discussed together.

The four endangered Colorado River fish species considered in this discussion are the humpback chub (*Gila cypha*), the bonytail chub (*Gila elegans*), the Colorado squawfish (*Ptchocheilus lucius*) and the razorback sucker (*Xyrauchen texanus*). The Colorado squawfish is the largest of the four species, attaining lengths of up to six feet and weighing over 80 pounds (Endangered Species Technical Bulletin 1993a). The razorback sucker and the humpback chub both possess dorsal keels, or humps, which are thought to be adaptations to the turbulent flows common in the Colorado prior to the dam building projects of the 1900s. The sucker has attained lengths of three feet. The humpback chub and the bonytail chub both have been reported to grow up to 18 inches in length (Endangered Species Technical Bulletin 1993a).

All four of these fish species have been affected by dams, changes in flow regimes, conversion of warmwater streams to reservoirs and cold tailwater habitat, loss of protected backwaters and pools and competition with introduced fishes (Tyus 1992; Endangered Species Technical Bulletin 1990; 1992a). All four species have been greatly reduced or eliminated from historic habitats on the lower Colorado River, and populations have declined in the upper Colorado River Basin.

Critical habitat has been proposed for the four species, on both the main stem of the Colorado and on several of its tributaries, including the San Juan, Green, Gunnison, White and Yampa rivers (Endangered Species Technical Bulletin 1993a). Hatchery-reared fish have been used to supplement declining populations. Tyus noted, however, that recovery of these fish requires difficult water management decisions and participation of the United States, Mexico, and the several states bordering and utilizing flows from the Colorado River.

Critical habitat proposed for these fish includes large rivers. None of the streams in the Project Area represent habitat for any of these species, and none of the four endangered Colorado River fish occurs in the Project Area (Jill Dufour, personal communication, April 16, 1998).

Sensitive Species
Based upon FS MLS Sensitive Species List, it has been determined that the Sensitive Species shown in Table 3.3 have the potential to occur within the Project Area.

Plants.

Link Trail Columbine (*Aquilegia flavescens* var. *rubicunda*)
Sensitive
The Link Trail (or Link Canyon) columbine is reported to occur in seeps and wet sites near the head of Link Canyon and in Straight Canyon, Ferron Ranger District (FS Files). According to Bob Thompson, MLS Forest Botanist, three populations of this plant occur in the Pines Tract Project area. One population of about 20 plants occurs on an approximately one-acre spring site at the head of Link Canyon. Two small populations (eight to ten plants, total) were recently found in upper Box Canyon (Bob Thompson, personal communication, July 24, 1998).

Cruetzfeldii Cryptantha (*Cryptantha creutzfeldii*)
Sensitive
This perennial Cryptantha is found on barren clay knolls and shaley slopes in shadscale and mat Atriplex communities on the Mancos Shale Formation (Cronquist et al., 1984; Atwood et al., 1991). Welsh (in Cronquist et al.) states that the species is restricted to the Blue Gate member of the Mancos Shale Formation along the strike of that formation below the coal measures of the Mėsa Verde Group of formations. Atwood et al. (1991) states that the species occurs between 5,250 and 6,500 feet in elevation. Flowering occurs from April to June.

Table 3.3 USDA-FS Sensitive Species Which have the Potential to Occur in the Pines Tract Project Area

Common Name	Specific Name	USDA-FS Status
Link Trail Columbine	*Aquilegia flavescens* var. *rubicunda*	Sensitive
Cruetzfeldii Cryptantha	*Cryptantha creutzfeldii*	Sensitive
Carrington Daisy	*Erigeron carringtoniae*	Sensitive
Canyon Sweetvetch	*Hedysarum occidentale* var. *canone*	Sensitive
Maguire Campion	*Silene petersonii*	Sensitive
Musinea Groundsel	*Senecio musinensis*	Sensitive
Arizona Willow	*Salix arizonica*	Sensitive
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Sensitive
Spotted bat	*Euderma maculatum*	Sensitive
Northern Goshawk	*Accipiter gentilis*	Sensitive
Flammulated Owl	*Otus flammeolus*	Sensitive
Northern Three-toed Woodpecker	*Picoides tridactylus*	Sensitive
Spotted Frog	*Rana pretiosa*	Sensitive

According to the Region 4 Sensitive Species accounts for the Ferron/Price Ranger District (USDA-FS Files), this species occurs on open Mancos Shale hillsides and lower slopes in Dry Wash and Lower Muddy Creek drainages, Ferron Ranger District, at elevations of 5,500 to 6,000 feet. The species is found in the pinyon, juniper, mixed mountain brush vegetation type. No populations have been found on the Price Ranger District, but some habitat does occur in the Upper Miller Creek drainage.

Populations of this species occur below the elevations of the lease area (5,500 to 6,000 feet vs. 6,300 to 8,900 feet in the Project Area.

Carrington Daisy (*Erigeron carringtoniae*)
Sensitive
This high elevation species occurs on escarpment margins, commonly on the Flagstaff Limestone (Welsh et al., 1983; 1987; Atwood et al., 1991). Cronquist et al. (1994) state the species occurs on open, rocky limestone atop the Wasatch Plateau, in Sanpete and Emery counties. The species is found at elevations of 10,000 to 11,000 feet. Flowering occurs from June to August.

Small isolated populations have been found mostly on Flagstaff limestone outcrops, at the head of Cove Creek, the top of East Mountain, the South Rim of Heliotrope Mountain, and top of Ferron Mountain (Region 4 Sensitive Species Accounts for the Ferron/Price Ranger District, USDA-FS Files). The species occurs on wind blown ridge tops and snow drift sites at elevations of 9,000 to 11,000 feet in the low forb vegetation type.

This species occurs at elevations above those found in the Project Area, and known occurrence locations are to the north of the lease area. There are no known populations of this species within the Project Area.

Canyon Sweetvetch (*Hedysarum occidentale* var. *canone*)
Sensitive
Cronquist et al. (1989) state that the species *Hedysarum occidentale*, the western sweetvetch, is widespread in the West, occurring in meadows in spruce-fir forest, aspen woodlands, boulder fields and talus slopes. The species descends to lower elevation oak and mountain mahogany scrub in Utah. These authors note that the populations found in relatively hot, dry environments on the sources of the Duchesne, Price and San Rafael rivers have recently been segregated as var. *canone*. Atwood et al. (1991) report that this variety occurs in pinyon juniper, sagebrush and wash communities between 5,000 and 8,000 feet. Flowering occurs from late June to mid-August.

The Region 4 Sensitive Species Accounts for the Ferron/Price Ranger District (USDA-FS Files) note that scattered populations of this plant occur in lower Huntington Canyon, Price District, in Straight Canyon, and near Joe's Valley, Ferron District. Plants are usually found on sites with a higher water table, near springs or along stream beds. Habitat includes riparian sites in the pinyon-juniper vegetation type. River birch and squaw bush are plants most commonly associated with this species. Elevation for this species ranges between 5,500 feet to 7,000 feet.

Although the Project Area is within the elevational range of the species, no populations have been recorded in the area. The closest known occurrence of the species is near the Joe's Valley Reservoir in Straight Canyon, approximately 18 miles north of the Pines Coal Lease Tract. This location also represents the southern-most known occurrence of this plant.

Maguire Campion (*Silene petersonii*)
Sensitive
Atwood et al. (1991) report this species occurs in ponderosa pine, Rocky Mountain juniper, bristlecone pine, spruce-fir and aspen sagebrush communities on open, calcareous and igneous gravels. The plant occurs between 7,000 and 11,200 feet in elevation. Flowering occurs in July and August.

The Region 4 Sensitive Species Accounts for the Ferron/Price Ranger District (USDA-FS Files) state that scattered populations have been found mostly on Flagstaff limestone formation outcrops on high elevation ridges and snowdrift sites. Occurrences have been reported from Wagon Road Ridge south to the top of White Mountain, Wasatch Plateau, MLS. There is also a small population on Mount Baldy and Black Mountain. The plant is part of the sub-alpine low forb plant community.

Descriptions of known locations of the species near the Project Area suggest that while this *Silene* occurs on the Forest, it is found at higher elevations (10,000 to 11,000 feet on the Flagstaff Limestone) than those found within the Project Area. The Flagstaff Limestone does not occur on the Project Area.

Musinea Groundsel (*Senecio musinensis*)
Sensitive
This species occurs on subalpine and alpine ridges, barrens, screes and talus on the Flagstaff Limestone, at elevations of 9,700 to 10,800 feet (Cronquist et al., 1994).

The Region 4 Sensitive Species Accounts for the Ferron/Price Ranger District (USDA-FS Files) note this species has been found on the open tops on Flagstaff Limestone barrens, Heliotrope Mountain, possibly on Mount Baldy and the White Mountains.

This groundsel is known to occur at elevations higher than those which occur on the Project Area. Reported occurrences are located approximately eight miles north of the lease area, and the species is not dependant on mesic conditions.

Arizona Willow (*Salix arizonica*)
Sensitive
Originally described from specimens in the White Mountains of east-central Arizona, this willow ranges in growth form from prostrate to large thickets or hedges (Endangered Species Technical Bulletin 1992b). In Arizona, the species has been found at elevations of 8,500 feet and above. It grows in riparian habitats, cold, wet meadows and stream edges.

Threats to the willow have been identified as cattle grazing and related impacts (stream bank erosion and siltation), competition with non-native grasses and attack by the rust *Melampsora* spp. Due to its limited distribution, low numbers and vulnerability, the USFWS proposed this species

for listing as endangered in the November 20, 1992 Federal Register (Endangered Species Technical Bulletin 1992b).

As described in the Region 4 Sensitive Species accounts for the Ferron/Price Ranger District (USDA-FS Files), this plant can be found within perennial wet meadow habitat on Beaver Creek (near the head of the Muddy Creek drainage). At this location, the willow averages 2-4 feet tall and prefers mostly shaded sites.

This willow has been found at a single location near the Project Area (on Beaver Creek, a tributary to Muddy Creek). This species is dependant on a high water table and mesic conditions. The known occurrence location of this species is outside of the Project Area. Limited habitat for the species presumably exists within the Project Area.

Wildlife.

Mammals
Townsend's Big-eared Bat (*Corynorhinus townsendii*)
Sensitive
Also known as Western big-eared bat, western long-nosed bat, and western lump-nosed bat (Kunz and Martin 1982). This bat occurs in juniper-pine forests, shrub-steppe grasslands, deciduous forests, and mixed coniferous forests from sea level to 10,000 feet in elevation (USDA-FS 1991). Jameson and Peeters (1988) state that western big-eared bats occur in desert scrub and pinyon-juniper associations. Although this species occurs in a variety of habitats and appears to be an adaptable forager, it is generally thought to be a moth specialist (Kunz and Martin 1982).

This species roosts primarily in caves or cave analogs such as old mine shafts (Pierson et al., 1991), but has also been known to utilize rocky outcrops and old buildings. The bats do not migrate but remain at these sites (hibernacula) from October to February. In summer, females roost with their young in nursery roosts (a group of small clusters, seldom exceeding 100 adults) in warm parts of the cave. Maternity colonies break up in August. Males and non-breeding females roost alone (Kunz and Martin 1982).

Western big-eared bats are considered to be so sensitive to human disturbance that simple entry into a nursery roost can induce site abandonment by a colony (Humphrey and Kunz 1976). According to Pierson et al. (1991) and Brown and Berry (1991), mine shafts/adits are the most important roosting habitat for western big-eared bats and other sensitive bat species, and should be protected from human disturbance where possible.

In 1992, Townsend big-eared bats were found using inactive coal mines as hibernacula on the Ferron Ranger District. They have also been found roosting in buildings of the Ferron/Price Ranger District in the town of Ferron during late summer of 1992.

In the summer of 1997, bat surveys were conducted by Genwal Resources Incorporated in areas within Huntington Canyon (Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, Mill Fork, and Bear Creek Canyon), approximately 25 to 30 miles north of the Project Area. No Townsend's Big-eared bats were located in those areas (Johansson et al., 1997). Also in 1997, Link, Muddy and Box Canyons, in and near the Project Area were surveyed for bat use (Perkins and Peterson 1997). These surveys detected no big-eared bat use of the canyons. Perkins and Peterson concluded potential for the occurrence of big-eared bats in the area was low, and suitable big-eared bat habitat was not present.

Spotted Bat (*Euderma maculatum*)
Sensitive
This species is also known as the pinto bat (Watkins 1977). Spotted bats occur in a variety of habitats including open ponderosa pine (*Pinus ponderosa*), desert scrub, pinyon-juniper, and open pasture and hay fields (Leonard and Fenton 1983). Most often, they are found in dry, rough desert terrain (Watkins 1977). Spotted bats roost alone in rock crevices high up on steep cliff faces. Critical roosting sites are cracks and crevices from 0.8 to 2.2 inches in width in limestone or sandstone cliffs (USDA-FS 1991).

Spotted bats are territorial with a fidelity to roost sites. They usually avoid each other while foraging. Information on this species is scarce, but spotted bats are thought to migrate south for winter hibernation (USDA-FS 1991).

Spotted bat populations may be limited by the availability of suitable roosting sites. Generally, spotted bats are found in relatively remote, undisturbed areas, suggesting that they may be sensitive to human disturbance (USDA-FS 1991).

In the summer of 1997, surveys conducted by Genwal Resources Incorporated detected spotted bats utilizing habitats within Mill Fork Canyon, Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, and Bear Creek Canyon. Foraging areas were located at relatively low elevation sites associated with riparian vegetation within Huntington Canyon. Specific individual roost sites were not located, but general roosting areas were identified on the cliff faces/rock outcrops in Crandall and Mill Fork Canyons. Additional roosting areas were identified throughout the Huntington Canyon drainage among sizeable cliff faces (Johansson et al., 1997).

Other known observations of spotted bats on the Ferron/Price Ranger District have been at Joes Valley Reservoir and at Emerald Lake. Surveys by Perkins and Peterson (1997) documented spotted bat use in Link, Muddy and Box Canyons, in and near the Project Area.

Birds

Northern Goshawk (*Accipiter gentilis*)

Sensitive

In most areas, the northern goshawk occupies montane forests in spring and summer, with some altitudinal migration into foothills and valleys in the winter (Terres 1980). Nest trees of this species are commonly located on benches or basins surrounded by much steeper slopes (Call 1979). The goshawk usually nests on a horizontal branch next to the trunk of mature conifers, aspen (*Populus tremuloides*), cottonwood, or other deciduous stream bottom trees (Call 1978), about 20 to 60 feet up in the tree canopy (Terres 1980).

Aspen groves are the species' preferred nesting sites in Nevada and parts of Colorado (Ryser 1985; Shuster 1980). Ponderosa and lodgepole pines were also utilized. Nest trees are typically located within 100 feet of water (Herron et al., 1985). Shuster found that nests in aspens were always located directly below the canopy. The oldest stands in the area were selected as nest sites. The same nest may be used for several seasons, but alternate nests are common within a single territory. Adjacent understory is usually fairly open (Call 1978). This large accipiter usually requires an extensive home range (Johnsgard 1990). Nests are often used year after year. Goshawks are very protective of their young in the nest and loudly defend them against intruders. They are very sensitive to human disturbance and have abandoned nests and young due to human activities that take place too close to their nest (Kennedy and Stahlecker 1989; and Hennessey 1978).

Grant et al. (1991) found wintering goshawks in northeastern Utah foraged in riparian areas and in juniper woodlands. In other areas, goshawks will remain year-round as long as prey remains available. Behle (1981) stated that goshawks in the Uinta Basin of Utah were permanent residents, but that some individuals may migrate to lower elevations during the winter.

The goshawk is a summer resident of the Ferron/Price Ranger District, and the number of nesting birds vary year to year. A goshawk nesting territory has been found in the southern portion of the Project Area in conifer timber habitat. The nest is not located near any escarpments or in areas that modeling suggests may show escarpment failure due to subsidence (Agapito Associates 1998).

Flammulated Owl (*Otus flammeolus*)

Sensitive

This diminutive owl inhabits the montane coniferous forests of North and Central America, ranging from southern British Columbia to Guatemala (Ryser 1985). In most areas, this owl occurs in close association with ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*Pinus jefferyi*), though it has been recorded less commonly in other forest types (Johnsgard 1988). Flammulated owls are also known to utilize successional aspen (*Populus tremuloides*) communities in some locations. This small and secretive owl is a cavity nester, and thus requires natural or woodpecker-excavated cavities as a component of its habitat. In Nevada, this owl is generally

found in yellow pine communities with old snags and dying trees which contain cavities (usually excavated by woodpeckers).

Flammulated owls seem to prefer mature ponderosa pine-Douglas fir forests with open canopies. Large diameter dead trees with cavities are used as nesting sites, and are an important habitat component of flammulated owl habitat. Flammulated owls avoid foraging in young dense stands where hunting is difficult. They are also known to avoid cut-over areas. Flammulated owls are almost exclusively insectivorous, preying on small to medium sized moths, beetles, caterpillars, and crickets (Reynolds and Linkhart 1987; Johnsgard 1988; and Bull et al., 1990). Like most insectivores, but unlike most owls, flammulated owls are migratory (Winter 1974; Balda et al., 1975; Collins et al., 1986; Gaines 1988).

Flammulated owls have been found in the Quitchupah drainage and the head of Muddy Creek on the Ferron/Price Ranger District. All but one of these locations have been associated with ponderosa pine. The sighting was a vocalization believed to be from a flammulated owl, heard while conducting owl surveys. This sighting was not confirmed visually.

The flammulated owl has been recorded in the general area of the Pines Tract Project.

Three-toed Woodpecker (*Picoides tridactylus*)
Sensitive
The three-toed woodpecker is a permanent resident of the taiga or circumboreal forests of Eurasia and North America, ranging southward into the continental United States (Ryser 1985). The species is found in northern coniferous and mixed forest types up to 9,000 feet elevation. Forests containing spruce, grand fir, ponderosa pine, tamarack and lodgepole pine are used. Nests may be found in spruce, tamarack, pine, cedar, and aspen trees. Three-toed woodpeckers forage mainly on dead trees, although they will feed in live trees. About 75 percent of their diet is woodboring insect larvae, mostly beetles, but they also eat moth larvae. Three-toed woodpeckers are major predators of the spruce bark beetle, especially during epidemics. The woodpeckers forage on a wide variety of tree species.

Surveys for three-toed woodpeckers took place in suitable habitat on the Ferron/Price, Sanpete, and Moab/Monticello Ranger Districts in June and July of 1992. Further surveys during the 1993, 1994, 1995, and 1996 field seasons on the Ferron/Price Ranger District resulted in additional three-toed woodpecker findings. This species was found on all districts surveyed.

The three-toed woodpecker likely occurs within the Project Area.

Amphibians
Spotted Frog (*Rana pretiosa*)
Sensitive
This species is most commonly found near permanent water in such habitats as marshy edges of ponds or lakes, in algae-grown overflow pools of streams, and near springs with emergent vegetation. The spotted frog may move considerable distances from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands of sage and rabbitbrush. It is thought that spotted frogs hibernate in holes near springs or other areas where water is unfrozen and constantly renewed (USDA-FS 1991).

Behler and King (1979) state that spotted frogs occur in mountainous areas near cold streams and lakes, and move overland in spring and summer. Both workers noted that the presence of bullfrogs (*Rana catesbeiana*) may exclude spotted frogs. Dumas (1966) found leopard frogs (*Rana pipiens*) may also eliminate spotted frogs. The relationship between spotted frogs and salmonids is less clear. Hovingh states that large salmonids will consume spotted frog tadpoles, but smaller fish may not pose this threat.

Spotted frogs have been located west of the Manti Division near Fairview. However, no spotted frogs have been located on the Forest, and they are only expected to occur on the west side on the Manti Division. Since the Project Area is located on the eastern side of the Manti Division, spotted frogs are not expected to occur in the Project Area.

3.7.2 Environmental Consequences

This assessment evaluates the potential for each Special Status Species to be directly or indirectly impacted by various alternatives associated with the proposed action. This assessment is based on a review of the species' preferred habitats (as described above) and its recorded occurrence locations in light of various project alternatives. Based upon this information, a determination was made regarding the potential for each species to be directly or indirectly affected by the various alternatives associated with the proposed action.

In the case of species which clearly do not occur in the area of the proposed action and have no potential to be directly or indirectly impacted by the proposed action or alternatives (plant species occurring at elevations outside that of the Project Area, for example), a "No Effect" (in the case of listed species) or "No Impact" (in the case of Sensitive Species) determination was made. In the case of species which occur or may occur in the Project Area and which may be directly or indirectly affected by the proposed action or alternatives, a further evaluation of potential impacts was prepared.

Table 3.4 summarizes the occurrence and effects analysis for threatened, endangered, potentially endangered, and candidate species potentially occurring in the Project Area. Table 3.5 provides similar information for sensitive species. The tables include rationales for the determinations shown.

Table 3.4 Potential Occurrence and Effects Analysis of Federally Listed Threatened, Endangered, Potentially Endangered and Candidate Plant and Animal Species in the Pines Tract Project Area

Species	Alternative				Rationale
	A	B	C	D	
Jones Cycladenia	NE	NE	NE	NE	Not known to occur in the Action Area[1]; not dependant on high water table. No populations are found within many miles of the project area.
Maguire Daisy	NE	NE	NE	NE	Not known to occur in the Project Area; geologic formations on which this species occurs do not occur in the Action Area
Last Chance Townsendia	NE	NE	NE	NE	Not known to occur in the Action Area; not dependant on high water tables
Barneby Reed-Mustard	NE	NE	NE	NE	Not known to occur in the Action Area; occurs at lower elevations and on different geologic formations than those found in the Action Area
San Rafael Cactus	NE	NE	NE	NE	Not known to occur in the Action Area; not dependant on high water table
Winkler Cactus	NE	NE	NE	NE	Not known to occur in the Action Area; not dependant on high water table
Wright Fishhook Cactus	NE	NE	NE	NE	Not known to occur in the Action Area; not dependant on high water table. No populations are found within many miles of the project area.
Heliotrope Milkvetch	NE	NE	NE	NE	Not known to occur in the Action Area; occurs on the Forest in alpine habitats which do not occur in the Project Area
Black-footed Ferret	NE	NE	NE	NE	Does not occur in Action Area
Utah Prairie Dog	NE	NE	NE	NE	Does not occur in Action Area

Table 3.4 Potential Occurrence and Effects Analysis of Federally Listed Threatened, Endangered, Potentially Endangered and Candidate Plant and Animal Species in the Pines Tract Project Area (cont.)

Species	Alternative				Rationale
	A	B	C	D	
Bald Eagle	NE	NE	NE	NE	Does not make regular use of the Action Area; mining impacts would not alter the limited use
Peregrine Falcon	NE	NE	NE	NE	Suitable habitat not found in analysis area
Southwestern Willow Flycatcher	NE	MA-NLAA	NE	MA-NLAA	If found in the Action Area, habitat may be impacted by subsidence of perennial streams
Mountain Plover	NE	NE	NE	NE	Unlikely to occur in Action Area; would occur only as a transient or migrant
Humpback Chub	NE	MA-NLAA	NE	MA-NLAA	None of the endangered Colorado fish species occur in or near the Action Area. Changes in groundwater volume unlikely to cause impacts to Colorado River habitats
Bonytail Chub	NE	MA-NLAA	NE	MA-NLAA	
Colorado Squawfish	NE	MA-NLAA	NE	MA-NLAA	
Razorback Sucker	NE	MA-NLAA	NE	MA-NLAA	

NE = No Effect
MA-NLAA = May Affect -Not Likely to Adversely Affect
MA-LAA = May Affect -Likely to Adversely Affect
BE = Beneficial Effect

[1] The Action Area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

Table 3.5 Potential Occurrence and Effects Analysis of USDA-FS Sensitive Plant and Animal Species in the Pines Tract Project Area

Species	Alternative				Rationale
	A	B	C	D	
Link Trail Columbine	NI	WIFV	MIIH	WIFV	Occurs in Link and Box Canyons; known range of this columbine is restricted. Occurrence site could be directly impacted by mine development if a new mine in Link Canyon is needed
Cruetzfeldii Cryptantha	NI	NI	NI	NI	Not known from the Project Area; not dependant on a high water table or mesic conditions
Carrington Daisy	NI	NI	NI	NI	Not known from the Project Area; not dependant on a high water table or mesic conditions
Canyon Sweetvetch	NI	NI	NI	NI	Not known from the Project Area
Maguire Campion	NI	NI	NI	NI	Not known from the Project Area; not dependant on a high water table or mesic conditions
Musinea Groundsel	NI	NI	NI	NI	Not known from the Project Area; not dependant on a high water table or mesic conditions
Arizona Willow	NI	NI	NI	NI	Not known from the Project Area; dependant on a high water table, mesic conditions
Townsend's Big-eared Bat	NI	NI	NI	NI	Not recorded in the Project Area; roosting habitat not currently present
Spotted bat	NI	MIIH	NI	MIIH	Exists in the Project Area; roost sites susceptible to subsidence
Northern Goshawk	NI	MIIH	NI	MIIH	Occurs in the Project Area. Impacts to water sources could affect foraging habitat

Table 3.5 Potential Occurrence and Effects Analysis of USDA-FS Sensitive Plant and Animal Species in the Pines Tract Project Area (cont.)

Species	Alternative				Rationale
	A	B	C	D	
Flammulated Owl	NI	MIIH	NI	MIIH	Probably occurs in the Project Area. Subsidence could impact nest trees, although not likely
Northern Three-toed Woodpecker	NI	MIIH	MIIH	MIIH	Occurs in the Project Area. Subsidence could impact nest trees, although not likely
Spotted Frog	NI	NI	NI	NI	Not known to occur on or near the Project Area

NI = No Impact
MIIH = May Impact Individuals or Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Viability to the Population or Species
WIFV* = Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Toward Federal Listing or Loss of Viability to the Population or Species
BI = Beneficial Impact

* Trigger for significant action as defined in NEPA

3.7.2.1 No Action Alternative

Threatened, Endangered, Proposed, and Candidate Species

Selection of the No Action - No Lease Alternative would not result in any direct, indirect or cumulative impacts to listed species occurring in the Project Area. Coal mining would not take place within the Project Area, other than that already permitted on the adjacent Quitchupah Lease. No additional mining-related disturbance would occur on the Project Area and no additional impacts to listed species would occur.

Sensitive Species

Selection of the No Action - No Lease Alternative would not result in any direct, indirect or cumulative impacts to Sensitive Species occurring in the Project Area. Coal mining would not take place within the Project Area, other than that already permitted. No additional mining-related disturbance would occur on the Project Area and no additional impacts to Sensitive Species would occur.

3.7.2.2 Alternative B

Threatened, Endangered, Proposed, and Candidate Species

Under this alternative, consideration of resources other than mine development would not occur. Riparian habitats would not be maintained in the event that surface waters are adversely impacted by the mining operations. Subsidence-induced ground movement could cause impacts to escarpments. Disruption of surface water flows could reduce or eliminate riparian vegetation.

Should Canyon Fuel be the successful bidder for the Pines Coal Lease Tract, only minimal new surface disturbance would result from mining operations. However, up to 40 acres of surface disturbance associated with exploration activities would create a temporary loss of habitat. Any of the potential impacts listed above could occur. Impacts to other surface resources would not be avoided or subject to mitigation.

As described above, no listed plant species occur within the Project Area. Therefore no direct impacts to listed species would result from selection of this alternative.

There is a known peregrine falcon nest site located near the Project Area (approximately one-half mile to the south). However, there are no subsidence impacts predicted for the escarpment area in which this nest is located. Escarpments on the northern and eastern edges of the Project Area, in Muddy Canyon and above Wileys Fork, respectively, could be affected by subsidence. Although these and other escarpments bordering the Project Area are not currently being used as peregrine falcon nest sites, they do represent potential peregrine falcon nesting habitat. Based upon modeling and experience in the Quitchupah Lease, Agapito Associates, Inc. (1998) concluded that while a relatively high potential for mining-induced escarpment instability exists, the incidence of actual impacts tends to be low.

While the current peregrine falcon nest site is not expected to be impacted by subsidence in the Project Area, changes in groundwater flow patterns that affect riparian communities could impact peregrine falcon foraging habitat. Under Alternative B, mining under perennial drainages in the East Fork of Box Canyon would occur. This action could potentially result in changes to the local hydrologic system, reducing riparian vegetation.

The willow flycatcher has recently been found on the Wasatch Plateau north of the Project Area; however, it has not been determined whether this was the Southwestern willow flycatcher. Habitats in the Project Area are not considered suitable for southwestern willow flycatchers. Should the species be found in the area; however, the same comments regarding subsidence-related impacts to riparian vegetation made relative to the peregrine falcon would apply to the flycatcher. Reductions in willow-riparian vegetation by mining and exploration impacts would reduce any potential willow flycatcher habitat present.

None of the four listed Colorado River fish species discussed above occur in the Project Area. Reductions in groundwater discharges in the Project Area could reduce the amount of water reaching the reaches of the Colorado River system inhabited by the fish species. Because these impacts are expected to be either nonexistent or minor (Mayo and Associates 1998), little or no impact to the habitats of these fish is expected. Previous Section 7 Consultation (Jill Dufour, personal communication, April 16, 1998) concluded that "the effects of the proposed small water withdrawals are so limited in scope and intensity and so far-removed from the remaining populations of [these] species that they are negligible. The impacts of large dams on sediment transport regimes, channel morphology and temperature; as well as the effects of introduced species, are the most significant impacts (direct, indirect and cumulative)." Because the Project Area represents a small percentage of the Colorado River drainage area, the May Effect - Not Likely to Adversely Affect determination made as a result of the 1996 Consultation remains warranted.

Should another company be the successful bidder, a new mine would be constructed, probably in Link Canyon. Under this scenario, approximately 100 acres of mining-induced impacts would occur in Link Canyon. Up to 40 acres of surface disturbance associated with exploration activities would also create a temporary loss of riparian habitat (3 years to 5 years). Mine construction in Link Canyon could directly impact 0.07 acres of riparian habitat used as foraging areas by peregrine falcons. Other potential impacts would be the same as those that would result should Canyon Fuel obtain the Pines Coal Lease Tract.

Sensitive Species

Riparian habitats would not be maintained in the event that surface waters are adversely impacted by the mining operations. Subsidence-induced ground movement could cause impacts to escarpments. Disruption of surface water flows could reduce or eliminate riparian vegetation.

Up to 40 acres of surface disturbance associated with exploration activities would also create a temporary loss of habitat. Any of the potential impacts listed above could occur; however, since no surface resources outside of the mine development would be considered.

The spotted bat, northern goshawk, and three-toed woodpecker are known to occur in the Project Area. The flammulated owl probably occurs within the Project Area. Roost crevices used by the spotted bat could be affected by subsidence. Based upon modeling and experience in the Quitchupah Lease, Agapito Associates, Inc. (1998) concluded that while a relatively high potential for mining-induced escarpment instability exists, the incidence of actual impacts tends to be low.

Recent surveys suggested big-eared bat use of the canyons is low, and suitable big-eared bat habitat is not present (Perkins and Peterson 1997). Accordingly, a No Impact determination would be warranted. Since Townsend's big-eared bats are primarily a cave or mine dweller, abandoned underground mines represent potential bat habitat. This potential can be enhanced by bat-gating mine portals. If suitable bat habitat can be left at the conclusion of mining, a Beneficial determination could be made.

Changes in hydrology could potentially affect riparian areas used by northern goshawks as foraging habitat. Flammulated owls may also forage in riparian areas. Under Alternative B, mining under the perennial drainage in the East Fork of Box Canyon would occur, as described in the previous section. Reductions in the extent of riparian areas present on the Project Area could reduce foraging habitat for these species. Because the Link Canyon area will not be subsided, no impacts to the Link Trail columbine present in this area are expected. Populations of this species present in upper Box Canyon; however, could be affected by subsidence-induced changes in hydrology. Loss of the Box Canyon populations of the Link Trail columbine would represent the loss of approximately 20% of the known population of this species. This could contribute to the potential for Federal listing of this species.

Should another company be the successful bidder, a new mine would be constructed, adding 100 acres of mining-related impacts in Link Canyon. The Link Trail columbine is known to occur at an approximately one acre spring site at the head of Link Canyon. Due to its highly limited distribution, the Link Trail columbine is sensitive to both local disturbance and changes in hydrology. Neither the canyon sweetvetch nor the Arizona willow have been recorded in the Project Area. Both species have the potential to occur in the area; however, and both occur in mesic situations. Since other resources would receive no consideration under this alternative, no specific surveys would be required to identify and quantify any such effects. Potential impacts to these species would; therefore, not be assessed.

Both mine construction in Link Canyon and exploration-related disturbances could directly impact riparian habitats used as foraging areas by peregrine falcons and representing potential nesting habitat by southwestern willow flycatchers.

3.7.2.3 Alternative C

Threatened, Endangered, Proposed, and Candidate Species

Under this alternative, several SCLS, that have direct bearing on listed species and their habitats would be implemented. These SCLS would eliminate or reduce the potential for impacts to these species. SCLS #2 requires that if threatened or endangered species occur in the area, the Lessee shall be required to conduct an intensive field inventory of the area to be disturbed or impacted. A plan must be prepared making recommendations for the protection of these species or action necessary to mitigate the disturbance. SCLSs #3 and #7 would require that adequate baseline data be obtained to locate, quantify, and demonstrate the interrelationship of the geology, topography, surface hydrology, vegetation, and wildlife. These data would be incorporated into future monitoring of potential impacts. The future monitoring would be established to locate, measure, and quantify the progressive and final effects of underground mining activities. SCLS #9 would require that the mining operations be conducted in such a manner so as to prevent surface subsidence that would cause potential escarpment failure, and prevent damage or alter the flow of perennial streams. Surface disturbance to steep canyon slopes, and surface disturbance in general, would be minimized by requiring the construction of all surface breakouts for ventilation tunnels be conducted from inside the mine (SCLS #10). Any removal of timber required to clear sites for construction activities would be conducted in accordance with regulations of the FS (SCLS #11). Surface disturbance would be further limited by the SCLS #12 which specifies that coal would only be extracted by underground mining methods. Seasonal restrictions on specific surface uses could be implemented to protect big-game wintering areas, sage grouse strutting areas (nor sensitive species) and other key wildlife habitat and/or activities, including sensitive species - SCLS #14. Stabilization and rehabilitation of sites supporting ancillary facilities, structures, equipment, and similar developments would be required following final termination of use of these facilities (SCLS #15). The Lessee would be responsible for replacing any surface water identified for protection, that may be lost or adversely affected by the mining operation. The water from an alternate source would be in sufficient quantity and quality to maintain existing riparian habitat, fishery habitat, and wildlife use (SCLS #17). Power lines used in conjunction with the mining of coal from this lease would be constructed so as to provide adequate protection for raptors and other large birds (including peregrine falcons).

As in Alternative B, up to 40 acres of disturbance for additional exploration roads and drill sites would be constructed, used, and reclaimed.

Under this alternative, the above stipulations would require specific assessments of project impacts to listed species. Only minimal new surface disturbance would result from mining operations, and up to 40 acres of exploration-related disturbance would occur. The stipulations would not allow mining under perennial streams or escarpments. Foraging and nesting habitats of peregrine

falcons would, therefore, not be impacted by subsidence-related impacts to these features. Similarly, any downstream impacts to listed Colorado River fish species resulting from reductions in water flow from the Project Area would not occur.

Under this scenario, approximately 100 acres of additional mining-related impacts would occur in Link Canyon. These impacts could directly impact 0.07 acres of riparian habitats used as foraging areas by peregrine falcons.

Sensitive Species
Under this alternative, several SCLSs that have direct bearing on Sensitive Species and their habitats would be implemented. These stipulations would eliminate or reduce the potential for impacts to Sensitive Species.

The above stipulations would require specific assessments of project impacts to Sensitive Species. Only minimal new surface disturbance would result from mining operations, and up to 40 acres of surface disturbance associated with exploration activities would occur. The stipulations would not allow mining under perennial streams or escarpments. Riparian areas used as foraging habitats by northern goshawks and possibly by flammulated owls would, therefore, not be impacted by subsidence-related impacts to these features. Similarly, escarpments used as roost sites by spotted bats would be less prone to failure. Vegetation impacts from exploration-related activities could have a minimal impact on Sensitive Species.

Since subsidence or subsidence-induced changes in hydrology would not occur in Box Canyon, populations of the Link Trail Columbine would not be impacted.

3.7.2.4 Alternative D

Threatened, Endangered, Proposed, and Candidate Species
Under this alternative, subsidence of Box Canyon and the East Fork of Box Canyon would be allowed and analyzed for impacts to determine if these specific locations could be excepted from stipulation #9. This stipulation also addresses escarpment failures. Impacts would be the same as described for Alternatives B and C.

Under this alternative, impacts to listed species and their habitats would be similar to those described for Alternative C, except that there would be potential for increased subsidence-induced impacts to riparian vegetation in Box Canyon and the East Fork of Box Canyon, and there would be increased potential for escarpment failure in these same areas. Although the riparian vegetation type represents less than one percent of the Project Area, it provides important peregrine falcon foraging habitat.

Should another company be the successful bidder, impacts expected under this alternative are similar to the local impacts described under the Alternative C.

Sensitive Species
Under this alternative, impacts to Sensitive Species and their habitats would be similar to those described for Alternative C, except that there would be potential for increased subsidence-induced impacts to riparian vegetation in Box Canyon and the East Fork of Box Canyon, and there would be increased potential for escarpment failure in these same areas.

Under this alternative, impacts to vegetation could occur from potential subsidence-induced ground movements that cause alteration of perennial surface water flows. Reduction or elimination of perennial surface flows to riparian areas, such as those in Box Canyon, would either reduce the acreage of riparian vegetation at these sites or eliminate the riparian vegetation completely, and could thus potentially impact Link Trail columbine populations present in this area. SCLS #3 and #7 would require baseline data collection and subsequent monitoring of this species, and would provide a basis for assessing impacts to the species.

Although the riparian vegetation type represents less than one percent of the Project Area, it provides important potential northern goshawk foraging habitat. Riparian areas also may be used by flammulated owls as foraging habitat. Reductions in the extent of riparian areas present on the Project Area could, therefore, reduce foraging habitat for these species.

Should another company be the successful bidder, impacts expected under this alternative are similar to the local impacts described under Alternative C.

3.7.3 Mitigation and Monitoring

Alternative A
No impacts were identified for this alternative. No mitigation or monitoring are necessary for this alternative.

Alternative B
This alternative was presented for analysis purposes only. Therefore, no mitigation or monitoring have been developed for this alternative.

Alternative C
Impacts identified under this alternative were minimal and of short duration. The SCLSs for Protection of Non-Coal Resources prevent major impacts from occurring or require monitoring of impacts and implementation of specific mitigation.

Alternative D
Based on the hydrologic and subsidence studies, exception from SCLS #9 is not expected to impact Special Status Species. However, as a safeguard, groundwater levels and surface water flows would be monitored, as required by SCLSs #3 and #7.

If water sources are impacted, SCLS #17 states that the Lessees, at their expense, will be responsible to replace any surface water identified for protection that may be lost or adversely affected by mining operations, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, fishery habitat, livestock and wildlife use, or other land uses.

Mining activities could directly impact the Link Trail columbine, a highly localized species known to occur at spring areas at the head of Link Canyon and in Box Canyon. The limits of these populations should be clearly identified and inhabited areas avoided.

Upgrading the Link Canyon Road could potentially result in direct impacts to the Jones Cycladenia and/or the Winkler cactus below the Forest boundary. Any new road alignment should be surveyed for the presence of these species, as required in SCLS #2. (Even though lands below the Forest boundary do not fall under the direct jurisdiction of the FS, construction of a road which is a part of an otherwise FS-administered project establishes the road construction as part of a Federal action.)

Monitoring of escarpments to determine impacts from increased potential for escarpment failure should be continued at regular intervals. Documentation of the escarpment failures can be achieved by the aerial photography surveys.

As mining in the tract is concluded, the possibility of bat gating some entrances to underground workings should be considered. This would increase the habitat for cave-dwelling bats in the area.

3.7.4 Cumulative Effects

Disturbance from exploration activities in the area has been revegetated and residual effects are not apparent. Roads associated with historic coal mining in Muddy Canyon remain as four-wheel drive or all-terrain vehicle tracks. A perennial discharge from the Link Canyon Mine portals has created a small riparian area below the mine portals.

In addition to coal mining conducted by SUFCO Mine on the Quitchupah Lease, timber sales in the East Fork of Box Canyon and in Link Canyon were harvested in the early 1980s. Revegetation/reforestation targets for these sales have been met. A variety of rangeland, wildlife, recreation and transportation projects have been completed in the area, with transportation alterations occurring largely in relation to mining and range activities.

In addition to the current proposed action in the Pines Tract Project Area, SUFCO Mine is proposing to construct a breakout in Link Canyon for a powerline and substation. Construction of this line would not impact the Link Trail columbine.

In addition to coal leasing, oil and gas drilling may occur. Such drilling may affect up to 78 acres at any one time. Reclamation would occur on sites which do not enter into production. Geophysical surveys, which require only short term disturbance, may also occur in the area. While no direct impacts to listed species are anticipated, the construction of additional roads in the area could impact listed or sensitive species either directly or indirectly. Activities which involve the removal of trees or snags habitat could impact the nesting or foraging habitat of northern goshawks, flammulated owls or three-toed woodpeckers. Impacts to riparian habitat could also reduce raptor foraging habitat.

Rangeland improvements, including construction of another stock pond and installation of solar pumps may occur in the area. Increased human presence could adversely impact sensitive wildlife species in the area, the creation of stock ponds may provide new water sources for wildlife, including sensitive species. Particularly if riparian vegetation is allowed to colonize pond margins, habitat for sensitive wildlife species could be enhanced.

3.7.5 Residual Adverse Impacts

Unreclaimed roads in the area (resulting from exploration or a new mine constructed in Link Canyon) could increase human presence in the area, potentially increasing disturbance to sensitive species.

3.7.6 Irreversible/Irretrievable Commitment of Resources

Should another operator be the successful bidder for the Pines Coal Lease Tract, a new mine would be constructed in Link Canyon. While any populations of the Jones Cycladenia or Winkler cactus present in lower Link Canyon below the Forest Boundary could be impacted, all evidence available to date indicates these species do not occur in the area.

3.7.7 Short Term Uses vs. Long Term Productivity

Unless water resources are affected by subsidence, productivity of most habitats should not be affected. Cliff nesting raptors and cavity roosting bats could be affected by escarpment failures resulting from subsidence. Indirect impacts to groundwater flow in Link or Box canyons, could impact the long term viability of the Link Canyon columbine.

3.8 CULTURAL RESOURCES AND PALEONTOLOGY

3.8.1 Cultural Resources

3.8.1.1 Affected Environment

The area of analysis for cultural resources encompasses the Pines Coal Lease Tract, Permit Amendment Area, the 150-acre Lease Modification Area, the northern portion of Link Canyon, and Muddy Creek Canyon.

A number of overviews have been written for the region and adjacent regions including Jennings (1974; 1978; 1986), Aikens (1970), Madsen (1980), and Aikens and Madsen (1986). See Cultural Resources Technical Report for regional overview (JBR 1998e).

Previous Research. JBR conducted a Class I file search of the Project Area at the MLS Forest office in Price, Utah on February 4, 1998, and at the USHPO on February 5, 1998. Thirteen previous cultural resource assessments have been conducted within, adjacent to, and/or within three miles of the Project Area (Table 3.6). In addition, during June, 1998 FS archaeologists conducted a cultural resource inventory near the head of Wileys Fork on the eastern edge of the analysis area. Previous research outside of 3 miles but within 20 miles of the Pines Tract Project Area has focused on rock shelters and open sites containing remains of Archaic, Fremont, Late Prehistoric, and historic occupations. Rock shelter sites include Sudden Shelter located 25 kilometers southwest of the Project Area; Pint Size Shelter located 10 kilometers southeast of the Project Area; Joe's Valley Alcove approximately 25 kilometers northwest of the Project Area; Aspen Shelter located 20 kilometers southwest of the Project Area. Significant open sites found in a 20 mile radius of the Pines Tract Project Area include Old Woman, Poplar Knob, Snake Rock Village, and Oak Creek, and four stratified, open sites from a project on Interstate Highway 70 (I-70), all located 20 to 25 kilometers south-southeast of the Project Area (Crosland 1993). For further detail on the results of these investigations and a summary of the history and prehistory of the region, the reader is referred to JBR (1998e).

Survey Coverage. Of the 7,781-acre Pines Tract Project Area, 2,530 acres (32.5 percent) have been inventoried. Of that acreage, only 130± acres have received intensive survey coverage (Table 3.6).

Known Cultural Resource Sites. As a result of the 13 previous cultural resource inventories, 38 cultural resource sites have been identified within the Pines Tract Project Area (Table 3.7). Of these 38 sites, 26 sites are prehistoric and 12 are historic. Thirteen sites have been determined eligible for the National Register of Historic Places (NRHP). Eight of these are rock shelters, two are prehistoric campsites, and three are prehistoric lithic scatters. Additionally, eight sites are considered unevaluated but will be considered NRHP eligible for purposes of this analysis. The unevaluated sites include ML-2565 (lithic scatter), ML-2566 (lithic scatter), ML-2567 (lithic scatter), 42SV1561 (campsite), 42SV1562 (campsite), 42SV2394 (rock shelter), 42SV2433 (rock shelter), and 42SV2434 (rock shelter). The remaining seventeen sites are considered ineligible for the NRHP (Table 3.7).

Table 3.6 Previous Inventories Conducted Within 1 Mile of the Pines Tract Project Area

Report Number	Report Title	Author	Acreage Surveyed and Cultural Resources	Date	Distance From Project
U96DH0050b,f,p/ ML-96-1378	A Cultural Resource Inventory of Three Coal Mines in Central and Southern Utah	Bassett, Everett	Mine Evaluation; 2 Historic Sites	May 1996	Overlaps
U84AS0319s	Cultural Resource Inventory of Three Proposed Utah Department of Transportation Canal Crossings South of Emery on SR-10, Emery County, Utah	Davis, William E.	10 Acres; 0 Sites	March 1985	Three miles from EIS, one mile from road corridor
U97AF0598f/ ML-97-863	Cultural Resource Evaluation of a Potential Mining Subsidence Zone in the Pines Locality, Sevier and Emery Counties, Utah	Hauck, F. Richard, Donna Daniels, Kristine M. Kunkel, and Brian Mueller	487 Acres; 21 Prehistoric 1 Historic Site	Nov. 1997	Overlaps
U96AF0443f/ ML-96-815	Cultural Resource Evaluation of a Potential Mining Subsidence Zone in the Box Canyon Locality of Sevier County, Utah	Hauck, F. Richard and Glade Hadden	113 Acres; 13 Prehistoric Sites	Oct. 1996	Overlaps
ML-75-0049	Archaeological Survey of Proposed Timber Sale	Gillio, David A.	Intuitive Survey; 6+ Prehistoric Sites	Oct. 1975	Overlaps
ML-76-0062	Cultural Resources Survey of Link Canyon Timber Sale	Gillio, David A.	920 Acres; 0 Sites	July 1976	Overlaps
ML-82-299	Cultural Resource Inventory of the Muddy Creek Dam and Reservoir	Harmon, Craig B.	781 Acres; 18 Prehistoric Sites	July 1982	One mile

Table 3.6 Previous Inventories Conducted Within 1 Mile of the Pines Tract Project Area (cont.)

Report Number	Report Title	Author	Acreage Surveyed and Cultural Resources	Date	Distance From Project
ML-83-0316	Class II Cultural Resource Inventory and Test Excavation Program of the Trough Hollow - Emery Coal Lease Tracts Within the Ivie Creek - Emery Area, Emery and Sevier Counties, Utah	Copeland, James M. and Laurie D. Webster	103 80-Acre Blocks in Sevier & Emery Counties; 100 Sites	Aug. 1983	Overlaps
U84-26-133f/ ML-85-0482	Cultural Resource Evaluation of the Link Coal Mine Site in Link Canyon, Sevier County, Utah	Hauck, F. Richard	Site Evaluation; 1 Historic Site	Nov. 1984	Overlaps
U97AF0675f/ ML-98-858	Cultural Resource Evaluation of a Proposed Breakout, Substation and Powerline in the Link Canyon Locality of Sevier County, Utah	Daniels, Donna	1.22 Acres; 0 Sites	Oct. 1997	Overlaps
ML-97-823	Archaeological Data Recovery Program for the Upper Box Canyon Site Complex Including Crazy Bird Shelter (42SV896) and Associated Sites (42SV2386, -2387, -2388) in Sevier County, Utah	Hauck, F. Richard and Glade V. Hadden	Data Recovery at 4 Prehistoric Sites	Jan. 1997	One-quarter mile from EIS
	Archaeological Evaluations of Proposed Well Locations and Access Roads in the MLS Forest in Sevier and Sanpete Counties, Utah.	Hauck, F.R. and Keith Montgomery	40 Acres	1982	Overlaps

Table 3.7 Cultural Resource Sites within the Pines Tract Project Area

Report Number	Site Number	Site Type	Cultural Affiliation	NRHP Eligibility
ML-83-316	42EM1626	Lithic Scatter	Unknown Aboriginal	Eligible
	42SV1545	Lithic Source	Unknown	Ineligible
	42SV1546	Lithic Scatter	Unknown	Ineligible
ML-97-863	42SV1561 (ML-2713)	Campsite	Late Paleo-Indian, *circa* 8000-7000 BC	Unevaluated
ML-97-863	42SV1562 (ML-2714)	Campsite	Fremont	Unevaluated
ML-97-863	42SV1563 (ML-2715)	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863	42SV1564 (ML-2716)	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-83-316	42SV1567	Lithic Scatter	Unknown Aboriginal	Eligible
ML-83-316	42SV1568	Campsite	Fremont	Eligible
ML-97-863	42SV1573 (ML-2725)	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863	42SV1574 (ML-2726)	Lithic Scatter	Unknown Aboriginal	Ineligible
N/A	42SV2378 (SV-5/ML-3374)	Squashed Bucket Shelter	Unknown	Eligible
UT-96-AF-0443f	42SV2388	Campsite	Early Archaic and Late Archaic	Eligible
UT-96-AF-0443f	42SV2390	Lithic Scatter	Unknown Aboriginal	Ineligible
UT-96-AF-0443f	42SV2391	Trash Scatters	Euro-American	Ineligible
UT-96-AF-0443f	42SV2392	Lithic Scatter with possible hearths	Unknown Aboriginal	Ineligible
UT-96-AF-0443f	42SV2393	Rockshelter	Unknown Aboriginal	Eligible
UT-96-AF-0443f	42SV2394	Rockshelter	Fremont	Unevaluated
UT-96-AF-0443f	42SV2395	Lithic/Ceramic Scatter	Fremont	Ineligible
ML-97-863	42SV2423 (ML-2280/SV-2)	Refugia Shelter	Late Archaic/Formative	Eligible

Table 3.7 Cultural Resource Sites within the Pines Tract Project Area (cont.)

Report Number	Site Number	Site Type	Cultural Affiliation	NRHP Eligibility
ML-97-863/ UT-97-AF-0598f	42SV2424	Saw Mill	Euro-American	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2425	Lithic Scatter	Unknown Aboriginal	Eligible
ML-97-863/ UT-97-AF-0598f	42SV2426	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2427	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2428	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2429	Lithic Scatter	Unknown Aboriginal	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2430	Elusive Peacock Shelter	Unknown Aboriginal	Eligible
ML-97-863/ UT-97-AF-0598f	42SV2431	Lithic scatter	Unknown Aboriginal	Ineligible
ML-97-863/ UT-97-AF-0598f	42SV2432	Rock Shelter	Archaic, Early Archaic, Numic, Fremont	Eligible
ML-97-863/ UT-97-AF-0598f	42SV2433	Big Mac Shelter	Fremont	Unevaluated
ML-97-863/ UT-97-AF-0598f	42SV2434	Little Mac Shelter	Unknown Aboriginal	Unevaluated
ML-76-62	ML-2565	Lithic Scatter	Unknown Aboriginal	Unevaluated
ML-76-62	ML-2566	Lithic Scatter	Unknown Aboriginal	Unevaluated
ML-76-62	ML-2567	Lithic Scatter	Unknown Aboriginal	Unevaluated

For this analysis, three site types have been delineated for prehistoric sites. These include lithic scatters, campsites, and rockshelters. Lithic scatters consist of surface scatters of chipped stone tools and waste. These sites often exhibit a single usage and are usually small in area. A campsite contains flakes (often with concentrations), tools, groundstone, diagnostic artifacts such as projectile points and ceramic, and sometimes hearths. A campsite can contain buried cultural features. Campsites were often used seasonally and may have had extended usage. Rockshelters consist of sites located in areas sheltered by natural rock overhangs. Rockshelters can contain buried artifacts and subsurface features such as fire hearths.

After consultation between the USHPO, Advisory Council on Historic Places, and the MLS National Forest, a data recovery and monitoring program has been prepared and is being implemented for four sites just south of the Permit Amendment area (Hauck and Hadden 1997). These four sites include the Crazy Bird Shelter (42SV896), 42SV2386 (rock shelter complex), 42SV2387 (rock shelter complex), and 42SV2388 (campsite). At this time, full data recovery excavations at the Crazy Bird Shelter have been completed. Sites 42SV2386, SV2387, and SV2388 will be monitored after mining activities occur. Site, 42SV2389 (rock shelter), was found to have potential for ceiling collapse. Test excavations were conducted at this site in 1997; significant subsurface archeological deposits were not located. Based on testing results, the site is recommended as ineligible for the NRHP. A preliminary report of the data recovery at 42SV896 and testing at 42SV2389 has been completed by Archeological-Environmental Research Corporation (AERC). For further information on these sites and the results of the excavations, the reader is referred to the Final Cultural Resources Technical Report (JBR 1998e) on file at the MLS office in Price, Utah.

Historic properties already documented in the Project Area include site 42SV2424, a sawmill, and site 42SV2391 a complex of trash scatters. Both sites are considered ineligible for the NRHP. The sawmill site reflects historic lumbering activities in the Project Area from *circa* 1914. The trash scatters may be related to any number of activities including mining, lumbering, ranching, and/or roadside dumping.

Possible Historic Properties

The historic General Land Office (GLO) maps, FS vegetation survey maps, and FS Intensive Land Classification maps of the area were reviewed for possible historic properties. The GLO maps are from the years 1873, 1917, 1920, 1922, and 1941, the vegetation survey map from about 1914, and the Intensive Land Classification map from 1949. The following historic properties were noted on the maps and may still be present in the Project Area: four sawmills, a structure of unknown function, roads, a trough, a stock pond, a FS telephone line, a cabin, and a spring (Table 3.8). None of these historic properties have been recorded or evaluated. If present, these sites might be evidenced on the ground by structural remains, wire, power poles, water diversion equipment, and road features.

Table 3.8 Possible Historic Properties Within the Pines Tract Project Area

Feature Description	Map / Year
T21S R5E	
Sawmill	1949 Forest Service Intensive Land Classification
Sawmill	1914 Forest Service Vegetation Survey
Road	1914 Forest Service Vegetation Survey, 1917 GLO
Road	1917 GLO
"Christiansen" Sawmill and associated Road	1949 Forest Service Intensive Land Classification
Forest Service Telephone Line	1914 Forest Service Vegetation Survey, 1917 GLO
Stock Pond	1914 Forest Service Vegetation Survey
Road	1917 GLO
Cabin	1917 GLO
Sawmill and unknown structure	1914 Forest Service Vegetation Survey
Trough	1949 Forest Service Intensive Land Classification
T20S R5E	
Possible Spring Development	1941 GLO

The 12 possible historic resources that are noted on early historic maps of the Project Area include sawmills, roads, a stock pond, a cabin and trough, and a telephone line. The sawmills may be indicated by structural remains, equipment, or stacks of machine-sawn wood. The roads may be evidenced as two-tracks, maintained, graded roads visible through the Project Area. The stock pond may still be present and possibly in use for grazing livestock. The cabin and trough locations may have foundations or wood or concrete features. The spring noted on the GLO map may be developed with water control/diversion devices visible on the surface.

Aboriginal Use of the Project Area. Based on the results of previous inventories and/or excavations within or near the Pines Tract Project Area, some inferences can be made regarding settlement patterns and site types that might be expected within the Project Area boundaries.

Prehistoric upland occupations in the general Project Area appear to have been oriented to the late spring through the early fall months due to the harsh winters. Settlement patterns also appear to be directed to more seasonal subsistence procurement strategies rather than residential settlement as noted in the lowlands.

Nearby Aspen Shelter, Joes Valley Alcove, and the sites reported by Hauck and Hadden (1996) in Box Canyon, all appear to have been sites that were not necessarily residential occupations, but functioned more as temporary logistical camps. These are all found at approximately similar elevations around 7,000 feet above sea level. It is more common to find residential sites in the lowlands and the temporary camps in the highlands. However, Hauck and Hadden suggest that "a stable residential style of occupation so common to the lowland environments may have been selectively used by both Archaic and Formative populations in highland environments" (1997:49).

Prehistoric sites previously recorded within the project boundaries appear to range generally from 8,000 feet to 8,700 feet in elevation. The site types noted include lithic scatters, lithic sources, campsites, and rock shelters. Several are designated as unknown aboriginal, while a few have distinct cultural affiliations including Late Paleoindian, Early, Middle, and/or Late Archaic, Fremont, and Numic.

The largest Class III cultural resource inventory (Copeland et al., 1983) conducted within the Pine Coal Lease Tract area consisted of 80 acre blocks scattered on top and along the edges of the plateau. From this project, about 1,000 acres were inventoried in which about six sites were identified in the Pines Tract Project Area. These sites consists of mostly prehistoric lithic scatters and some campsites. The sites identified are all associated with interior canyons or are situated near the edge of the plateau. Based on all the previous completed inventories within the Pines Tract Project Area, most cultural resources appear to be primarily present in or near Box Canyon, with some scattered along the edge of the plateau. Very few sites have been found within the interior of the plateau, away from the Box Canyon drainages. The completed inventories within the Pines Tract Project Area have included inventories across Box Canyon and East Fork of Box Canyon, along with most of the plateau escarpment edge.

3.8.1.2 Environmental Consequences

3.8.1.2.1 No Action Alternative

No mining or development would affect any of the known sites in the identified Pines Tract Project Area. Therefore, no impacts will occur to any known or unidentified cultural resources due to mining. However, other impacts may occur to cultural resources from recreational and livestock activities, along with site vandalism. The sites located within the existing Quitchupah Lease could undergo mining-induced subsidence.

Subsidence Affects On Sites - Preface to Analysis of Impacts for All Action Alternatives

Agapito's studies suggest that upper Box Canyon and the surrounding area are less likely to exhibit strains caused by the longwall mining due to its stability. Compressional strains during

and after mining may fracture rock and/or cause some buckling or movement of rock. Tension strains may cause open cracks. These movements may cause collapse. Further, Agapito Associates, Inc. states:

> *...cultural resources within the longwall panel will undergo full subsidence but, being within the subsidence trough, theoretically, will sustain no permanent, significant strain, slope or curvature. In general, the dynamic strains are smaller than the static strain (Brauner 1973). However, the ...cultural resources near the panel margins and ends will sustain permanent strain and slope changes...*

Based on studies completed by Agapito Associates, Inc. (1998), possible impacts to NRHP eligible and unevaluated cultural resources in the Pines Tract Project Area were predicted. The possible degree of impact on the cultural resources (Table 3.9) has been broken down into four levels. In Level I up to four feet of subsidence occurs but little tension or compression results. Some erosion is possible due to a very slight sloping of the ground. No recommendations are made for cultural resource sites at this impact level. Level II involves less subsidence with more compression or tension occurring depending on where the site lies within the subsidence trough.

Increased compressional strains may cause fractures in rock with little or low topography displacement. Level II impacts are likely to be low or minimal to cultural resources. Level III addresses cultural resource sites that are located on cliff edges, overhangs, or canyon edges. At Level III, subsidence and compression are present with compressional strains possibly causing some buckling and/or movement of the rock. At Level III, it is possible that cracking could cause block failure at sites located near cliff faces or escarpments resulting in potential adverse effect to cultural resources. Level IV impacts occur at the subsidence trough margins or ends and these areas will sustain permanent displacement, strain, and slope changes. At Level IV, the potential for collapse of arched geologic structures protecting archaeological rockshelters could collapse. The resulting rock fall could damage/destroy or render archaeological deposits inaccessible for further research.

3.8.1.2.2 Alternative B

Longwall coal mining activities in the Pines Coal Lease Tract could result in Level III/IV impacts to six eligible/unevaluated sites. Possible cracking and subsidence of escarpment areas could cause block failure or structural collapse of rockshelter areas resulting in adverse affects to the National Register integrity of these sites. Seven eligible/unevaluated sites lie within areas which will be subjected to Level I-II impacts; however, these impacts are not projected to have any effects on the National Register eligibility of these sites.

Table 3.9 Mining Subsidence Affects Determination on Cultural Resource Sites Within the Pines Tract Project Area (only NRHP eligible/unevaluated sites included)

Site Number	Site Type	Possible Impact	Possible Effect
42EM1626	Lithic Scatter	1-3 foot subsidence	Level I - II
42SV1561 (ML-2713)	Campsite	4 foot subsidence, near reservoir	Level I
42SV1562 (ML-2714)	Campsite	2-2.5 foot subsidence, near reservoir	Level I
42SV1567	Lithic Scatter	0-1 foot subsidence, tension crack zone	Level II
42SV1568	Campsite	tension crack zone	Level IV
42SV2378 (SV-5/ML-3374)	Squashed Bucket Shelter	Outside proposed mining	No Impact
42SV2388	Campsite	2.5-4 foot subsidence, possible compression zone	Level III
42SV2393	Rockshelter	3.5-4 foot subsidence, compression zone	Level III
42SV2394	Rockshelter	3-3.5 foot subsidence, compression zone	Level III
42SV2423 (ML-2280/SV-2)	Refugia Shelter	.5-1 foot subsidence, .001-.0015 tension strain	Level III
42SV2424	Saw Mill	4 foot subsidence	Level I
42SV2425	Lithic Scatter	up to 2 foot subsidence, spans tension crack zone	Level IV
42SV2430	Elusive Peacock Shelter	3.5-4 foot subsidence, compression	Level III
42SV2432	Rock Shelter	0-1 foot subsidence, tension crack zone	Level IV
42SV2433	Big Mac Shelter	3.5 foot subsidence, compression	Level III
42SV2434	Little Mac Shelter	3.5 foot subsidence, compression	Level III
ML-2565	Lithic Scatter	1-2 foot subsidence	Level II
ML-2566	Lithic Scatter	0-1 foot subsidence	Level II
ML-2567	Lithic Scatter	Outside proposed mining	No Impact

Only one of the 12 possible historic resources noted in Table 3.8 may be impacted. This is the sawmill noted on a 1914 FS Vegetation Survey. One sawmill site would possibly sustain Level III subsidence impacts. Since the historic roads and telephone line are on top of the plateau, little subsidence impacts are expected to these features. All of above would apply with either Canyon Fuel or another successful applicant developing in Link Canyon. The remaining possible historic sites fall in areas of minimal impact within the Pines Coal Lease Tract area.

Direct impacts to cultural resource sites could occur with increased water supply in Muddy Creek and Link Canyon from a proposed mine water discharge structure. There will be a need for mine water to be discharged into Link or Muddy Canyons at a rate of 1,000 gpm to 1,800 gpm for at least 3 years, until main entries could be developed to the north, to the proposed breakout in Muddy Creek. It has been estimated that the discharged water would only add a 10 percent flow to Muddy Creek. Though there is moderate potential for cultural resource sites along the bench and terrace areas of Muddy Creek, minimal impacts are likely to occur to the sites due to the water flow increase. Discharge would be subject to separate NEPA and NHPA analysis and approval.

Should a company other than Canyon Fuel obtain the Pines Coal Lease Tract, impacts, in addition to those previously mentioned, could be manifested through the construction of mine facilities near the head of Link Canyon, waste dump/stock-pile accumulation, 2,500 feet of discharge pipe, and haul road improvement within Link Canyon to SR-10, near the town of Emery. Indirect impacts could be manifested through increased erosion, or improved access which could increase accidental or deliberate disturbance, vandalism, and/or illegal artifact collection. In April 1998, JBR Environmental Consultants, Inc. conducted a Class III inventory for a proposed power line along portions of and adjacent to the Link Canyon road, resulting in the documentation of both historic and prehistoric archaeological sites. The Class I review at the USHPO indicated that a large portion of the Link Canyon road corridor from Emery has not been inventoried for cultural resources. Any proposed processing facility site would have to be properly evaluated for any cultural resources, and if found eligible, mitigated, before construction, or improvements were to proceed.

Under Alternative B, the significant affected sites include, 13 sites considered eligible for the NRHP or unevaluated (Table 3.10).

If a new mine was developed in Link Canyon, two eligible sites are presently known to be within the canyon itself which could be affected by the development of new surface facilities, but not by the purposed underground mining. These include, 42SV2378, a rockshelter and 42SV3451, the historic Emery to Mayfield road. Site 42SV2378 is eligible and site 42SV3451 has road segments which are potentially eligible for the NRHP. Beyond these above identified sites, additional cultural resources may be encountered.

Table 3.10 Cultural Resource Sites Within the Pines Tract Project Area Potentially Affected by Alternatives (only NRHP eligible/ unevaluated sites included)

Site Number	Site Type	NRHP Eligibility	Predicted Potential Level of Impacts by Alternative			
			A	B	C	D
42SV2393	Rockshelter	Eligible	None	None	None	III
42SV2394	Rockshelter	Unevaluated	None	None	None	III
42SV2423	Rockshelter	Eligible	None	III	None	III
42SV2425	Lithic Scatter	Eligible	None	IV	None	IV
42SV2430	Rockshelter	Eligible	None	III	None	III
42SV2432	Rockshelter	Eligible	None	IV	None	IV
42SV2433	Rockshelter	Unevaluated	None	III	None	III
42SV2434	Rockshelter	Eligible	None	III	None	III
42SV2565	Lithic Scatter	Unevaluated	None	II	II	II
42SV2566	Lithic Scatter	Unevaluated	None	II	II	II
42SV2567	Lithic Scatter	Unevaluated	None	II	II	II
42EM1626	Lithic Scatter	Eligible	None	I-II	I-II	I-II
42SV1561	Campsite	Unevaluated	None	I	I	I
42SV1562	Campsite	Unevaluated	None	I	I	I
42SV1567	Lithic Scatter	Eligible	None	None	None	II
42SV1568	Campsite	Eligible	None	None	None	IV
42SV2378	Rockshelter	Eligible	None	None	None	None
42SV2388	Campsite	Eligible	None	None	None	III

3.8.1.2.3 Alternative C

Under this alternative six cultural resource sites could be affected by Level II or less impacts. None of these sites will sustain Level III or IV subsidence impacts.

One sawmill site will possibly sustain Level III or greater subsidence impacts. Since the historic roads and telephone line are on top of the plateau, little subsidence impacts are expected to these features.

SCLS #1 states that prior to undertaking surface disturbing activities, the lessee may be required to conduct a cultural resource inventory of the proposed impact area. A plan will then be submitted making recommendations for the protection of, or measures to be taken, to mitigate impacts for identified cultural resources. If cultural resources of significant interest are discovered during operation under this lease, "the lessee prior to disturbance shall immediately bring them to the attention of the appropriate authority." According to SCLS #1, partial or full excavation of the eligible sites should be conducted following inventory and evaluation if these subsidence impacts occur, in accordance with standards and guidelines which would be outlined by the FS and USHPO. Section 106 consultation would then take place between the MLS and USHPO. JBR Environmental Consultants, Inc. is recommending that those sites as identified above and in Table 3.9, which are eligible or potentially eligible for the NRHP, that may have a subsidence impact of Level III or IV, should be addressed through an integrated research design for some level of site mitigation prior to mining activities.

If a new mine was developed in Link Canyon, the effects would the same as those described in Alternative B

3.8.1.2.4 Alternative D

Under this alternative, nine sites could sustain Level III or greater subsidence impacts. Six are rockshelters and should be tested in order to determine there NRHP status. One sawmill site will possibly sustain Level III or greater subsidence impacts. Since the historic roads and telephone line are on top of the plateau, little subsidence impacts are expected.

SCLS #1 states that prior to undertaking surface disturbing activities, the lessee may be required to conduct a cultural resource inventory of the proposed impact area. This would be applied as described under Alternative C.

If a new mine was developed in Link Canyon, the effects would be the same as described for Alternatives B and C.

3.8.1.3 Mitigation and Monitoring

At levels of III and IV impacts, it is recommended that the mining operations be avoided in the area or testing/mitigation measures be completed before mining activities occur. In terms of site preservation, avoidance of impacts to eligible and unevaluated cultural resource sites is the

preferred method of site preservation. However, when disturbance of National Register eligible sites is unavoidable, direct, and/or indirect impacts may be mitigated through data recovery, site monitoring, and research in accordance with standards and guidelines agreed upon by the FS, the USHPO, and the Advisory Council on Historic Places. However, both direct and indirect impacts would result in permanent loss of site context, and in the case of indirectly impacted sites, potential loss of information and artifacts.

The proposed Pines Coal Lease Tract shall be considered unsuitable as stated in 43 CFR 11(g)(1) criterion number 7 when the following apply:

> *(g) (1) Criterion Number 7. All publicly or privately owned places which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that made it eligible for listing in the National Register.*
>
> *(2) Exceptions. All or certain stipulated methods of coal mining may be allowed if, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, they are approved by the surface management agency and, where appropriate, the State or local agency with jurisdiction over the historic site.*
>
> *(3) Exemptions. This criterion does not apply to lands; to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which included operations on which a permit has been issued.*

It has been determined that the Pines Coal Lease Tract can be suitable for leasing with the implementation of appropriate mitigation measures approved by the USHPO, Advisory Council, and the FS. This would lessen impact from an adverse to no adverse impact level.

Under Alternative B, 6 cultural resource sites could be affected at Level III or IV within the Pines Tract Project Area. Under Alternative C, no sites will be affected by Level II or IV impacts. Under Alternative D, nine sites could be affected by Level III or greater impacts.

National Register eligible or unevaluated cultural resource sites with Level III and IV subsidence impacts can be mitigated through site mapping, monitoring, testing, and/or partial or full excavation (Table 3.11).

Table 3.11 Proposed Mitigation for National Register Eligible and Unevaluated Sites Within and adjacent to the Pines Tract Project Area

Site Number	Site Type	Action Alternative	Proposed Mitigation
42EM1626	Lithic Scatter	B,C,D	Level I-II impacts - no work
42SV1561 (ML-2713)	Campsite	B,C,D	Level I impacts - no work
42SV1562 (ML-2714)	Campsite	B,C,D	Level I impacts - no work
42SV1567	Lithic Scatter	D	Level II impacts - no work
42SV1568	Campsite	D	Site mapping and monitoring
42SV2378 (SV-5/ML-3374)	Squashed Bucket Shelter	B,C,D	Within lease area, but outside proposed mining area
42SV2388	Campsite	D	Site mapping and monitoring
42SV2393	Rockshelter	D	Testing to determine possible mitigation
42SV2394	Rockshelter	D	Testing to determine possible mitigation
42SV2423 (ML-2280/SV-2)	Refugia Shelter	B,D	Partial mitigation and monitoring
42SV2425	Lithic Scatter	B,D	Site mapping and monitoring
42SV2430	Elusive Peacock Shelter	B,D	Partial mitigation and monitoring
42SV2432	Rockshelter	B,D	Testing to determine possible mitigation
42SV2433	Big Mac Shelter	B,D	Testing to determine possible mitigation
42SV2434	Little Mac Shelter	B,D	Testing to determine possible mitigation
ML-2565	Lithic Scatter	B,C,D	Level II impacts - no work
ML-2566	Lithic Scatter	B,C,D	Level II impacts - no work
ML-2567	Lithic Scatter	B,C,D	Outside proposed mine area