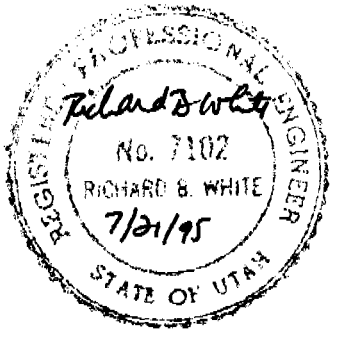
APPENDIX 12-3-2

SECTION 3.2, VEGETATION INFORMATION
WILLOW CREEK COAL MINE



3.2 VEGETATION INFORMATION

3.2.1 General Vegetation Information

This section describes existing vegetation communities, types, species, and conditions within the permit and adjacent areas that could be affected or impacted by the mining and reclamation activities. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-140 and R645-301-300) for coal mine permitting in the State of Utah.

3.1.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-310 and 311, 321.100 through 200, 322.210, and 323.100 and 400. Operation plans (Rules R645-301-330 and 331) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules 645-301-341, 342.200 through 400, and 352 through 357) are addressed in Section 5.3.

The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section		Applicable Regulatory Provisions
3.2.1		
	3.2.1.1	
	3.2.1.2	R645-301-321.100, and 200
	3.2.1.3	R645-301-321.100
	3.2.1.4	R645-301-140, 311 and 323
3.2.2		
	3.2.2.1	R645-301-321.100 and 200
	3.2.2.2	R645-301-321.100 and 200
	3.2.2.3	R645-301-321.100
	3.2.2.4	R645-301-321-200
	3.2.2.5	R645-301-321-200
	3.2.2.6	R645-301-321.100 and 200, and 323.100 and 400
3.2.3		
	3.2.3.1	R645-301-322.210, 230 and 300
	3.2.3.2	R645-301-322.210 and 230
	3.2.3.3	R645-301-322.210
	3.2.3.4	R645-301-322.210 and 323.300
Maps		R645-301-323.100 and 400
Exhibits		R645-301-311, 321.100 and 200, 322.210, and 323.100 and 400

The following discussion describes the vegetation resources within the boundaries of the Willow Creek Mine Permit Area in sufficient detail to identify the characteristics of the plant communities and their associated habitats. This evaluation specifically addresses the requirements of the UDOGM's regulations for Biology at R645-301-300.321, Vegetation Information, as well as the requirements contained in the UDOGM's Vegetation Information Guidelines. This evaluation addresses the types of plants found in the permit area in order to assure that all mining and related activities minimize the impacts on the vegetation resources of the area and contains sufficient information to assure that all unavoidable impacts caused by mining are mitigated through properly planned reclamation operations. Mining will be a temporary land use and following the cessation of mining the disturbed areas will be reclaimed to a suitable configuration to effectively sustain the postmining land use of wildlife habitat.

3.2.1.2 Sources of Vegetation Information

The following characterization of vegetation resources in the permit and adjacent areas represents a compilation of data collected by independent biologists and Federal agency representatives over a period of several years. Since much of the data collected by the various Federal agencies focused on different objectives than those addressed by the UDOGM's current regulatory requirements, this data may be only partially relevant to this permitting action. Nearly all of the data collected by private sector biologists was obtained subsequent to 1981 to address UDOGM requirements, however, it is important to note that since much of this data was collected, applicable regulations, regulatory standards, guidelines, and UDOGM policies have changed.

Prior to the initiation of the vegetation data collection efforts associated with this effort, the principal reference for vegetation information for this area was the "Vegetation Data Report of Price River Coal Company's Mine Area" prepared by Mariah Associates for Price River Coal Company in November 1981. Exclusive of this permitting effort, this report, which generated a detailed vegetation map and resulted in the sampling of several reference areas, has been utilized as the sole basis for every subsequent permitting action in this area. The Mariah Associates report in slightly different edited forms was used as the basis for permit vegetation information for the American Electric Power Company's Blackhawk Coal Company Permit in 1988; the Blackhawk Coal Company's Willow Creek Site, Final Closure and Reclamation Plan in May of 1989; the Castle Gate Coal Company's June 1989 Permit; and the Castle Gate Coal Company's Permit submitted in February 1994. Exclusive of the sampling efforts associated with this permitting action the only other site specific vegetation information pertinent to this location is that associated with the UDOGM's AMR efforts performed in this area. Other information utilized in this evaluation, nature of the information and relevance to this site are summarized below:

- Crofts, K.A. and B.A. Grimes. 1988. Cover Soil Requirements for Reclamation of Coal Refuse Material in Utah. pages 179 to 185 In: D.H. Graves and R.W. DeVore. Editors, Proceedings, 1988 Symposium on Mining, Hydrology, Sedimentology and Reclamation. University of Kentucky UKY BU148. Lexington, Kentucky. 234 pages.

- Ferguson, R.B. and N.C. Frischknect. 1985. Reclamation of Utah's Emery and Alton Coal Fields: Techniques and Plant Materials. USDA-FS, Intermountain Forest and Range Experimentation Station. Research Paper INT-335. 78 pages.

- Frischknect, N.C. and R.B. Ferguson. 1980. 1979 Annual Progress Report, Revegetation Studies on Disturbed Overburden, Emery Coal Field. Interagency Agreements UT-910-1A9-0436 and Utah 6. Prepared for Intermountain Forest and Range Experiment Station, Shrub Sciences Laboratory, Provo, Utah. 35 pages.

- Hodder, D.T., R.C. Jewell (Editors). 1979. Reclaimability Analysis of the Emery Coal Field, Emery County, Utah. USDI, Bureau of Land Management, EMRIA Report No. 16. 408 pages.

- USDA-SCS. 1988. Soil Survey of the Carbon Area, Utah. 294 pages.

- USDI-BLM 1983. Unita-Southwestern Utah Coal Region, Round Two, Final Environmental Impact Statement. Utah State office, Bureau of Land Management. 581 pages plus appendices.

- Welsh, S.L. 1977. Endangered and Threatened Plant Species of the Central Coal Lands, Utah. Brigham Young University, Provo, Utah.

- Welsh, S.L. and K.H. Thorne. 1979. Illustrated Manual of Proposed Endangered and Threatened Plants of Utah. U.S. Fish and Wildlife Service, Denver, Colorado. 318 pages.

- Welsh. S.L. and Neese. 1980. Inventory of Potentially Endangered or Threatened Plant Species of Selected Coal Lands of Emery County, Utah. Endangered Plant Studies, Inc. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, Utah. Contract Number UT-060-79-SOA-019.

Given the changes in regulatory requirements which have occurred since much of the data was originally collected and subsequent disturbance of many of the areas previously sampled at this location, the original data cannot be used directly to comply with current vegetative baseline requirements. To the maximum extent possible and with appropriate consultation with UDOGM, the original data have been reevaluated in light of currently applicable UDOGM requirements. Where the existing vegetation data does not comply with current regulatory standards, site specific vegetation studies were conducted to obtain required supplemental data. In those limited instances where the original data is not consistent with current standards and it was impossible to collect additional supplemental data due to subsequent mining or other surface disturbance, it is expected that UDOGM will "grandfather" the original data under the regulatory requirements applicable at the time the data was collected. In the following discussion and tables, existing available vegetation data as well as recently collected sampling data have been compared, as appropriate, with the standards which existed at the time the data was originally collected as well as current regulatory standards.

In certain areas, knowledge of the vegetation resources of the area has expanded since the original data were collected. This is particularly applicable with respect to limitations for some of the original sampling parameters as well as general knowledge of plant taxonomy as it relates to threatened, endangered, and sensitive (TES) plant species. As appropriate, the original data has been corrected or reevaluated where data errors or problems in interpretation were discovered. Generally, required corrections relate to errors in the original mapping (several community mapping units were unlabeled and other units had multiple community designations) and obvious errors in plant identification. With respect to threatened, endangered and sensitive plants, some species of potential concern have been deleted from consideration while additional species have been added since the original data was collected. All existing available vegetation data have been reevaluated in light of the present knowledge of area vegetation resources.

The November 1981 report prepared by Mariah Associates entitled "Vegetation Data Report for Price Rive Coal Company's Mine Area" is limited since it contained only a very generalized bibliography related to plant ecology or cited the authority for plant scientific names. Since there was no accepted plant taxonomy for this area at the time this study was completed, this report contains data and designations which are inconsistent with more recent work conducted in the area.

In order to provide for the highest level of scientific accuracy and consistency with future vegetation characterization efforts, 1994 field data collection and evaluation methodologies were closely coordinated with the UDOGM and appropriate approvals obtained prior to the initiation of the field work. All plant designations used in conjunction with the 1994 field work were obtained from the most current taxonomic manual for this area. Correlation of the plant species designations from the 1981 vegetation report with those currently accepted by Welsh et. al. (1987) was not possible since the unidentified authority used to compile the 1981 report contained many names which could not be directly related to any of the synonyms found in Welsh. In order to expedite the 1994 field work, plant designations recorded on field maps and data sheets utilized abbreviated scientific plant symbols consistent with Plummer et. al. (1966). Where the 1981 plant names could be correlated to current designations and similar species were encountered in the 1994 sampling effort, the 1981 plant symbols were modified to correspond with those found in Plummer. However, where the 1981 names were not readily identified following consultation of synonyms found in Welsh, the original plant names and symbols were retained as originally presented.

Given the need for supplemental vegetation data, required additional data was obtained through site-specific field investigations conducted by Kent A. Crofts during summer 1994. The supplemental data collection effort was initiated on July 18, 1994 with initial site surveys to identify any potential plant occurrences within the coal exploration drilling area nd mine permit area. During the period from August 1 to August 13, 1994 supplemental vegetation mapping was completed as well as additional field reconnaissance for TES species. Field vegetation and soils sampling in the riparian zone along Willow Creek was initiated on August 2, 1994. Cover and production sampling for the Disturbed, Reclaimed, and Riparian Bottom vegetation communities was performed during the period from September 10 through September 17, 1994. Analysis of the cover data, weighing of the production samples, and summarization of the production data was completed between December 12, 1994 and January 2, 1995. the supplemental field investigations, which included mapping and vegetation sampling, were conducted using the methodologies described in the following sections.

Normal Precipitation Year

Prior to initiation of the 1994 field vegetation sampling, both recent and historical and precipitation data from Utah Power & Light Company's nearby Carbon Generating Station was obtained and compared against the definition for "normal precipitation year" contained in the UDOGM Vegetation Guidelines. The results of this comparison were reviewed with Mr. Paul Baker of UDOGM who gave verbal approval to proceed with the required supplemental vegetation data collection for the Willow Creek Mine.

Vegetation Mapping

As a result of several discussions with Mr. Paul Baker of the UDOGM in August and September, it was determined that limited supplemental vegetation mapping and sampling would be necessary to adequately characterize plant communities within the boundaries of the permit area, with specific emphasis on the surface facilities disturbance area. This determination resulted in detailed mapping and vegetation sampling during 1994 for the entire mine facilities surface disturbance area as identified at that time. Data for the water tank and fan area disturbances, which were added late in the permitting process, will be collected as soon as conditions allow in 1995.

The original vegetation mapping did not include certain areas in the vicinity of Panther Canyon and along the northwest boundary of the permit area which were also added to the permit area. Discussion of overall vegetation mapping and mapping of the additional areas with Mr. Baker resulted in his recommendations that the original 1981 Vegetation Map be used as the basis for delineation of vegetation mapping units for the permit area and that the additional areas be mapped separately with resulting mapping information to be added to the base vegetation mapping. Consistent with these recommendations, supplemental vegetation mapping was completed for the additional areas during 1994 and a regional vegetation map developed by combining this supplemental information with the 1981 mapping. At this same time, the issue of vegetation mapping for adjacent areas was discussed. The original vegetation mapping did not include any adjacent areas beyond the designated permit boundary. Given this consideration, the extensive history of underground mining this area, and the general lack of significant related surface impacts except in actual surface disturbance areas, Mr. Baker indicated that it would not be necessary to complete vegetation mapping for adjacent areas.

Cover Sampling

Potential vegetation sampling methodology was also discussed with Mr. Paul Baker of the UDOGM prior to initiation of supplemental field work. At that time, Mr. Baker indicated that the "Baseline Data Method" as described in the UDOGM's Vegetation Guidelines would be the preferred sampling methodology for this new disturbance area. Vegetation mapping of the surface facilities area resulted in identification of a total of three plant community types which would potentially be impacted by the proposed disturbance; 1) Disturbed Plant Community; 2) Reclaimed Plant Community; and 3) Riparian Plant Community. Further review of both permit requirements and the existing vegetation community types resulted in a determination that the vegetation sampling would need to meet the requirements of both the UDOGM and US Army Corps of Engineers for two stream locations. Accordingly, it was decided to use two separate cover sampling techniques.

Vegetative cover for both the Disturbed and Reclaimed plant communities was sampled using an inclined metal ten point frame or "Point Method" as outlined in the UDOGM Vegetation Guidelines. Standard field data sheet reflecting ten randomly located stations to be established along a 50 meter tape, with ten sample points for each station, were prepared prior to going to the field. Then, in the field, sample locations and the orientation of transects for each vegetation community were determined through the use of random numbers generated by a hand-held calculator. Cover values for each type were determined by recording total vegetative cover, rock, litter, lichens, moss, and bare ground for a total of 100 points per type.

Vegetative cover values for the Riparian Bottom Plant Community were determined using the cover estimation technique outlined in the 1987 Corps of Engineers Wetland Delineation Manual. This sampling methodology involves the use of the "Ocular Estimation" cover sampling technique which is also described in the UDOGM Vegetation Guidelines. Using this sampling methodology, four distinct plant strata are sampled. The canopy cover of trees, defined as all woody plants with a diameter at breast height (DBH) greater than 3.0 inches, was

recorded within a plot defined by a 30 foot radius from the sample point. The canopy cover of saplings and shrubs, defined as all woody plants with a DBH of less than 3.0 inches, was recorded for a plot defined by a 10 foot radius from the sample point. Canopy cover for all remaining herbaceous plants occurring within a 3.28 by 3.28 foot quadrant was then recorded to the nearest percent. Finally, all woody vines rooted within a plot defined by a 10 foot radius from the sample point were recorded. Since multiple overlying plant strata are quantified using this sampling method, cumulative canopy cover values may exceed 100 percent.

Production Sampling

Production estimates for the Disturbed, Reclaimed, and Riparian Bottom plant communities were determined by clipping five randomly located one quarter square meter circular plots along each cover transect. All standing biomass for grasses and forbs was clipped by species and the current year's growth of shrubs was sampled. These samples were placed in individually labeled paper sacks in the field and brought back to the laboratory where they were dried and weighted to the nearest tenth of a gram on an electronic scale.

Sample Adequacy

Sample adequacy determinations for plant cover used total plant cover values obtained from each cover transect for the Disturbed and Reclaimed plant communities. The cover value from each transect was used as a datum for purposes of data summation. The total canopy cover value for each Riparian Bottom plot sampled were also used as a datum. The sample adequacy formula presented in Appendix A of the UDOGM Vegetation Guidelines was then used to determine sample adequacy. Sampling continued for all vegetation parameters until a sufficient number of samples was obtained to achieve a 90 percent confidence interval within 10 percent of the mean.

Range Condition Sampling

Nearly all existing plant communities within the proposed mine surface facilities area have been disturbed by previous mining or other development and reclamation activities and do not represent native or undisturbed conditions, although some of the vegetative communities in fan area (upper pad) and water tank site may not have been previously disturbed. Consequently, the USDA-Soil Conservation Service approach to range condition sampling and classification can not be utilized to determine range condition for the potentially affected areas.

3.2.1.3 General Ecology of Permit and Adjacent Areas

Given the rugged terrain there is considerable variation in vegetation resources over the permit area, with vegetation types ranging from low elevation salt desert shrub to montane coniferous stands. Changes in elevation, with associated moisture and temperature gradients have a major influence on vegetation types in the area. topography, aspect, soil type, past and present land uses, historical grazing management practices, and historical range fires are also significant factors affecting plant community distributions.

Dominant vegetation types for the Book cliffs area in the vicinity of the proposed permit area include Sagebrush-Grass, Mountain Brush, Pinyon-Juniper, Aspen, Conifer, Ponderosa Pine, and Riparian community types. The Riparian Community, typified by cottonwoods and willows, is generally found only along perennial and intermittent streams. The Mountain Brush Community is often interspersed with other vegetation types. The Pinyon-Juniper Community is most commonly found on lower elevation south facing slopes. Conifer stands, dominated by Douglas Fir, Subalpine Fir and White Fir are found on protected north facing slopes. Extensive areas of ledges, talus slopes and rock outcrops which typify the Book Cliffs result in many areas which lack any significant vegetation.

3.2.1.4 Mapping of Vegetation Information

In order to accurately show both the general vegetation communities occurring within the proposed mine permit area and more specific vegetation information for the proposed mine surface facilities disturbance area, two separate vegetation maps were developed. The Regional Vegetation Map, (Map 5), presented at a scale of 1 inch equals 2,000 feet delineates the boundaries of and identifies all existing vegetation communities within the

permit area. This map was developed using information from the original Mariah Associates 1981 Vegetation Map for all areas included in the original Price River Coal Company permit area, and additional information from supplemental mapping efforts. Those additional areas required to provide full coverage for the large Willow Creek mine permit area, including Panther Canyon and areas along the northwestern permit boundary, were mapped at a scale of 1 inch equals 1,000 feet on the original Mariah Associates Map. The supplemental mapping was accomplished by delineating vegetation communities on the vegetation map using color aerial photography obtained from the USDI-BLM followed by extensive ground truthing during the August and September 1994 field work at which time the plant community boundaries were finalized. Both original and supplemental mapping information was then digitized from the Mariah Associates Map and transferred to the Willow Creek Mine base map. A breakdown of the acreage associated with each vegetation community found within the proposed permit area is presented in Table 3.2-1, Permit Area - Vegetation Types and Corresponding Acreages.

TABLE 3.2-1
PERMIT AREA VEGETATION TYPES AND CORRESPONDING ACREAGES

Vegetation Type (Map Symbol)	Acres
Mountain Brush (MB)	6,452.8
Pinyon Juniper (PJ)	3,611.9
Conifer (CO)	2,978.1
Grass-Sage (GS)	1,511.4
Riparian Bottom (RB)	15.1
Disturbed by Mining After 8/3/1977 (D2)	109.9
Non Mining Disturbance (DS)	103.0
Disturbed by Mining Pre 8/3/1977 (D1)	65.8
TOTAL	14,850.0

The mine surface facilities area is the only area where direct mine related surface disturbance is currently planned. In order to provide more detailed vegetation mapping for this area the Facilities Area Vegetation Map, (Map 6), at a scale of 1 inch equals 200 feet was developed. The detailed mapping reflects more specific vegetation mapping units than those originally used by Mariah Associates in the 1981 permit area vegetation mapping. The major difference in the more detailed mapping is that the mapping for the surface facilities disturbance area uses dominant vegetation types as the mapping units rather than general plant assemblages as was used in the original mapping.

The location and extent of all previous mining and other surface disturbance is delineated on the two vegetation maps. All mining related disturbance which occurred prior to August 3, 1977 is shown on the Facilities Area Vegetation Map, (Map 6), and designated by the symbol D1. No areas impacted by mining subsequent to August 3, 1977 are known to exist in this area. All other non-mining related disturbances are also shown on this map and denoted by the symbol DS. This disturbance corresponds largely with the disturbance associated with State Highway 191, none of which lies within the Willow Creek mine facilities area. The location of all previously disturbed areas is also depicted on the Regional Vegetation Map, (Map 5).

The respective acreages associated with all previous and proposed disturbance is summarized in Table 3.2-2, Previous and Proposed New Disturbance by Vegetation Type. The extent of all areas where vegetation disturbance is anticipated in conjunction with the mining and related activities is shown on this map.

TABLE 3.2-2 PREVIOUS AND PROPOSED NEW DISTURBANCE BY VEGETATION TYPE	
Vegetation Type (Map Symbol)	**Acres**
Previous Disturbance (Disturbed Prior to August 3, 1977, D1)	
Pinyon Juniper - Salina Wildrye	5.3
Pinyon Juniper - Big Sagebrush	4.3
Big Sagebrush - Salina Wildrye	38.3
Total Existing Disturbance	47.9
Proposed New Disturbance	
Pinyon Juniper - Salina Wildrye	6.1
Big Sagebrush - Salina Wildrye	0.5
Pinyon Juniper - Big Sagebrush	0.3
Total New Disturbance	6.9
Previously Disturbed Unreclaimed	31.1
AML Reclamation	16.8
TOTAL DISTURBANCE	54.8

3.2.2 Vegetation Information

3.2.2.1 Vegetation Communities

A total of five major undisturbed vegetation types, a disturbed area classification, and three miscellaneous vegetation types were identified and mapped in Mariah Associates original vegetation report as occurring within the area corresponding to the permit area. The identified vegetation types include the following:

- Grass-Sage
- Mixed Brush
- Conifer
- Pinyon-Juniper
- Riparian Bottom
- Disturbed

Subsequent to the Mariah Associates work, the UDOGM's Abandoned Mined Land Reclamation (AMR) Group initiated several reclamation projects in the vicinity of the surface facilities area. The reclaimed vegetation sites were mapped and this mapping information has been transferred to the Facilities Area Vegetation Map, (Map 6), with the designation of reclaimed. In order to standardize the nomenclature for plant community types, vegetation types from the 1981 Mariah Associates vegetation report have been correlated to current USDA-Soil Conservation Service (SCS) Ecological Sites as designated in the 1988 Soil Survey of Carbon Area, Utah. To maintain consistency, all reference areas identified in the Mariah Associates report have also been correlated to current SCS Ecological Sites found in the published soils survey. Vegetation correlations are summarized by Table 3.2-2, Previous and Proposed New Disturbance by Vegetation Type. The following sections describe and characterize the individual vegetation types identified as occurring within the proposed permit area.

Grass-Sage Vegetation Type

The Grass-Sage vegetation type occurs on steep dry slopes and in the lower reaches of several of the small intermittent and ephemeral drainages in this area. Depending on site conditions, either Basin big sagebrush *(Artemisia tridentata spp. tridentata)* or Salina wildrye *(Elymus salinus)* are the dominant species. Along the banks of Willow Creek in the vicinity of the mine facilities area, Basin big sagebrush dominates. Along the eastern banks of the Price River and on most of the exposed knolls and ridges in this area, however, Saline wildrye is the dominant plant species. Other frequently occurring plants in this vegetation type are Western wheatgrass *(Agropyron smithii)*, Cheatgrass brome *(Bromus tectorum)* and Fourwing saltbush *(Atriplex canescens)*. Correlation of Grass-Sage sites sampled during the 1981 field study with the 1988 SCS soils survey of the area indicates that this vegetation type generally corresponds with the Mountain Very Steep Loam (Salina wildrye) Ecological Site.

Review of the 1981 Mariah Associates vegetation report indicates that the dominant graminoid for this type was designated at the time as an unidentified wheatgrass *(Agropyron spp.)* The report did not list Salina wildrye as occurring in this or any of the other vegetation types in this area. However, the 1988 SCS soil survey and several botanical studies conducted in this area, including site descriptions prepared in conjunction with the UDOGM's AMR program consistently indicate Salina wildrye is the dominant grass species found in this area. Given this additional information it has been assumed that the unidentified wheatgrass, as designated by Mariah Associates is actually Salina wildrye.

Mixed Brush Vegetation Type

The Mixed Brush Vegetation Type generally occurs on relatively moist sites such as the bottoms of canyons, gulches and other depressions and is typically found on moderate to well developed soils at the lower elevations near Willow Creek and along the Price River. At higher elevations however, such as in the eastern portion of the proposed permit area, it occurs over a wide range of slope and aspect combinations. The visually dominant plant species for this type is Gambel's oak *(Quercus gambelli)*, but Utah serviceberry *(amelanchier utahensis)* is often a co-dominant. Basin big sagebrush, Utah juniper *(Juniperus osteosperma)* and Pinyon pine *(Pinus edulis)* are often found on more xeric sites, while more xeric sites frequently support Wolfberry, *(Symphoricarpos occidentalis)*, Bigtooth maple *(Acer grandidentatum)* and Quaking aspen *(Populus tremuloides)*. Common understory plant associated with this vegetation type include Salina wildrye, Cheatgrass brome, and Oregon grape *(Mahonia repens)*. Correlation of the 1981 vegetation mapping with the 1988 SCS soil survey reveals that in most areas this vegetation type corresponds to the Mountain Very Steep Loam (Oak) Ecological Site.

Pinyon-Juniper Vegetation Type

The Pinyon-Juniper Vegetation Type is most typically found on steep, rocky, dry south-facing slopes between the Price River and Willow Creek and near the base of the Book Cliffs in the south portions of the proposed permit area. Below the base of the Book Cliffs, such as in the area to the east of Kenilworth, this type also occurs on more level or gently sloping but equally dry sites. The pinyon-Juniper type may be characterized as open, pygmy forested type dominated by Pinyon pine and Utah juniper as the principle overstory species. Common understory shrubby species include Basin big sagebrush, Gambel's oak, Curlleaf mountain mahogany *(Cerocarpos ledifolius)* and various species of Rabbitbrush *(Chrysothamnus spp.)*. The most common grasses are Salina wildrye and various wheatgrasses. The 1988 USDA-SCS soils survey lists several Pinyon-Juniper Ecological Sites, but examination of the corresponding sampling sites suggests that most of the Pinyon-Juniper Vegetation Types occurrences within the proposed permit area correspond to the Upland Very Steep Shallow Loam (Pinyon-Juniper) Ecological Site.

Riparian Bottom Vegetation Type

The Mariah Associates vegetation report indicates that the Riparian Bottom Vegetation Type is limited to the streambanks immediately adjacent to the Price River, a few small sites in the bottom of Crandall Canyon, and a very narrow bank along portions of Willow Creek in the vicinity of the proposed mine facilities area. Additional, very limited occurrences may exist in portions of other small area drainages although they have

never been delineated or mapped. This type, however, is not shown in the original 1 inch to 1,000 foot 1981 vegetation mapping. This exclusion appears to be due to the very limited occurrence and width of this type and the fact that the areal extent of its distribution is typically narrower than the line width used for the original mapping. The larger map scale used in mapping the proposed mine facilities area for this submittal allowed mapping of the Riparian Bottom Vegetation Type as a separate vegetation type.

The visually dominant tree species for this type include Narrowleaf cottonwood *(Populus angustifolia)* in the upper portions of the proposed facilities area and Fremont cottonwood *(Populus fremontii)* in the lower portions of this site. Coyote willow *(Salix exigua)* is the most common understory shrub, Redtop, *(Agrostis stolonifera)* is the most common grass species, and Yellow sweetclover *(Melilotus officinalis)* is the most common forb associated with this vegetation type. Review of the 1981 Mariah Associates vegetation report, the 1988 SCS soils survey, and documentation of a consultation between the SCS and Mariah regarding productivity sampling of these riparian sites reveals that they do not correspond to any recognized Ecological Sites.

Conifer Vegetation Type

In the general permit area, the Conifer Vegetation Type is typically found at higher elevations, on north facing slopes, and in some drainage bottom areas. The most common tree species associated with this type is Douglas fir *(Pseudotsuga meziesii)*, although Subalpine fir *(Abies lasiocarpa)* and White fir *(Abies concolor)* can be locally dominant depending on site conditions. The density of tree canopy cover is the primary influence on the site-specific composition for this vegetation type. Relatively dense conifer stands typically have a very sparse understory with understory species typically being limited to Wolfberry, Oregon grape and Salina wildrye. Open conifer stands generally have relatively more shrubs and grasses in the understory and often resemble the Mixed Brush Vegetation Type in appearance. Correlation of the 1981 vegetation mapping with the 1988 SCS soils survey information indicates that most occurrences of this type correspond to the Mountain Very Steep Loam (Douglas fir) Ecological Site.

Disturbed Vegetation Type

Mining and related activities have been conducted for over a century in the proposed surface facilities and nearby areas, resulting in a long sequence of development activities and significant related surface disturbance. As described in Section 3.4 of this permit document and based on historic land use information submitted by Blackhawk Coal Company for the Willow Creek Site Final Closure and Reclamation Plan, mining within the proposed surface facilities area commenced in 1890 when five portals were opened along the south side of Willow Creek. Active mining operations in this area occurred more or less continuously from 1890 through 1972 when the final active mine closed.

The Castle Gate No. 4 Mine, located on the north side of Willow Creek, opened in 1958 and operated until it was closed in 1970. The historical summary notes that the shallow canyons to the west of the original mines as well as open areas on the north side of Willow Creek were used as coal refuse disposal sites from about 1938 through 1972. In 1974, a new portal area was faced up and a 1,000 foot segment of Willow Creek adjacent to the new face-up area was diverted from its original channel and rechanneled. Minor regrading occurred on the site in 1975 in anticipation of development of the new portals and some additional earthwork was completed on the Willow Creek diversion channel. Following the decision in late 1975 to not proceed further with portal and mine development until the site was designated as an abandoned mined land reclamation site in the fall of 1989 little or no activity occurred in this area.

In 1989, under UDOGM's AMR program, approximately 250,000 tons of coal refuse were removed from a site along the Price River and buried in the planned mine face up area exposed in 1974. The AMR project also resulted in movement of more than 200,000 cubic yards of additional coal fines and coal refuse from previously disturbed areas to the disposal site and regrading and revegetation of both the refuse source areas and the disposal site. While it is difficult to quantify the exact age of the many disturbed and abandoned areas in and adjacent to the proposed mine surface facilities area it appears that most of the apparent disturbance is related to the 1974 mine face-up and subsequent AMR activities, although some of the disturbance obviously dates from historic mining activities in the area extending back to about 1890.

As identified by the Facilities Area Vegetation Map, (Map 6), three basic categories of disturbance exist in this area; 1) Mining related disturbance which occurred prior to August 3, 1977 and which has not been further effected by subsequent mining or reclamation activities; 2) Areas disturbed or utilized for mining related activities after August 3, 1977; and 3) Non-mining related disturbances associated with highway, railroad, power lines, utility, or other non-mine related development and activities. The 1981 Mariah Associates field investigations did not include sampling and characterization of the disturbed sites but the resulting report did include the following statement regarding these areas:

> "... most disturbed sites are in such condition that vegetation growth is limited, if it is allowed at all. Although isolated patches of species usually associated with the various natural vegetation types occur within and on the edges of adjacent disturbed areas, most species growing in these sites are primary successional species and are considered weeds: *Salsola kali, Kochina scoparia, and Convolvulus arvense. Chrysothamnus nauseosus*, a shrub species that invades disturbed sites, commonly grows on the edges of disturbed areas..."

Since the Disturbed Vegetation Type has been designated as a distinct vegetation type, it was sampled during the supplemental 1994 field sampling effort. Sampling results for the Disturbed Vegetation Type are discussed along with the sampling results for the other designated vegetation types in Sections 3.2.2.4 and 3.2.2.5.

3.2.2.2 Vegetation Types

Breaking the Disturbed Vegetation Community classification into the three disturbance categories noted in the preceding section, a total of seven vegetation types have been identified as occurring within the permit area. Occurrences of the all of these types have been previously disturbed in connection with mining and related activities conducted by Price River Coal Company, Castle Gate Coal Company, and Blackhawk Coal Company, and the AMR project in the facilities area. Four of these vegetation types (Grass-Sage, Mountain Brush, Pinyon-Juniper, and Conifer) were sampled in conjunction with the 1981 Mariah Associates vegetation studies and three more (Pre 8/3/77 Mining Disturbance, Post 8/3/77 Mining Disturbance, and AMR Reclaimed Sites) have been sampled as part of the supplemental 1994 field work. A completed listing of all individual plant species encountered during these sampling efforts is presented as Table 3.2-3, Plant Species List by Vegetation type.

This table reveals that a total of 282 different plant species have either been encountered in the previous vegetation sampling or have been reported in site specific vegetation literature as occurring in association with the vegetation plant community types occurring within the Willow Creek Mine permit area. Of these 282 species, 239 or 85 percent are considered to be naturally occurring or native plants to this area. Forty three species or 15 percent of the flora of this site can be considered as introduced species which are not native to this area. Of the 43 introduced species; 10 are grasses, 28 are forbs, 4 are shrubs and one is a tree. All of the introduced plant species found in this area are identified in bold lettering in Table 3.2-3, Plant Species List by Vegetation Type.

The most commonly occurring introduced grass species include: Cheatgrass brome (Brous tectorum) which was encountered in the sampling of six of the seven plant community types sampled. Other commonly occurring introduced grass species include Intermediate wheatgrass *(Agropyron intermedium)*, Crested wheatgrass *(A. cristatum)*, Pubescent wheatgrass *(A. trichophorum)*, Orchardgrass *(Dactylis glomerata)* and Common oat *(Avena sativa)*. With the exception of Cheatgrass brome nearly all of the introduced grass species appear to have been brought into this area in connection with agricultural or reclamation plantings. The most commonly occurring forbs at this site below largely to the Mustard and Goosefoot Families. The most commonly occurring forbs are Summer cypress *(Kochia scoparia)* and Russian thistle *(Salsola iberica)*. As a rule most of the introduced forbs can be considered to be weedy species. With the exception of Prostrate kochia *(Kochia prostrata)* which was seeded in the AMR plantings at this site all of the introduced shrub species occurring at this site are confined to the Willow Creek Riparian Plant Community. Introduced shrub species encountered in this area included Russian olive *(Elaeagnus angustifolia)* and Small-flowered tamarisk *(Tamarix parviflora)*. The only introduced tree species found occurring in this area was Siberian elm *(Ulmus pumila)* which has been widely planted at this location in connection with former homesites where this plant was planted for landscaping purposes.

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Grasses							
Agropyron cristatum (AGCR)	x	x				x	
Agropyron dasystachyum (AGDA)	x	x		x		x	
Agropyron intermedium (AGIN)	x	x	x		x	x	
Agropyron smithii (AGSM)	x		x			x	x
Agropyron spicatum (AGSP)	x	x					x
Agropyron subsecundum (AGSU)	x						
Agropyron trachycallum (AGTR)	x	x		x	x		
Agropyron trichoporum (AGTR2)						x	x
Agrostis stolonifera (AGST)				x			
Avena sativa (AVSA)					x		
Bouteloua gracilis (BOGR)	x						
Bromus ciliatus (BRCI)		x			x		
Bromus inermis (BRIN)	x						x
Bromus tectorum (BRTET)	x	x	x	x		x	x
Calamagrostis candensis candensis (CACAC)				x			
Dactylis glomerata (DAGL)				x		x	
Deschampsia caespitosa (DECA)		x					
Elymus canadensis (ELCA)				x			
Elymus glaucus (ELGLJ)					x		
Elymus junceus (ELJU)						x	x
Elymus salinus (ELSA)	x	x	x	x	x	x	x
Festuca ovina (FEOV)							x
Hordeum jubatum (HUJU2)		x	x	x			
Koeleria macrantha (KOMA)					x		x
Leucopoa kingii (LEKI)					x		
Muhlenbergia filiformis (MUFI)	x	x					
Oryzopsis hymenoides (ORHYH)	x	x	x	x	x	x	x
Panicum capillare (PACA)							x
Poa ampla (POAM)					x		
Poa compressa (POCO)		x					
Poa interior (POIN)				x			
Poa palustris (POPA)	x	x			x		
Poa pratensis (POPR)	x	x		x			
Poa spp. (POA)			x				

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Sitanion hystrix (SIHY)						x	
Sporobolus cryptandrus (SPCR)						x	
Stipa columbiana (STCO2)		x					
Stipa comata (STCO)	x	x		x	x	x	
Stipa lettermani (STLE)		x					
Grasslikes							
Carex rostrata (CARO4)				x			
Carex sprengelis (CASP3)				x			
Eleocharis palustris (ELPA)				x			
Juncus filiformis (JUFI)				x			
Juncus longistylis (JULO)				x			
Juncus hodosus (JUHO)				x			
Forbs							
Achillea millefolium (ACMIL)	x	x		x	x		
Agoseris glauca (AGGL)					x		
Ambrosia psilostachya (AMPS)						x	
Ambrosia trifida (AMTR7)		x					
Androsace septentrionalis (ANSE)		x			x		
Antennaria microphylla (ANMI5)					x		
Antennaria parvifolia (ANPA3)		x					
Antennaria pulcherrima (ANPU)			x				
Antennaria spp. (ANTEN)				x			
Antennaria umbrinella (ANUM)					x		
Apocynum androssaemifolium (APANP)				x	x		
Arabis holboellii (ARHO)		x	x				
Arabis lignifera (ARLI)	x	x					
Arabis microphylla (ARMI3)					x		
Arctium minus (ARMI2)				x			
Arnica cordifolia (ARFO)					x		
Artemesia dracunculus (ARDR)	x						
Artemisia ludoviciana (ARLUL)	x	x	x	x	x		
Asclepias speciosa (ASSP)	x			x			
Asparagus officinalis (ASOF)				x			
Aster adscendens (ASAD7)	x	x		x	x		
Aster arencsus (ASAR8)	x	x					
Aster glaucoides (ASGL)		x		x	x		

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)
(Page 3 of 8)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Aster perelegans (ASPE)					x		
Astragalus agrestis (ASAG2)					x		
Astragalus asclepiadoides (ASAS2)			x				
Astragalus diversifolius (ASDI)	x	x					
Astragalus flavus (ASFL)			x				
Astragalus miser (ASMI2)					x		
Astragalus spp. (ASTRA)	x			x			
Atriplex argentea (ATAR)			x				
Atriplex hortensis (ATHO2)		x					
Calochortus nuttallii (CANUA)			x				
Cardaria chalepensis (CACH2)	x	x					
Carduus nutans (CANU)		x					
Castilleja chromosa (CACH3)	x						
Castilleja flava (CAFL3)					x		
Castilleja linariaefolia (CALI)					x		
Castilleja sulphurea (CASU)					x		
Centaurea repens (CERE2)	x						
Cerastium arvense (CEAR)					x		
Chenopodium album (CHAL)	x	x		x			
Chenopodium berlandieri (CHBE)	x	x					
Chenopodium glaucum (CHGL)		x	x				
Cirsium arvense (CIAR2)				x			
Cirsium pulchellum (CIPU)	x	x		x	x		
Clematis columbaiana (CLCO)				x			
Clematis lingusticifolia (CHLI2)	x	x		x	x		
Cleome serrulata (CLSE)		x		x			
Comandra umbellata (COUM)				x			
Convolvulus arvensis (COAR2)		x		x			
Corydalis aurea (COAU)			x				
Cryptantha humilis (CRHU)		x	x		x	x	
Cymopterus longipes (CYLO)					x		
Cynoflossum officinale (CYOF)	x	x		x	x		
Cystopteris fragilis (CYFR)				x	x		
Delphenium nuttannianum (DENU)					x		
Descurainia pinnata (DEPI)	x						
Descurainia sophia (DESO)	x	x	x	x			

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)
(Page 4 of 8)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Epilobium alpinum (EPAL)				x			
Epilobium angustifolium (EPAN)					x		
Epilobium ciliatum (EPCI)				x			
Equisetum arvense (EQAR)				x			
Equisetum laevigatum (EQLA)				x			
Erigerion eatonii (EREA)				x	x	x	
Erigerion lonchophyllus (ERLO)		x	x				
Eriogonum alatum (ERAL)		x	x				
Eriogonum cernuum (ERCE)		x				x	
Eriogonum chrysocephalum (ERCH)					x		
Eriogonum corymborum (ERCO7)	x						
Eriogonum flavum (ERFL2)					x		
Eriogonum heracleoides (ERHE3)					x		
Eriogonum microthecum (ERMI5)	x						
Erodium cicutarium (ERCI)	x						
Erysimum asperum (ERAR6)					x		
Erysimum inconspicuum (ERIN3)		x	x				
Euphorbia robusta (EURO)			x				
Fragaria virginiana (FRVI)					x		
Galium aparine (GAAP)		x			x		
Galium coloradoense (GACO2)		x					
Geranium viscosissimum (GEVI)		x	x		x		
Gilia aggregata (GIAG)		x	x		x		
Glycyrrhiza lepidota (GLLE)				x			
Grindelia squarrosa (GRSQ)	x	x		x		x	
Hackelia jessicae (HAJE)			x				
Halogeton glomeratus (HAGL)	x						
Haplopappus spinulosus (HASP2)		x					
Haplopappus watsonii (HAWA2)	x	x					
Hedysarum occidentale (HEOC)		x					
Helianthella uniflora (HEUN)	x	x					
Helianthus petiolaris (HEPE)		x					
Heuchera parvifolia (HEPA)		x					
Hymenopappus filfolius (HYFI4)		x					
Hymenopappus richardsonii (HYRI)		x					
Hymenoxys acaulis (HYAC)					x		

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Hymenoxys richardsonii (HYRI)	x		x		x		
Iva axillaris (IVAX)	x	x		x			
Kochia scoparia (KOSC)	x	x	x	x		x	x
Lappula occidentalis (LAOC)	x	x		x			
Lathyrus lanszwertii (LALA)		x					
Lepidium densiflorum (LEDE)	x						
Linanthus septentrionalis (LISE)	x						
Linum lewisii (LILE)				x			x
Lithospermum incisum (LIIN)					x		
Lupinus argenteus (LUAR)		x					
Lupinus sericeus (LUSE)	x	x					
Lygodesmia grandiflora (LYGR)	x						
Machaeranthera canescens (MACA)	x	x			x		
Medicago lupulina (MELU)					x		
Medicago sativa (MESA)				x			x
Melilotus alba (MEAL)		x		x			
Melilotus officinalis (MEOF)				x		x	x
Mentha arvense (MEAR)				x			
Mentzelia albicaulis (MEAL2)						x	
Mertensia viridis (MEVI)					x		
Monadora fistolosa (MOFI)		x					
Monolepis nuttalliana (MONU)	x			x			
Nepeta cataria (NECA2)	x	x					
Oenothera caespitosa (OECA)		x					
Onopordum acanthium (ONAC)					x		
Osmorhiza chilensis (OSCH)					x		
Oxybaphus linearis (OXLI)				x			
Penstemon angustifolius (PEAN)					x		
Penstemon cyananthus (PECY)	x	x					
Penstemon cyaneus (PECY2)		x					
Penstemon eatonii (PEEA)	x			x	x		
Penstemon humilis (PEHU)					x		
Penstemon palmeri (PEPA)				x			x
Penstemon spp. (PENST)			x				
Penstemon watsonii (PEWA2)	x	x			x		
Phacelia crenulata (PHCRC)			x				

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Phacelia demissa (PHDE)			x				
Phlox austromontana (PHAU)		x			x		
Phlox longifolia (PHLO)		x			x		
Phlox spp. (PHLOX)			x				
Physaria australis (PHAU3)					x		
Plagiobothrys scouleri (PLSC)				x			
Polygonum aviculare (POAV)	x			x			
Potentillia pennsylvanica (POPE4)					x		
Psoralea lanceolata (PSLA)				x			
Rumex crispus (RUCR)				x			
Rumex salicifolius (RUSA)		x					
Salsola iberica (SAIB)	x	x			x		
Salsola kali (SAKA)	x	x		x		x	x
Sanguisorba minor (SAMI)							x
Senecio aronicoides (SEAR)					x		
Senecio eremophilus (SEER)					x		
Senecio multilobatus (SEMU2)	x	x	x		x		
Senecio pauperculus (SEPA2)	x	x					
Silene menziesii (SIME)					x		
Sisymbrium altissimum (SIAL)	x	x		x			
Sisymbrium linifolium (SILI)	x	x					
Sisyrinchium montanum (SIMO2)				x			
Smilacina racemosa (SMRAA)		x		x	x		
Solanum trifolum (SOTR)		x					
Solidago canadensis (SOCA2)				x			
Solidago graminifolia (SOGR)		x					
Solidago sparsiflora (SOSP3)	x				x		
Sonchus arvensis (SOAR)		x			x		
Sphaeralcea munroana (SPMU)		x					
Stanleya pinnata (STPI2)	x		x				
Stephanomeria exigua (STEX)		x					
Taraxacum officinale (TAOF)	x				x		
Thalictrum fendleri (THFE)					x		
Thlaspi arvense (THAR)	x					x	
Tragopogon dubuis (TRDU)	x	x			x	x	
Typha angustifolia (TYAN9)				x			

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Urtica dioca (URDI)	x	x			x		
Verbascum thapsus (VETH)		x		x			
Vicia americana (VIAMT)	x				x		
Shrubs							
Amalanchier alanifolia (AMALA)	x						
Amelanchier utahensis (AMUTU)	x	x		x			
Arctostaphylos uva-ursi (ARUV)		x			x		
Artemisia arbuscula (ARARA)					x		
Artemisia frigida (ARFR)	x	x		x	x		
Artemisia nova (ARNO)	x						
Artemisia tridentata (ARTRT)	x	x	x	x		x	x
Atriplex canescens (ATCA)	x	x				x	x
Atriplex confertifloia (ATCO)		x	x				
Berberis repens (BERE)	x	x			x		
Ceratoides lanata (CELAL)					x	x	x
Cercocarpus ledifolius (CELEL)		x	x	x	x		
Cercocarpus montanus (CEMOM)	x	x	x		x		
Chrysothamnus linifolius (CHVIL)				x		x	
Chrysothamnus nauseosus (CHNAN)	x	x	x	x		x	x
Chrysothamnus viscidiflorus (CHVIV)	x	x	x	x			
Cornus stolonifera (COSTS)				x			
Echinocereus triglochidiatus (ECTRM)	x						
Elaeagnus angustifolia (ELAN)				x			
Ephedra viridis (EPVI)	x	x					
Guterrezia sarothrae (GUSA)	x	x			x	x	
Holodiscus dumosus (HODUD)		x		x	x		
Juniperus communis (JUCOS)	x				x		
Kochia prostrata (KOPR)							x
Opuntia fragilis (OPFRF)		x					
Opuntia polyacantha (OPPO)	x	x					
Pachistima myrsinites (PAMY)		x			x		
Philadelphus microphyllus (PHMIM)			x				
Physocarpus malvaceus (PHMA)		x					
Prunus virginana (PRVID)	x	x		x			
Quercus gambelii (QUGA)	x	x		x	x		
Rhus radicans (RHRA)				x			

TABLE 3.2-3
PLANT SPECIES LIST BY VEGETATION TYPE
(Introduced Species are denoted by bold lettering)

Species (Symbol)	Grass Sage	Mixed Brush	Pinyon Juniper	Riparian Bottom	Conifer	Disturbed	Reclaimed
Rhus trilobata (RHTRS)	x	x		x			
Ribes cereum (RICEC)	x	x		x			
Ribes spp. (RIBES)		x	x		x		
Rosa woodsii (ROWOU)	x	x		x	x		x
Rubus idaeus (RUIDS)				x	x		
Salix exigua (SAEX)				x			
Salix lasiandra (SALA3)				x			
Salix melanopsis (SAME2)				x	x		
Salix rigida watsonii (SARIW)				x			
Salix spp. (SALIX)		x					
Samabucus canadensis (SACA5)				x			
Symphoricarpos occidentalis (SYOC)	x	x	x	x	x	x	x
Symphorcarpos oreophilus (SYOR)							x
Tamarix chinensis (TACH6)		x					
Tamarix parviflora (TAPA)				x			
Tetradymia canescens (TECA)	x						
Viburnum spp. (VIRBU)				x			
Yucca glauca (YUGL)	x						
Trees							
Abies concolor (ABCO)		x	x		x		
Abies lasiocarpa (ABLA)		x			x		
Acer glabrum (ACGLG)				x	x		
Acer grandidentatum (AGGR)	x	x	x	x	x		
Acer negundo (ACNEN)				x			
Betula glandulosa (BEGL)		x		x			
Juniperus osteosperma (JUOS)	x	x	x	x	x		
Juniperus scopulorum (JUSC)					x		
Pinus edulis (PIED)	x	x	x		x		
Pinus ponderosa (PIPO)		x	x	x	x		
Populus anguistifolia (POAN)	x	x		x	x		
Populus fremontii (POFR)				x			
Populus tremuloides (POTR)	x				x		
Populus sargentii (POSA)		x					
Pseudotsuga menziesii (PSME)		x		x	x		
Ulmus pumila (ULPU)				x			

3.2.2.3 Vegetation Parameters

The UDOGM Regulations and Vegetation Guideline normally require that cover, woody plant density and production be sampled from all proposed disturbance and corresponding reference areas. In the original Mariah vegetation report information on all of these parameters was collected. However, it applies in only a general sense to the Willow Creek mine facilities area since nearly all of the site specific sampling was conducted on sites with vegetation types dissimilar with those associated with this site. The only site specific information collected by Mariah pertinent to this area corresponds to their Willow Creek grass-sage reference area. The location of all Mariah Reference Areas is shown on the Facilities Area Vegetation Map, (Map 6). According to this report, vegetative cover on this site was reported to equal 40 percent. Shrub density was reported to equal 17,782.3 stems per hectare (which is different than the current standard of reporting plants per acre). Production estimates from the USDA-SCS for this site were given as 850 to 900 pounds per acre. Range condition was not addressed in this evaluation. While the original report states that data for each sample site were presented in Appendix C, none of the documents examined during this study, including those in the UDOGM files, could be located which contained data showing anything other than generalized summaries.

After a careful evaluation of the Mariah data and discussions with Mr. Paul Baker of the UDOGM, it was decided that these data did not apply to the current standards and that additional sampling needed to be conducted to satisfy the present permitting requirements. Based upon these discussions it was decided that the best method to use for the needed sampling of the Willow Creek mine facilities area was the "Baseline Data Method" which utilizes the baseline information collected from areas proposed for disturbance as the revegetation success standards. The parameters which need to be addressed for the "Baseline Data Method" include ground cover by species, woody plant densities and productivity. Following extensive discussions, Mr. Baker suggested that only cover and productivity needed to be sampled since it would be more reasonable to establish a woody plant density standard based upon a more suitable standard rather than the existing conditions.

Consistent with discussions with Mr. Baker, three vegetation types were sampled as part of the 1994 supplemental vegetation efforts. These included the Disturbed Vegetation Type, the Reclaimed Vegetation Type, and the Riparian Bottom Vegetation Type. Based upon discussions with Mr. Baker, sampling was limited to cover and production for these three types. The following sections summarize the results of the 1994 cover sampling and production for the three designated vegetation types.

3.2.2.4 Vegetation Production

The following narrative summarizes the results of the plant cover sampling for the three plant communities which were sampled during the 1994 vegetation sampling efforts.

Disturbed Vegetation Type (Cover)

Total plant cover for the Disturbed Vegetation Community was found to average 26.72 percent as indicated by Table 3.2-4, Disturbed Plant Community Cover. Whitestem rubber rabbitbrush *(Chrysothamnus nauseosus var. albicaulis)* was the dominant shrub, contributing nearly fifty percent of the total cover found on this site, with Indian Ricegrass *(Oryzopsis hymenoides)* contributing nearly 19 percent and the annual grass, Cheatgrass brome, contributing slightly more than 12 percent to total plant cover. Sample adequacy was tested after 25 transects had been sampled and found to equal 16.9 transects.

The results obtained from the 1994 sampling for the Disturbed Vegetation Type are significantly different from the observations reported in the 1981 Mariah Associates vegetation report which indicates that disturbed sites were heavy dominated by annual weedy plants. According to the 1981 observations, Russian thistle *(Salsola kali)*, Summer cypress *(Kochia scoparia)*, and Bindweed *(Convolvulus arvense)* dominated the disturbed sites and various native perennials occurred in scattered patches and along the edges of the disturbed areas. However, the 1994 vegetation sampling data document that native perennial plants account for 86.22 percent of the cover found on the disturbed sites.

TABLE 3.2-4 DISTURBED PLANT COMMUNITY PLANT COVER			
Plant Species	**Percent Cover**	**Percent Composition**	**Frequency**
Grasses			
Oryzopsis hymenoides	5.04	18.86	88
Bromus tectorum	3.32	12.43	76
Elymus salinus	1.28	4.79	24
Sporobolus cryptandrus	0.60	2.25	32
Elymus junceus	0.24	0.90	4
Sitanion hystrix	0.16	0.60	12
Agropyron smithii	0.12	0.45	8
Stipa comata	0.08	0.30	4
Agropyron intermedium	0.08	0.30	4
Agropyron cristatum	0.04	0.15	4
subtotal	10.96	41.03	-
Forbs			
Erigerion eatonii	0.36	1.35	24
Grindelia squarrosa	0.36	1.35	16
Salsola kali	0.24	0.90	8
Melilotus officinalis	0.20	0.75	8
Kochia scoparia	0.12	0.45	12
Eriogonum cernuum	0.08	0.30	4
Amborsia psilostachya	0.08	0.30	4
Cryptantha humilis	0.08	0.30	4
subtotal	1.52	5.70	-
Shrubs			
Chrysothamnus nauseosus	12.56	47.01	100
Artemisia tridentata	0.88	3.29	20
Atriplex canescens	0.68	2.54	12
Chrysothamnus linifolius	0.08	0.30	4
Symphoricarpos oreophilus	0.04	0.15	4
subtotal	14.24	53.29	-
TOTAL PLANT COVER	26.72	100.02	-
BARE GROUND	24.28	-	-
LITTER	20.20	-	-
ROCK	28.80	-	-
TOTAL	100	100	-
Mean = 26.72; Standard Deviation = 6.68; N = 25 samples; Nm 90/10 = 16.9 samples			

The Willow Creek Grass-Sage Reference Area was originally designated as the reference area for the proposed mine surface facilities area. If the sampling data collected for the Grass-Sage Reference Area, which was found to have an average cover value of 39.6 percent, is compared with the measured average plant cover for the Disturbed Vegetation Type, which averaged 26.72 percent, it can be stated that natural reinvasion has been quite successful in reestablishing a native perennial plant community on the disturbed areas.

Reclaimed Vegetation Type (Cover)

Examination of UDOGM files for the Willow Creek AMR Project files documents that disturbed areas were seeded without any topsoil in the fall of 1989. Under normal reclamation provisions, the sampling conducted in 1994 would have corresponded to revegetation success monitoring during year five of the bond liability period. Total plant cover for the sampled reclaimed areas averaged 28.73 percent as indicated by Table 3.2-5, Reclaimed Plant Community Cover. Vegetative composition for the reclaimed areas was dominated by Prostrate kochia *(Kochia prostrata)*, a species which was not included in the reclamation seed mixture designated under contract specifications for the AMR project. Prostrate kochia contributed nearly 19 percent of the cover on this site. Summer cypress was the second most abundant plant, contributing nearly 14 percent of the cover with other common plants including Yellow sweetclover, Pubescent wheatgrass, Whitestem rubber rabbitbrush and Paiute orchardgrass *(Dactylis glomerata)*, contributing 10, 9, 7, and 6 percent respectively of the measured vegetative cover. Sample adequacy was tested after a minimum of 15 transects had been sampled and found to equal 10.2 transects.

Riparian Plant Community Type (Cover)

Total canopy cover for the Riparian Plant Community was found to average 70.43 percent as indicated by Table 3.2-6, Riparian Plant Community Canopy Cover. Narrowleaf cottonwood was found to be the most common tree species, with an average canopy cove of 2.5 percent. Coyote willow was the most common shrub for this type, contributing nearly 30 percent of the total cover found on this site. Redtop and Yellow sweetclover were found to be the most common herbaceous plants on these areas contributing 19.7 and 9.6 percent of the canopy cove found. Sample adequacy was tested after 21 plots had been sampled and found to equal 11.3 plots.

3.2.2.5 Vegetation Production

The following summarize the results of production sampling for the three plant communities sampled during the supplemental 1994 vegetation field efforts.

Disturbed Vegetation Type (Production)

Total forage production for the Disturbed Plant Community averaged 13.24 grams of air dry forage per quarter square meter, or 472 pounds per acre as indicated by Table 3.2-7, Disturbed Plant Community Production. Whitestem rubber rabbitbrush was the dominant vegetative species contributing 31 percent of the total forage for this type. Indian ricegrass was the second highest contributor to the total forage values at 23 percent of total forage, and Cheatgrass brome as the third highest forage producing species contributing slightly more than 11 percent of total production. Sample adequacy was tested after 22 transects, or 110 plots had been clipped and found to equal 18.1 transects.

Reclaimed Vegetation Type (Production)

The total forage production for the Reclaimed Vegetation Type based on the 1994 sampling effort was found to average 19.89 grams per quarter square meter or 709 pounds of air dry forage per acre as shown on Table 3.2-8, Reclaimed Plant Community Production. From the production standpoint, composition of the reclaimed site was dominated by Prostrate kochia, which contributed nearly 20 percent of the forage produced on the site. Yellow sweetclover was the second most abundant plant, contributing nearly 14 percent of total production. Other common species found on this site and their relative contribution to total production include Pubescent wheatgrass, 13 percent; Summer cypress, 9 percent; and Smooth bromegrass *(Bromus inermis)*, 7 percent. Sample adequacy was tested after 19 transects had ben sampled and found to equal 17.7 transects.

TABLE 3.2-5 RECLAIMED PLANT COMMUNITY PLANT COVER			
Plant Species	**Percent Cover**	**Percent Composition**	**Frequency**
Grasses			
Agropyron trichophorum	2.67	9.28	67
Dactylis glomerata	1.73	6.03	47
Agropyron smithii	1.67	5.79	26
Elymus junceus	1.40	4.87	47
Bromus tectorum	1.20	4.18	40
Oryzopsis hymenoides	0.87	3.02	47
Bromus inermis	0.80	2.78	47
Festuca ovina	0.40	1.39	20
Koeleria macrantha	0.07	0.23	7
subtotal	10.81	37.57	-
Forbs			
Kochia scoparia	4.00	13.92	67
Melilotus officinalis	2.80	9.75	73
Medicago sativa	1.20	4.18	40
Salsola kali	0.33	1.16	27
Penstemon palmeri	0.20	0.70	13
Sanguisorba minor	0.07	0.23	7
subtotal	8.60	29.94	-
Shrubs			
Kochia prostrata	5.33	18.56	87
Chrysothamnus nauseosus	2.07	7.19	60
Atriplex canescens	1.47	5.11	40
Artemisia tridentata	0.13	0.46	7
Rosa woodsii	0.13	0.46	7
Ceratoides lanata	0.13	0.46	7
Symphoricarpos oreophilus	0.07	0.23	7
subtotal	9.33	32.98	-
TOTAL PLANT COVER	28.73	99.98	-
BARE GROUND	27.33	-	-
LITTER	19.40	-	-
ROCK	24.54	-	-
TOTAL	100	100	-
Mean = 28.73; Standard Deviation = 5.59; N = 15 samples; Nm 90/10 = 10.2 samples			

TABLE 3.2-6
RIPARIAN PLANT COMMUNITY CANOPY COVER

Plant Species	Percent Cover	Percent Composition	Frequency
Grasses and Grasslikes			
Agrostis stolonifera	13.90	19.74	91
Juncus longistylis	2.24	3.17	38
Agropyron trachycaulum	2.10	2.97	24
Poa pratensis	1.38	1.96	38
Elymus glaucus	1.00	1.42	19
Dactylis glomerata	0.86	1.22	19
Oryzopsis hymenoides	0.43	0.61	5
Hordeum jubatum	0.19	0.27	5
subtotal	22.10	31.36	-
Forbs			
Melilotus officinalis	6.76	9.60	81
Grindelia squarrosa	0.57	0.81	5
Aster gloucodes	0.40	0.68	10
Kochia scoparia	0.38	0.54	5
Monolepis nuttalliana	0.33	0.47	10
Medicago sativa	0.33	0.47	10
Erigerion eatonii	0.33	0.47	10
Iva axillaris	0.29	0.41	10
Sisymbrium altissimum	0.29	0.41	5
Mentha arvensis	0.19	0.27	5
Equisetum arvense	0.19	0.27	5
Salsola kali	0.14	0.20	5
Penstemon palmeri	0.14	0.20	5
subtotal	9.94	13.71	-
Shrubs and Saplings			
Salix exigua	20.76	29.48	95
Populus fremontii	5.71	8.11	71
Populus angustifolia	5.38	7.64	62
Chrysothamnus nauseous	1.19	1.69	29
Tamarix parviflora	0.81	1.15	5
Chrysothamnus linifolius	0.57	0.81	10
Acer negundo	0.43	0.61	14
Ulmus pumila	0.29	0.41	10
Ribes cereum	0.19	0.27	5
Artemisia tridentata	0.10	0.14	10
subtotal	35.43		

TABLE 3.2-6
RIPARIAN PLANT COMMUNITY CANOPY COVER

Plant Species	Percent Cover	Percent Composition	Frequency
Trees			
Populus angustifolia	1.76	2.50	10
Populus fremontii	0.43	0.61	5
Ulmus pumila	0.29	0.41	5
TOTAL CANOPY COVER	70.43	99.99	-
Mean = 70.43; Standard Deviation = 14.41; N = 21 samples; Nm 90/10 = 11.3 samples			

TABLE 3.2-7 DISTURBED PLANT COMMUNITY PRODUCTION			
Plant Species	**Production grams per 1/4 meter²**	**Percent Composition**	**Frequency**
Grasses			
Oryzopsis hymenoides	3.05	23.07	82
Bromus tectorum	1.48	11.14	95
Elymus salinus	0.87	6.60	32
Sporobolus cryptandrus	0.69	5.20	23
Stipa comata	0.35	2.61	14
Elymus junceus	0.20	1.54	5
Agropyron intermedium	0.15	1.13	5
Sitanion hystrix	0.11	0.83	27
Agropyron smithii	0.06	0.49	5
subtotal			
Forbs			
Grindelia squarrosa	0.46	3.51	32
Salsola kali	0.34	2.57	55
Kochia scoparia	0.31	2.34	55
Melilotus officinalis	0.21	1.61	14
Erigerion eatonii	0.14	1.02	32
Amborsia psilostachya	0.04	0.28	5
Mentzelia albicaulis	0.02	0.14	5
Tragopogon dubuis	0.01	0.10	5
Thlaspi arvense	T	0.01	5
subtotal			
Shrubs			
Chrysothamnus nauseosus	4.13	31.19	100
Artemisia tridentata	0.28	2.19	23
Symphoricarpos oreophilus	0.12	0.91	18
Atriplex canescens	0.09	0.69	5
Chrysothamnus linifolius	0.06	0.43	5
Gutierrezia sarothrae	0.03	0.23	5
Ceratoides lanata	0.02	0.14	5
subtotal			
TOTAL PRODUCTION	13.24	99.97	-
Mean = 13.24; Standard Deviation = 3.42; N = 21 samples; Nm 90/10 = 18.1 samples			

TABLE 3.2-8 RECLAIMED PLANT COMMUNITY PRODUCTION			
Plant Species	Production grams per 1/4 meter^2	Percent Composition	Frequency
Grasses			
Agropyron trichophorum	2.59	13.02	95
Bromus inermis	1.40	7.05	53
Elymus junceus	1.11	5.59	63
Dactylis glomerata	1.11	5.59	63
Agropyron smithii	0.84	4.22	16
Bromus tectorum	0.39	1.96	47
Festuca ovina	0.36	1.83	21
Oryzopsis hymenoides	0.33	1.65	47
Elymus salinus	0.08	0.41	5
Panicum capillare	T	0.03	5
Agroypron spicatum	T	0.02	5
subtotal			
Forbs			
Melilotus officinalis	2.83	14.25	95
Kochia scoparia	1.81	9.06	95
Medicago sativa	0.64	3.24	47
Salsola kali	0.46	2.31	68
Penstemon palmeri	0.21	1.08	16
Sanguisorba minor	0.09	0.47	16
Erigerion eatonii	0.07	0.33	11
Grindelia squarrosa	0.05	0.26	32
Linum lewisii	0.02	0.12	5
subtotal			
Shrubs			
Kochia prostrata	3.97	19.94	89
Chrysothamnus nauseosus	0.68	3.42	74
Atriplex canescens	0.43	2.16	42
Artemisia tridentata	0.25	1.25	32
Symphoricarpos oreophilus	0.07	0.36	27
Ceratoides lanata	0.04	0.22	16
Rosa woodsii	0.03	0.17	5
subtotal			
TOTAL PRODUCTION	19.89	99.99	-
Mean = 19.89; Standard Deviation = 5.08; N = 19 samples; Nm 90/10 = 17.7 samples			

Riparian Plant Community Type (Production)

Total forage production for the Riparian Plant Community averaged 43.68 grams per quarter square meter or 1,557 pounds of air dry forage per acre as shown on Table 3.2-9, riparian Plant Community Production. For this vegetation community, Redtop was the most common forage producing species, with an average composition value of nearly 35 percent. Coyote willow was found to be the second most important forage producing species, and the most common shrub for this type, contributing nearly 31 percent to total production. Narrowleaf cottonwood and Yellow sweetclover were found to be the next most abundant forage producing plants encountered on these areas, each contributing 7 percent of the total forage production for this site. Sample adequacy was tested after 37 transects had been sampled and found to equal 28.4 transects.

3.2.2.6 Reference Area Descriptions

At the time that the field sampling was completed all of the planning information suggested that all of the proposed disturbance would be confined to previously disturbed areas. Under such conditions the Baseline Data Method was used to characterize the plant communities which will potentially be disturbed as a result of this action and no reference area sampling was conducted or believed necessary. However, subsequent to the completion of this field work, planning identified three areas of potential disturbance which would occur in currently undisturbed areas. These three areas are associated with enlargement of the existing facilities pad to the west, the placement of a new fire and mine water tank, and the construction of a mine fan, all on areas outside of the boundaries originally mapped and sampled. Due to the seasonal constraints which exist on the site at this time it is impossible to complete the vegetation field work needed to quantify these areas within the current permitting time frame associated with this project. In order to proceed with the permit application process it has been decided to submit the permit with this deficiency recognizing that this information will have to be collected at the earliest during late June 1995 according the Vegetation Guideline. This outstanding information will be collected based upon discussions held with UDOGM prior to any field work being initiated and incorporated into the permit application as soon as possible during the review process.

3.2.3 Threatened, Endangered and Other Sensitive Plant Species

The 1981 Mariah Associates vegetation report notes that a survey of threatened and endangered plants was conducted for the Price River Coal Permit area and no listed o candidate species were found. This report states that David's Corymb buckwheat *(Eriogonum corymbosum var. davidsei)* and Lanceleaf buckwheat *(Eriogonum lancifolium)* occur on the Salt Desert Community near Price and that suitable habitat for these species does not exist within the permit area. This limited study has been utilized as the basis for threatened and endangered plant evaluations conducted in conjunction with all subsequent permitting actions since that time.

The Unita-Southwestern Utah, Round Two - Final Environmental Impact Statement, issued by the BLM in October 1983 reports that Canyon sweetvetch *(Hedysarum occidentale var. canone)* occurs in several locations in the Book Cliffs area to the north Price. There is no indication that the permit area has been evaluated for the occurrence of this species. A careful review of the mine permitting documents pertinent to this area subsequent to this time indicates that they do not address this issue.

The AMR reclamation project completed at the Willow Creek Mine is the first site specific investigation we are aware of which directly addressed the potential occurrence of Canyon sweetvetch in this area. In a letter from UDOGM requesting a Section 7 consultation to the Utah State Office of the USFWS, the reply dated 9 March 1989 stated that Canyon sweetvetch "may occur in the area of your project...". In the Biological Opinion issued by UDOGM on 14 April 1989 they reported that "Canyon sweetvetch may occur in Hardscrabble Canyon." This letter also stated that prior to any field work being initiated in the Willow Creek area formal field surveys would be conducted. In an office memo dated 29 September 1989 it was reported that an entire day was spent looking at Hardscrabble Canyon and four sites in Willow Creek for Canyon sweetvetch and Creutzfeldt catseye *(Crypthantha creutzfeldtii)* and that "no plant of either species was discovered."

TABLE 3.2-9
RIPARIAN PLANT COMMUNITY PRODUCTION

Plant Species	Production grams per meter2	Percent Composition	Frequency
Grasses and Grasslikes			
Agrostis stolonifera	15.06	34.48	100
Poa pratensis	1.29	2.95	35
Agropyron trachycaulum	0.82	1.87	8
Dactylis glomerata	0.71	1.62	8
Juncus longistylis	0.50	1.14	11
Elymus glaucus	0.41	0.95	3
Agropyron smithii	0.16	0.37	8
subtotal			
Forbs			
Melilotus officinalis	3.21	7.34	70
Medicago sativa	0.72	1.65	3
Athyrium filix-femina	0.60	1.37	3
Grindelia squarrosa	0.46	1.05	14
Erigerion eatonii	0.44	1.01	11
Aster glaucus	0.28	0.64	5
Iva axillaris	0.06	0.14	3
Mentha arvensis	0.02	0.04	3
Penstemon palmeri	0.02	0.04	11
Astragalus cicer	0.02	0.04	3
Epilobium ciliatum	0.01	0.02	3
Equisetum arvense	T	0.01	3
subtotal			
Shrubs and Saplings			
Salix exigua	13.47	30.84	84
Populus angustifolia	3.23	7.39	16
Populus fremontii	1.34	3.07	14
Chrysothamnus nauseous	0.70	1.60	19
Chrysothamnus linifolius	0.09	0.22	3
Rosa woodsii	0.07	0.16	3
subtotal			
TOTAL PRODUCTION	43.68	100.01	-
Mean = 43.68; Standard Deviation = 14.15; N = 37 samples; Nm 90/10 = 28.4 samples			

Prior to the initiation of field work associated with this effort contact was made with the TES plant specialists in the USDI-BLM, USFS, USFWS and the Utah Natural Heritage Program. The only information received suggestive of this species occurring in this area was a letter from the Utah Natural Heritage Program which indicated in a letter dated 8 August 1994 that this species had been encountered "just outside of the project boundary in Willow Creek Canyon."

In August 1994 several days were spent in the Willow Creek mine facilities area, Panther Canyon and in Dry Canyon looking for the Canyon sweetvetch. All of these investigations failed to identify any plants of this species. Two apparently unreported populations were observed approximately one half mile south of the permit area boundary n the mouth of Cordingly Canyon. One population consisted of 48 plants and the other population consisted of 5 plants. These plants were found at the point where the road to Cordingly Canyon first crosses the drainage on private land in the SW 14/ E 1/2 of Section 15, Township 12 South, Range 8 West. This investigation reveals with a very high degree of certainty that Canyon sweetvetch does not exist in the vicinity of the Willow Creek mine facilities area and thus this species will not be impacted by the proposed development. However, since it is documented that this species occurs at different locations in the immediate area it is possible that it might occur at other locations within the permit area. Additional disturbance to such areas which could potentially affect this plant are unlikely since mining within the permit area will all be deep underground and surface disturbances due to subsidence will be minimal.

Table No.	Description	Page No.

E 2,170,000 | E 2,180,000 | E 2,190,000 | E 2,200,000 | E 2,210,000

N 510,000 | N 500,000 | N 490,000

R 9 E | R 10 E | R 11 E

T 12 S | T 13 S

WILLOW CREEK MINE PORTALS

Martin | Kenilworth | Helper

LEGEND

PROPOSED COAL LEASE AREA	
PERMIT AREA BOUNDARY	
TRAIL	
ROAD	
STREET	
POWERLINE	
REFERENCE AREA	
CO	CONIFER
DS	DISTURBED (ROADS, ABANDONED MINES, TOWNSITES, ETC.)
D1	DISTURBED BY MINING (PRE-1977)
D2	DISTURBED BY MINING (POST-1977)
GS	GRASSLAND-SAGEBRUSH
MB	MIXED BRUSH
PJ	PINYON-JUNIPER
RB	RIPARIAN BOTTOM

N

SCALE

2000' 0 2000' 4000'

CONTOUR INTERVAL 40 FT.

NOTE

CERTIFICATION

REFERENCE DRAWINGS

DWG. NO.	TITLE

APPROVALS

DEPT.	DATE	SIGNATURE/TITLE

No.	REVISION	DATE	BY	CHKD
4				
3				
2				
1				
0	ISSUED FOR PERMIT	4-95	KLC	JMN

SCALE: 1"=2000'

DESIGN BY: J.NETTLETON

DRAWN BY: K.CONRATH

CHECK BY: J.NETTLETON

PROJECT No. 866-2200

FILE NAME: REGVEG.DWG

CYPRUS Plateau Mining

PROJECT: WILLOW CREEK MINE

DRAWING TITLE: REGIONAL VEGETATION MAP

TerraMatrix

Mine & Mill Engineering, Inc.

SHEET: 1 OF 7

DRAWING No.: MAP 5

REV 0

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

September 29, 1989

TO: Willow Creek Phase I, AMR/007/912
Sego Phase I File, AMR/019/901

THRU: Mary Ann Wright, Program Administrator

FROM: Mark Mesch, Reclamation Specialist

RE: Update on the T and E Clearance Plan for Willow Creek Phase I, the Willow Creek Disposal Pit, and Sego Phase I

On September 18, 1989, I called Larry Dalton in the Division of Wildlife Resources Office in Price, Utah, to discuss with him the need for a certified raptor ecologist to perform nesting surveys in the areas affected by construction work on the four sites in the Willow Creek Project, Phase I. This raptor nesting survey was specified in our original Threatened and Endangered Species plan, however the time has now past for all nesting activity and a survey at this time would not provide much information. Mr. Dalton was not in the office so I spoke with Miles Moretti, the Regional Non-Game Manager for the South Central Region. He agreed that performing the survey at this time of year would not provide much data. Additionally, he stated that construction work at this time of the year would have little impact on raptor activity.

On September 19, 1989 Chris Rohrer, Jim Peterson, and I surveyed the portal areas in Hardscrabble Canyon, the Willow Creek Disposal Pit, Burial Area #1 at the Royal Pile, and the Dogleg Pile at Willow Creek for Creutzfeldt Catseye, Cryptantha creutzfeldtii, and Canyon Sweetvetch, Hedysarum occidentale. At large sites, surveys were done by walking two meter wide transects over the entire site. Small areas in front of portals were examined visually. No plant of either species was discovered.

On September 27, 1989, I surveyed the areas slated for work at the Sego Canyon site for Physaria acutifolia var. purpurea. These areas are comprised of two abandoned coal refuse piles, one totally devoid of vegetation. No evidence of this species was located either on the coal refuse piles or the immediate surrounding area.

vmn
AM115/148

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center Suite 350
Salt Lake City Utah 84180-1203
801-538-5340

APR 18

April 14, 1989

Mr. Clark Johnson
U.S. Fish and Wildlife Service
2078 Administration Building
1745 West 1700 South
Salt Lake City, Utah 84104-5110

Dear Mr. Johnson:

Re: Willow Creek Reclamation Project AMR/007/912

In response to your letter of March 9, 1989, I have the following comments regarding listed species:

1. The Bald Eagle is a migratory winter resident of the Willow Creek area arriving as early as November and remaining through March. Birds should not be present in the vicinity during our proposed period of construction work, July through November. The proposed work should not affect this species.

2. The Uinta Basin Hookless Cactus, Sclerocactus glaucus, is not known to exist in Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, staff from the Division of Oil, Gas and Mining with botanical training (Luci Malin, MS in Range Management, University of California, Davis; and Bob O'Brien, BS in Botany, Weber State College) will survey the site for any evidence of this species. If any individuals of this species are found, the Division will notify you immediately and change the plan of work accordingly. However, the proposed work should not affect this species.

3. The fish that are listed, the Humpback Chub, Gila cypha; the Bonytail Chub, Gila elegans; and the Colorado Squawfish, Ptychocheilus lucius; do not occur in the Price River or Willow Creek. These species could be indirectly affected through sediment loading caused during construction, or dewatering of either stream resulting from a need to suppress dust during construction. Some riparian work is scheduled for Willow Creek. Protection measures in the form of silt fencing and straw bales, (suggested by Utah Division of Wildlife Resource personnel), as well as rip-rap and gabians will be utilized during construction activities.

Additionally, work in the riparian zone will be scheduled to occur during periods of low stream flow. Results of the above mentioned protection should prevent turbidity due to construction activities from exceeding the 10% increase from background as measured in nephelometric turbidity units as stipulated by Utah Division of Wildlife Resources. Finally, stream alteration permits pursuant to 73-3-29, Utah Code Annotated, 1953, will be completed showing construction plans and filed with the Utah Division of Water Rights for approval prior to the work commencing. The proposed work should not adversely affect these species.

Regarding species which are candidates for listing:

1. The Razorbacked Sucker, Xyrauchen texanus, would not be affected for the same reasons discussed in the previous paragraph regarding the listed fish species.

2. The Yellow Blanketflower, Gaillardia flava, is not known to occur in Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, Division personnel will survey the site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

3. The Creutzfeldt Catseye, Cryptantha creutzfeldtii, is known to occur in the western portion of Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, Division personnel will survey the project site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

4. The Canyon Sweetvetch, Hedysarum occidentale var. canone, may occur in Hardscrabble Canyon. This species has been found in north-south trending canyons, in xeric communities, primarily on the west facing slopes. Prior to work, Division personnel will survey the project site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

5. Regarding Migratory Birds of High Federal Interest, our work is not planned to start until mid July. This start date should alleviate any conflicts with nesting birds, specifically the Williamson's Sapsucker, the Flammulated Screech Owl, Prairie Falcon, Cooper's Hawk, and Golden Eagle.

I believe that by taking these considerations the AMR Program has complied with Section 7 (c) of the Endangered Species Act of 1973 and has adequately addressed the needs of high interest, rare, and endangered species in its planning for the Willow Creek Project.

By signature of this letter you concur with the above and give clearance to the Division of Oil, Gas & Mining, Abandoned Mine Reclamation Program to proceed with the reclamation slated for the Willow Creek Project. A signature block is provided for you. Please return a signed copy. Thank you.

Sincerely,

Mark Mesch
Reclamation Specialist
Abandoned Mine Reclamation Program

CONCURRENCE:

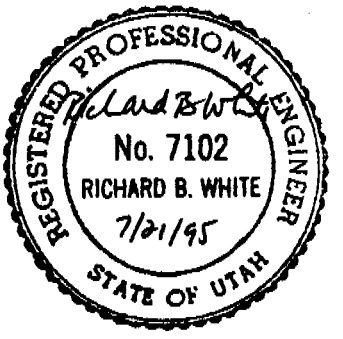
Robert A. Ruesink 5/16/89
U.S. Fish & Wildlife Service Date

vmn
AM65/26-28

July 1995

APPENDIX 12-3-3

SECTION 3.3, FISH AND WILDLIFE INFORMATION
WILLOW CREEK COAL MINE



LIST OF TABLES

LIST OF FIGURES

3.3 FISH & WILDLIFE INFORMATION

3.3.1 General Fish and Wildlife Information

This section generally describes existing habitat conditions and potential fish and wildlife resources within the permit area and adjacent areas that could be affected or impacted by the mining and reclamation activities. Information presented in this section was developed in accordance with applicable regulatory requirements (R645-301-300) for coal mine permitting in the State of Utah.

3.3.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-310 and 311, 322.100 through 300, and 323.200 and 300. Operation plans (Rules R645-301-330 through 333) are addressed in Section 4.3 of this permit application and reclamation plans and performance standards (Rules R645-301-342 and 358) are addressed in Section 5.3.

The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Provisions
3.3.1		
	3.3.1.1	
	3.3.1.2	R645-301-322.100, 200 and 300
	3.3.1.3	R645-301-322.220, 330 and 323.400
	3.3.1.4	R645-301-323.200, 300 and 400
3.3.2		
	3.3.2.1	R645-301-311 and 322
	3.3.2.2	R645-301-322.200, 210, 220 and 230
	3.3.2.3	R645-301-311 and 322
3.3.3		
	3.3.3.1	R645-301-311 and 322
	3.3.3.2	R645-301-322.200, 210, 220 and 230
	3.3.3.3	R645-301-311 and 322
3.3.4		
	3.3.4.1	R645-301-322.100, and 300
	3.3.4.2	R645-301-322.210, and 230
	Maps	R645-301-324
	Exhibits	R645-301-322.100 and 300

3.3.1.2 Sources for Fish and Wildlife Information

Fish and wildlife resources and habitat values in the permit area and adjacent areas have been characterized in this section using information from previous and ongoing baseline characterization and monitoring activities, principally by the UDWR. Existing available information was utilized to the extent possible. Information resources utilized, nature of information, and relevance to this site are summarized below:

- Both recent and on-going site-specific investigations including aquatic ecological studies and raptor and sensitive plant investigations conducted in 1994.

- Multiple historic site-specific investigations, principally by the UDWR, contributory to previous permit applications for this proposed permit area. These studies typically occurred during the late 70s and early 80s.

- Occasional site-specific investigations, observations, and/or notes which have occurred intermittently over the previous two decades.

- Amax Coal Company. 1981. Fish and Wildlife Resource Information and Protection Plans, Chap. X - Castle Gate Mining and Reclamation Plan. Rev. 8/82, 5/84, 4/87, and 7/89.

- Blackhawk Coal Company. 1987. Fish and Wildlife Resource Information - Exhibit 14 -Eastern Coal Reserves. Draft Mining and Reclamation Plan.

- USDI-BLM. 1983. Uintah - Southwestern Utah Coal Region. Round Two, Draft EIS.

- USDI-BLM. 1992. Final EIS for the Castle Gate Coalbed Methane Project, Carbon County, Utah. USDI-BLM Moab District, Price River Resource Area.

- Dalton, L.B., J.S. Price, and L.A. Romin. 1990. Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. Publication No. 90-11. Utah Dept. of Nat. Res. Div. of Wildlife Resources. 326 pp.

- Musclow, H.J. and L.B. Dalton. 1990. Wildlife Mitigation Technologies for Man-Made Impacts. Publication No. 90-3. Utah Dept. of Nat. Res. Div. of Wildlife Resources. 141 pp.

- Personal Communications with UDWR Biologists, Christopherson, K.D. (Regional Fisheries Manager), Phippen, K. (Fisheries Biologists), and Bates, W. (Habitat Manager), from June -Sept., 1994, with Rollin Daggett (HydroBios Consultants).

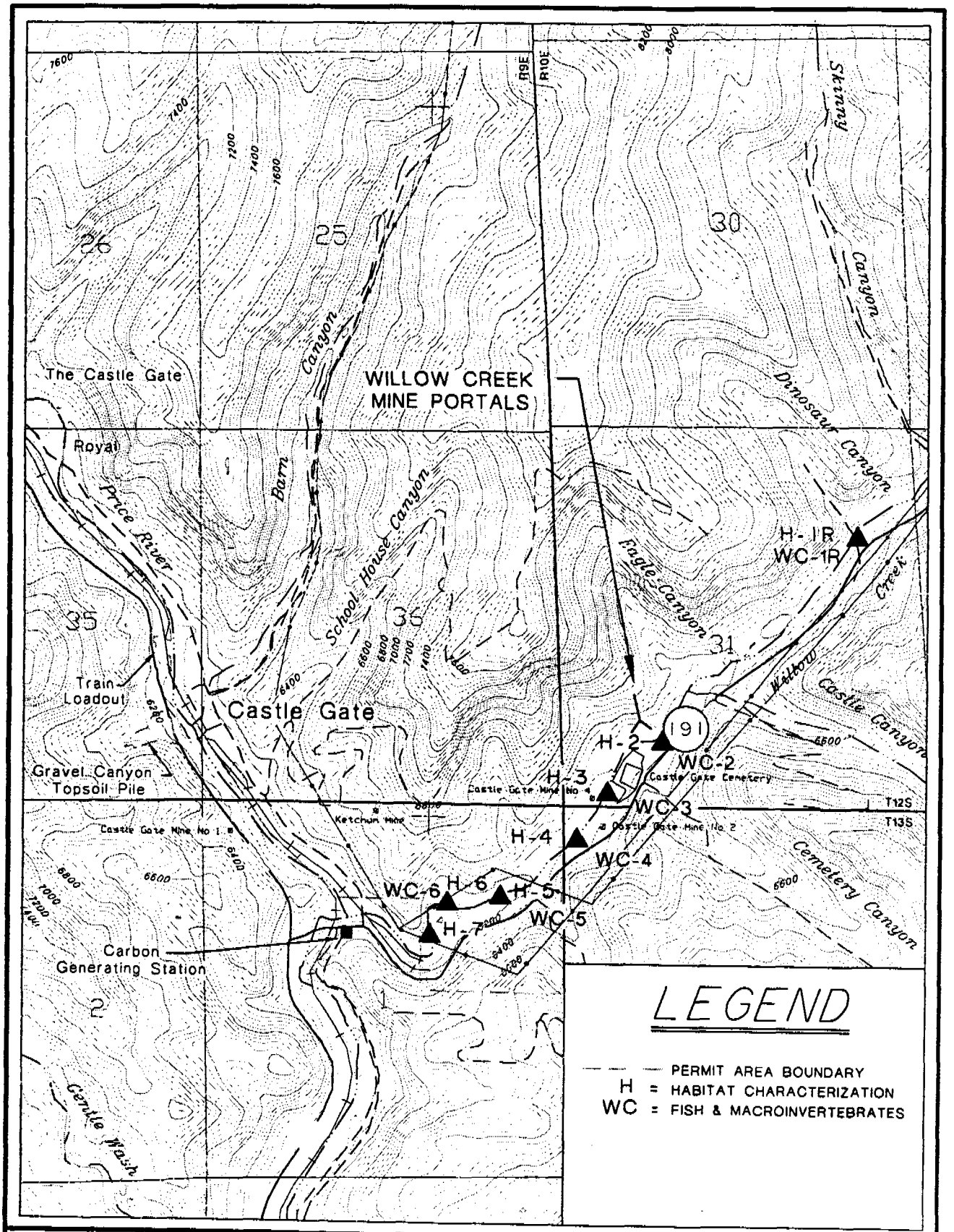
- Janssen, P. and W.K. Donaldson. 1987. Progress Report Section 4 in the Price River. Utah Division of Wildlife Resources, Price, Utah,. October 22, 1987.

- Utah Division of Wildlife Resources. 1981. Unpublished fish surveys for sections 6 and 7 in the Price River. UDWR, Price, Utah.

- Binns, N.A. 1982. Habitat quality index procedures manual. Wyoming Game and Fish Department. Cheyenne, Wyoming. 209 pp.

Identification of studies needed to characterize aquatic communities and habitat in the Willow Creek drainage was based on a review of the UDOGM draft document entitled *Fish and Wildlife Information Guidelines for Permanent Program Submissions for Coal Mines* and discussions with fisheries biologists (Ken Phippen and Kevin Christopherson) and a habitat specialist (Bill Bates) with the UDWR in Price, Utah. Discussions with UDWR resulted in an initial decision to conduct aquatic habitat and biology studies during the fall of 1994 and spring/summer of 1995. However, as a result of further discussion and by mutual agreement between CPMC and UDWR the studies were postponed because flows in Willow Creek were impacted by drought conditions in 1994. Given a lack of historic aquatic data for Willow Creek, however, the decision was made to conduct preliminary site-specific surveys in October 1994 to provide basic permitting data on habitat and biological communities. Assuming sufficient water is present, the aquatic studies requested by UDWR will be completed in 1995 and resulting data will be incorporated in this permit application document. The 1994 and proposed 1995 aquatic studies are described in the following section.

Site-specific aquatic studies were conducted on October 10 through 12, 1994 to provide habitat, benthic macroinvertebrate, and fisheries information for Willow Creek. Six sampling locations were used to characterize aquatic biota, while seven locations were examined for aquatic habitat as shown by Figure 3.3-1, Habitat and Aquatic Biology Sampling Locations. One reference location (i.e., H-1R for habitat and WC-1R for aquatic biology) was sampled to provide data for a section of Willow Creek located upstream of the surface



Project No.: 500-5000	Design By: J.NETTLETON	Scale: NOT TO SCALE
File: PLATGLOC.DWG	Drawn By: K.CONRATH	Date: MARCH 1994

TerraMatrix
Engineering & Environmental Services
475 Pine Grove Road, P.O. Box 774018
Steamboat Springs, Colorado 80477

FIGURE 3.3-1

CYPRUS Plateau Mining

WILDLIFE AND AQUATIC SAMPLING LOCATIONS

facilities area. The type of information collected or recorded during site-specific habitat surveys included stream depth, width, velocity, pool/riffle ratio, pool and riffle lengths, and substrate. The benthic macroinvertebrate survey involved the collection of two replicate samples at each location using a Surber sampler. Samples were preserved in the field with 70 percent ethanol and returned to the laboratory for analysis A backpack electro-shocker was used to sample fish populations within a segment of Willow Creek approximately 300 feet long at each sampling location. The duration of the fish sampling effort at each location was approximately 20 minutes. All fish collected at each location were identified, enumerated, and then returned to the stream.

During 1995, aquatic habitat, benthic macroinvertebrate, and fish surveys will be conducted at the same locations surveyed in 1994. Habitat characterization will be conducted once in the fall of 1995 using the *Habitat Quality Index Procedures Manual* (Binns 1982). Information to be measured and evaluated will include stream flow, temperature, nitrate nitrogen, velocity, substrate, cover, stream bank erosion, and stream width. Results of the benthic macroinvertebrate sampling will also be incorporated into the habitat analysis and a Habitat Quality Index (HQI) will be calculated for Willow Creek.

Fish sampling at each location will consist of electro-shocking the entire length of the segment (about 100 ft long). A population study will be completed for trout species using two passes through each study location. The details of the population evaluation method will be finalized through subsequent discussions with UDWR. All trout will be identified and enumerated by species, measured for total lengths and weights, and then returned to the stream immediately after completing the population study. Non-trout species will also be netted in the initial pass at each sampling location. Non-trout species will be identified and enumerated and then returned to the stream. Information resulting from the fish survey will include quantitative estimates (densities and biomass/area) and length/weight summaries for trout species and relative abundance for non-trout species. Appropriate literature sources also will be used to describe important habitat requirements and life histories for trout and any special status species collected in Willow Creek.

Benthic macroinvertebrate communities will be sampled at the same locations in the fall of 1995, as discussed above for the fish study. Duplicate samples will be collected in riffle areas at each location using a Surber sampler. All organisms and substrate material will be removed in the quadrat frame and allowed to drift into the net end of the sampler. The material in the net then will be concentrated in a sieve and placed into a labeled sample container with a 70 percent ethanol/water mixture. All samples will be returned to the laboratory for processing (i.e., sorting, enumeration, and identification to the lowest practical level). The following information will be used to characterize benthic macroinvertebrate communities in Willow Creek; densities (number of individuals/ft^2 for each taxonomic designation), percent relative abundance, and species diversity.

3.3.1.3 Background Ecology of Proposed Permit Area and Adjacent Areas

The mining and related activities surface facilities and permit area are located immediately north of the towns of Helper and Kenilworth within the Book Cliffs of Central Utah. Primary surface facilities will be sited within the Willow Creek Canyon area immediately upstream of the PacifiCorp Carbon Generating Station in the area of the old town of Castle Gate. Proposed operations will also involve utilization of the existing Castle Gate preparation plant and loadout facilities located north of PacifiCorp's Carbon Station on the east side of the Price River. Given the existing and proposed surface facility locations, the principal surface disturbances related to mine development will be in areas which have already been largely disturbed by previous mining related activities.

The south-facing Bookcliffs are dissected by intermittent and perennial streams and deep box canyons which form steep escarpments and a rugged topography along and adjacent to the cliff faces, and more moderate pediments which slope gradually toward the Price River from the base of the cliffs. Elevations in the proposed permit area range between 6,200 feet near the lower end of the central facilities area up to about 8,640 feet at an upper plateau bench along the northeastern portion of the permit area. The proposed permit area encompasses a portion of the far western reach of the Tavaputus Plateau and drains to the Price River which is tributary to the Green River which in turn flows to the Colorado River. Soils are generally shallow and skeletal in the steeper portions of the proposed permit area and those portions exhibiting Mancos Shale parent materials. Where sandstone is the parent material and slopes are flatter, soils are deeper and more well developed. The potential vegetation communities of the region consist predominantly of Douglas-fir forest (*Pseudotsuga*) at the higher elevations and piñon - juniper woodland (*Juniperus-Pinus*) and Great Basin sagebrush (*Artemisia*) at the mid-elevations. Lower elevation potential vegetation

communities consist of saltbush-greasewood (*Atriplex-Sarcobatus*) and sagebrush steppe (*Artemisia-Agropyron*) types. In descending order, these communities are encompassed by the montane (Canadian and Hudsonian life zones), submontane (Transition life zone), and cold desert (upper Sonoran life zone) ecological associations. Other than coal exploration and mining, the predominant land uses of the area include wildlife habitat, livestock rangeland, and dispersed recreation. A wide variety of wildlife species may potentially utilize habitats within and adjacent to the mine plan area. Common species of interest or species which are economically important include mule deer, elk, mountain lion, bobcat, black bear, coyote, blue grouse, ruffed grouse, sage grouse, snowshoe hare, mountain cottontail, desert cottontail, several raptor species, brown trout, and rainbow trout.

As a reflection of the arid climate and rugged topography of the region streams in the study area are characterized by narrow, high-gradient channels, and limited narrow floodplains. Because these drainages receive runoff flows from numerous steep canyons and washes, flows fluctuate significantly, especially in response to spring runoff and major summer thunderstorms, giving rise to a highly varied and often unpredictable aquatic environment.

3.3.1.4 Mapping of Fish and Wildlife Information

Information relative to fish and wildlife resources and habitat values is presented on the Regional Wildlife Map, (Map 3-7) and the Willow Creek Biological Surveys Map (Map 8), which show key wildlife monitoring points and aquatic sampling locations for recent and on-going studies. Information presented on the Regional Wildlife Map includes the following UDWR designations:

- Critical Mule Deer Winter Range
- High Priority Mule Deer Winter Range
- Critical Elk Winter Range
- Critical Sage Grouse Yearlong Range
- Critical Bald Eagle Winter Range
- Wetlands and Riparian Zones
- Wildlife Monitoring Locations

Aquatic sampling locations for site-specific studies conducted in 1994 and on-going studies proposed for 1995 are shown in the Willow Creek Biological Surveys Map (Map 8). The sampling program included one reference location (H-1R for habitat and WC-1R for aquatic biota) and five (aquatic biology) or six locations (habitat) in an area adjacent to the surface facilities area.

3.3.2 Terrestrial Wildlife Information

As indicated in Section 3.3.1.2, characterization of fish and wildlife resources is based on existing available documentation from previous wildlife research and studies and recent site specific wildlife research, principally by UDWR, and field investigations.

3.3.2.1 Habitat Evaluation for Proposed Permit Area and Adjacent Areas

There are a number of accepted approaches for habitat definition and evaluation, however, with respect to the proposed permit area and evaluation of potential mining related impacts, two basic approaches are of particular relevance. First, the floral associations and physical attributes of a given area can be described relative to habitat value as most species have particular affinities for certain features and conditions of their environment. Second, habitat value for certain geographical areas which correspond to a unique combination of floral associations and/or physical attributes can be described with respect to the necessary life requisites they provide for particular species of wildlife, especially during critical periods of their life cycles.

With respect to the first approach to habitat classification, five characteristic floral associations are described in Section 3.2, Vegetation Information. The location and areal extent of these associations within the proposed permit area are illustrated by the Regional Vegetation Map, (Map 3-5). As indicated in Section 3.2, the five floral associations are generally described as follows: Mixed-Conifer Forest, Piñon-Juniper Woodland, Sagebrush/Grasslands, Mixed Brush, and Riparian Bottoms. Relative utility of these habitats is dependent on each species of wildlife, but in general, the riparian bottom areas offer the highest level and greatest diversity of habitat values due to their use by most species at some point in their diurnal activities or life-cycles. The following discussion of wildlife occurrence and use identifies known affinities for each potential species relative to any specific floral association(s) and physical habitat attributes. In addition to these five floral associations, two physical attributes of portions of the proposed permit area provide distinct life-requisite values, or lack thereof, for several species. These attributes are; 1) Disturbed areas; and 2) Areas of exposed rock, typically expressed as rock outcrop, cliffs, or talus slopes.

The identification of "disturbed areas" (the majority of the surface facilities area) is important as this physical feature of the landscape provides very few of the life-requisite values for indigenous wildlife, with the exception of occasional rodent species. Native vegetation, micro-habitat and relief features, watering sources, and breeding requisites have been destroyed or significantly altered in these previously disturbed areas; therefore, the potential for adverse effect by the proposed mining and related activities has been substantially diminished owing to the fact that impacts have already been realized. With respect to rock outcrops, etc., habitat values such as nesting opportunities for raptors or roosting opportunities for bats, among other attributes, are presented. However, for the most part, physical habitat features will remain unaltered and unaffected by the mining and related activities.

The second approach to habitat classifications relating to geographical areas and/or areas occupied by certain species during particular periods of their life-cycle, focuses on four main designations by the UDWR with respect to the need for various levels of isolation or protection from human activity and development. These categories, as defined by the UDWR for management purposes, include Critical, High-Priority, Substantial Value, and Limited Value areas[1]. Designation of these categories for specific species in the vicinity of the proposed permit area is shown on the Regional Wildlife Map, (Map 7).

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during critical periods of their life-cycles. These areas are restricted in areal extent and lie within high-priority wildlife use areas. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 1 or 2 are classified as critical use areas. Biological intricacies dictate that significant disturbances cannot normally be tolerated by the members of an ecological assemblage within critical sites. Generally, disturbance of critical use areas or habitats may result in irreversible changes in species composition and/or biological productivity of an area. However, what constitutes a "disturbance" must be left to the interpretation of professional ecologists.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in areal extent and in conjunction with limited value use areas form the substantial value

---

[1]It is important for the reader to understand that these designations have only the specific definition assigned by the UDWR as discussed in the subsequent four paragraphs, and should not be interpreted otherwise, especially when reviewing the discussions for individual species in the next section. These designations are unique to the state of Utah and are general guidelines used by that state's wildlife agency for their management responsibilities. It is unfortunate that the terminology used for these designations tend to color the actual and potential circumstances surrounding impact in a more negative light than may actually be the correct circumstance. In addition, not all portions of an area necessarily meet the criteria of a given designation, and a given designation should not be used to judge the quality of habitat or the population density of a given species. For example, critical habitat can be assigned an area in poor range condition whether the density is one animal/100 square miles or 100 animals/one square mile. Finally, these designations predispose the assumption that any impact to the habitat components within a designated area will have some level of consequence to a given species. In fact, in many instances minor and sometimes major changes to the environment will only have inconsequential or unmeasurable effects upon a particular species; or realized effects can fall under the classification as an acceptable trade-off. Each potential impact must be addressed on a case-by-case basis.

distribution for a wildlife species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 3 are classified as high-priority use areas. In addition, wildlife use areas where either significant surface disturbance or underground activities which result in subsidence, interruption of any significant ground water aquifers, and consequent decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

Substantial value wildlife use areas are "existence areas" for one or more species of wildlife. "Existence areas" represent a herd or population distribution and are formed by the merging of high-priority and limited value wildlife use areas for a species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 4 are classified as substantial value use areas.

Limited value wildlife use areas are "occasional use areas" for one or more species of wildlife. "Occasional use areas" are part of the substantial value wildlife use area for a species. All stream segments, reservoirs, lakes and ponds identified by UDWR as Class 5 or 6 are classified as being of limited value.

3.3.2.2 General Wildlife Occurrence and Use

While the majority of the permit area occupies only a small portion of the West Tavaputs Plateau, it has essentially the same characteristic associated habitats and faunal resource potentials and is a typical representation of the Transitional and Canadian life zones in this part of Utah. However, the central facilities area is not characteristic of these life zones owing to both past and current impacts from previous mining activities, residential development, transportation corridor, and electrical power transmission. Given these associations and characteristics, the "greater" permit area could provide potential habitat for approximately 312 species of vertebrate wildlife, including; 18 fish species, 5 amphibians, 15 reptile species, 196 birds, and 78 mammals. Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, identifies those species known to occur in this general area as well as the likelihood of occurrence in the permit area. Of the 312 species identified as occurring in the general area, 56 are known inhabitants of the permit area, another 21 are judged to be likely inhabitants, 97 are possible inhabitants or transients, and 138 are considered unlikely inhabitants based on known range or habitat preference. Included on this list are several species of wildlife considered to be of high interest to the State of Utah. High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific, or educational significance (such as tiger salamanders, collard lizards, and milk snakes). Included in this category are those species of wildlife Federally listed as Endangered or Threatened.

Given the significant extent of previous and existing disturbance in the proposed surface facilities area and the very limited aerial extent of the new surface disturbance, comprehensive site-specific wildlife baseline studies are not required based on applicable UDOGM and UDWR guidelines and conversations with representatives of these two agencies. However, in order to address potential mining related wildlife impacts, the following discussion addresses important and/or typical species which may occur as inhabitants or transients in the permit area. Unless specifically addressed in the following discussion, species of special interest including migratory birds are not expected to occur within or utilize the permit area. Furthermore, though the permit area may provide "critical", "high priority", or "substantial value" habitat for these species (according to UDWR definitions), the potential for adverse impact to the vast majority of species, and individual animals, is quite low. A reasonably accurate evaluation of the potential for impact is detailed in Section 4.3.2 of this application.

Amphibians

Five species of amphibians, as listed on Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit and adjacent areas are located. However, only three amphibious species are categorized as possible inhabitants of the permit area. The tiger salamander, the only species of high-interest to the State, although a common species may be a yearlong resident and substantial value use areas for adult salamanders is represented by any moist underground site or sites offering similar conditions such as inside rotting logs or in deep animal burrows. These conditions can be found in virtually any habitat extending from the cold desert to the montane ecological association.

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
Fishes - 38 species total in SE Utah					
1	Cutthroat trout	*Salmo clarki*	C	P	
2	Rainbow trout	*Salmo gairdneri*	C	K	
3	Brown trout	*Salmo trutta*	C	P	
4	Carp	*Cyprinus carpio*	C	U	
5	Utah chub	*Gila atraria*	L	P	
6	Leatherside chub	*Gila copei*	C	U	C2
7	Humpback chub	*Gila cypha*	E	N	Endgrd.
8	Bonytail chub	*Gila elegans*	E	N	Endgrd.
9	Roundtail chub	*Gila robusta*	C	U	C2
10	Red shiner	*Notropis lutrensis*	C	U	
11	Fathead minnow	*Pimephales promelas*	C	U	
12	Colorado Squawfish	*Ptychocheilus lucius*	E	N	Endgrd.
13	Speckled dace	*Rhinichthys osculus*	C	K	
14	Redside shiner	*Richardsonius balteatus*	C	U	
15	Bluehead sucker	*Catostomus discobolus*	C	U	
16	Flannelmouth sucker	*Catostomus latipinnis*	C	U	
17	Mountain sucker	*Catostomus platyrhynchus*	L	K	
18	Razerback sucker	*Xyrauchen texanus*	R	N	
19	Black bullhead	*Ictalurus melas*	C	U	
20	Channel catfish	*Ictalurus punctatus*	C	U	
21	Green sunfish	*Lepomis cyanellus*	C	U	
22	Largemouth bass	*Micropterus salmoides*	C	U	
Amphibians - 11 species total in SE Utah					
1	Tiger salamander	*Ambystoma tigrinum*	D	P	
2	Great Basin spadefoot toad	*Scaphiopus intermontanus*	C	P	
3	Woodhouse's toad	*Bufo woodhousei*	C	U	
4	Chorus frog	*Pseudacris triseriata*	C	U	
5	Leopard frog	*Rana pipiens*	C	P	
Reptiles - 36 species total in SE Utah					
1	Collared lizard	*Crotaphytus collaris*	C	P	
2	Leopard lizard	*Crotaphytus wislizenii*	C	U	
3	Eastern fence lizard	*Sceloporus undulatus*	C	P	
4	Sagebrush lizard	*Sceloporus graciosus*	C	K	
5	Tree lizard	*Urosaurus ornatus*	C	P	
6	Side-blotched lizard	*Uta stansburiana*	C	K	
7	Short-horned lizard	*Phrynosoma douglassi*	C	K	

* Status in West Tavaputs Plateau; K = Unknown; C=Common; U=Uncommon; R=Rare; O=Occasional; A=Accidental; E=Endangered; T-Threatened; L=Limited; X=Extirpated; P=Protected; N=Unprotected

** Likelihood in Mine Plan Area: K=Known; L=Likely; P=Possible; U=Unlikely; N=None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
8	Western whiptail	*Cnemidophorus tigris*	C	P	
9	Striped whipsnake	*Masticophis taeniatus*	C	P	
10	Racer	*Coluber constrictor*	C	U	
11	Gopher snake	*Pituophis melanoleucus*	C	P	
12	Milk snake	*Lampropeltis triangulum*	L	U	
13	Western terrestrial garter snake	*Thamnophis elegans*	C	L	
14	Night snake	*Hypsiglena torquata*	C	U	
15	Midget faded rattlesnake	*Crotalus viridis concolor*	C	L	
Birds - 278 species total in SE Utah					
1	Common loon	*Gavia immer*	U	N	
2	Horned grebe	*Podiceps auritus*	R	U	
3	Eared grebe	*Podiceps nigricollis*	C	U	
4	Western grebe	*Aechmophorus occidentalis*	K	U	
5	Pied-billed grebe	*Podilymbus podiceps*	C	U	
6	White pelican	*Pelecanus erythrorhynchos*	L	N	
7	Double-crested cormorant	*Phalacrocorax auritus*	K	N	
8	Great blue heron	*Ardea herodias*	K	U	
9	Green heron	*Butorides striatus*	R	U	
10	Snowy egret	*Egretta thula*	C	N	
11	Black-crowned night heron	*Nycticorax nycticorax*	C	N	
12	American bittern	*Botaurus lentiginosus*	U	N	
13	White-faced ibis	*Plegadis chihi*	K	N	
14	Whistling swan	*Olor columbianus*	O	N	
15	Trumpeter swan	*Olor buccinator*	R	N	
16	Canada goose	*Branta canadensis*	C	U	
17	White-fronted goose	*Anser albifrons*	R	U	
18	Snow goose	*Chen caerulescens*	U	U	
19	Ross goose	*Chen rossii*	O	N	
20	Mallard	*Anas platyrhynchos*	C	P	
21	Gadwall	*Anas strepera*	C	U	
22	Northern pintail	*Anas acuta*	C	U	
23	Green-winged teal	*Anas crecca*	C	U	
24	Blue-winged teal	*Anas discors*	U	U	
25	Cinnamon teal	*Anas cyanoptera*	C	U	
26	American wigeon	*Anas americana*	C	U	
27	Northern shoveler	*Anas clypeata*	C	U	
28	Wood duck	*Aix sponsa*	R	U	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
29	Redhead	*Aythya mericana*	C	U	
30	Ring-necked duck	*Aythya collaris*	U	U	
31	Canvasback	*Aythya vallisineria*	C	U	
32	Greater scaup	*Aythya marila*	U	U	
33	Lesser scaup	*Aytha affinis*	C	U	
34	Common goldeneye	*Buccephala clangula*	U	U	
35	Bufflehead	*Bucephala albeola*	U	U	
36	Ruddy duck	*Oxyura jamaicensis*	C	U	
37	Hooded merganser	*Mergus cucullatus*	R	U	
38	Common merganser	*Mergus merganser*	C	U	
39	Red-breasted merganser	*Mergus serrator*	C	U	
40	Turkey Vulture	*Cathartes aura*	C	K	
41	Northern goshawk	*Accipiter gentilis*	U	K	C2
42	Sharp-shinned hawk	*Accipiter striatus*	U	U	
43	Cooper's hawk	*Accipiter cooperii*	C	P	
44	Red-tailed hawk	*Buteo jamaicensis*	C	K	
45	Swainson's hawk	*Buteo swainsoni*	U	P	
46	Rough-legged hawk	*Buteo lagopus*	C	U	
47	Ferruginous hawk	*Buteo regalis*	U	U	C2
48	Golden eagle	*Aquila chrysaetos*	C	K	
49	Balk Eagle	*Haliaeetus leucocephalus*	E	U	Endgrd.
50	Northern harrier	*Circus cyaneus*	C	P	
51	Osprey	*Pandion haliaetus*	U	N	
52	Prairie falcon	*Falco mexicanus*	C	L	
53	Peregrine falcon	*Falco peregrinus*	E	U	Endgrd.
54	Merlin	*Falco columbarius*	K	U	
55	American kestrel	*Falco sparverius*	C	K	
56	Blue grouse	*Dendragapus obscurus*	C	K	
57	Ruffed grouse	*Bonasa umbellus*	C	K	
58	Sage grouse	*Centrocercus urophasianus*	C	K	
59	California quail	*Lophortyx californicus*	C	U	
60	Chukar	*Alectoris chukar*	C	U	
61	Ring-necked pheasant	*Phasianus colchious*	C	N	
62	Sandhill crane	*Crus canadensis*	L	N	
63	Virginia rail	*Rallus limicola*	C	N	
64	Sora rail	*Porzana carolina*	U	N	
65	American coot	*Fulica americana*	C	U	

* Status in West Tavaputs Plateau; K = Unknown; C=Common; U=Uncommon; R=Rare; O=Occasional; A=Accidental; E=Endangered; T-Threatened; L=Limited; X=Extirpated; P=Protected; N=Unprotected

** Likelihood in Mine Plan Area: K=Known; L=Likely; P=Possible; U=Unlikely; N=None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
66	Semipalmated plover	*Charadrius semipalmatus*	U	N	
67	Snowy plover	*Charadrius alexandrinus*	K	N	
68	Killdeer	*Charadrius vociferus*	C	U	
69	Mountain plover	*Charadrius montanus*	R	N	C2
70	American golden plover	*Pluvialis dominica*	U	N	
71	Black-bellied plover	*Pluvialis squatarola*	C	N	
72	Common snipe	*Capella gallinago*	C	U	
73	Long-billed curlew	*Numenius americanus*	K	U	
74	Willet	*Catoptrophorus semipalmatus*	K	N	
75	Spotted sandpiper	*Actitis macularia*	C	N	
76	Solitary sandpiper	*Tringa solitaria*	U	N	
77	Greater yellowlegs	*Tringa melanoleuca*	U	N	
78	Lesser yellowlegs	*Tringa flavipes*	C	N	
79	Pectoral sandpiper	*Calidris melanotos*	U	N	
80	Baird's sandpiper	*Calidris bairdii*	U	N	
81	Least sandpiper	*Calidris minutilla*	C	N	
82	Western sandpiper	*Calidris mauri*	C	N	
83	Sanderling	*Calidris alba*	U	N	
84	Short-billed dowitcher	*Limnodromus griseus*	U	N	
85	Long-billed dowitcher	*Limnodromous scolopaceus*	C	N	
86	Marbled godwit	*Limosa fedoa*	C	N	
87	American avocet	*Recurvirostra americana*	C	N	
88	Black-necked stilt	*Himantopus mexicanus*	C	N	
89	Wilson's phalarope	*Phalaropus tricolor*	C	N	
90	Northern phalarope	*Phalaropus lobatus*	C	N	
91	Herring gull	*Larus argentatus*	U	N	
92	California gull	*Larus californicus*	C	N	
93	Ring-billed gull	*Larus delawarensis*	C	N	
94	Franklin's gulll	*Larus pipixcan*	C	N	
95	Bonaparte's gull	*larus philidelphia*	U	N	
96	Forsters tern	*Sterna forsteri*	C	N	
97	Common tern	*Sterna hirundo*	U	N	
98	Black tern	*Childonias niger*	C	N	C2
99	Caspian tern	*Hydropprogne caspia*	U	N	
100	Rock Dove	*Columba lavia*	C	P	
101	Mourning dove	*Zenaida macroura*	C	L	
102	Yellow-billed cuckoo	*Coccyzus americanus*	K	U	

* Status in West Tavaputs Plateau; K = Unknown; C=Common; U=Uncommon; R=Rare; O=Occasional; A=Accidental; E=Endangered; T-Threatened; L=Limited; X=Extirpated; P=Protected; N=Unprotected

** Likelihood in Mine Plan Area: K=Known; L=Likely; P=Possible; U=Unlikely; N=None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
103	Barn owl	*Tyto alba*	K	U	
104	Screech owl	*Otus asio*	U	U	
105	Flammulated owl	*Otus flammeolus*	K	U	
106	Great-horned owl	*Bubo virginianus*	C	K	
107	Northern Pygmy owl	*Glaucidium gnoma*	K	P	
108	Burrowing owl	*Speotyto cunicularia*	L	U	
109	Long-eared owl	*Asio otus*	C	P	
110	Short-eared owl	*Asio flammeus*	C	U	
111	Northern saw-whet owl	*Aegolius acadicus*	K	U	
112	Common nighthawk	*Chordeiles minor*	C	L	
113	Poor-will	*Phalaenoptilus nuttallii*	C	L	
114	Black swift	*Cypseloides niger*	U	U	
115	White-throated swift	*Aeronautes saxatalis*	C	K	
116	Black-chinned hummingbird	*Archilochus alexandri*	C	P	
117	Broad-tailed hummingbird	*Selasphorus platycercus*	C	K	
118	Rufous hummingbird	*Selasphorus rufus*	C	P	
119	Calliope hummingbird	*Stellula calliope*	C	P	
120	Belted kingfisher	*Ceryle alcyon*	K	U	
121	Northern flicker	*Colaptes auratus*	C	L	
122	Red-headed woodpecker	*Melanerpes erythrocephalus*	R	U	
123	Yellow-bellied sapsucker	*Sphryapicus varius*	C	K	
124	Hairy woodpecker	*Picoides villosus*	C	P	
125	Downy woodpecker	*Picoides pubescens*	C	P	
126	Three-toed woodpecker	*Picoides tridactylus*	U	P	
127	Western kingbird	*Tyrannus verticalis*	C	P	
128	Cassin's kingbird	*Tyrannus vociferans*	C	U	
129	Eastern kingbird	*Tyrannus tyrannus*	C	P	
130	Ash-throated flycatcher	*Mylarchus cinerascens*	C	P	
131	Say's Phoebe	*Savornis sava*	C	L	
132	Willow flycatcher	*Empidonax traillii*	C	U	
133	Hammond's flycatcher	*Empidonax hammondii*	U	U	
134	Dusky flycatcher	*Empidonax oberholderi*	C	P	
135	Gray flycatcher	*Empidonax wrightii*	K	U	
136	Western flycatcher	*Empidonax difficilis*	C	P	
137	Western wood-pewee	*Contopus sordidulus*	C	K	
138	Olive-sided flycatcher	*Contopus borealis*	U	P	
139	Horned lark	*Eremophila alpestris*	C	L	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
140	Violet-green swallow	*Tachycineta thalassina*	C	K	
141	Tree swallow	*Tachycineta biocolor*	C	P	
142	Bank swallow	*Riparia riparia*	C	U	
143	Northern rough-wing swallow	*stelgidopteryx serripennis*	C	U	
144	Barn swallow	*Hirundo rusitca*	C	P	
145	Cliff swallow	*Hirundo pyrrhonota*	C	L	
146	Purple martin	*Progne subis*	K	P	
147	Steller's jay	*Cyanocitta stelleri*	C	K	
148	Gray jay	*Perisoreus Canadensis*	R	L	
149	Scurb jay	*Abhelocoma coerulescens*	C	L	
150	Black-billed magpie	*Pica pica*	C	K	
151	Common raven	*Corvus corax*	C	K	
152	Common crow	*Corvus brachyrhynchos*	O	U	
153	Pinyon jay	*Gymnorhinus cyanocephale*	C	L	
154	Clark's nutcracker	*Nucifraga columbiana*	C	K	
155	Black-capped chickadee	*Parus atricapillus*	C	P	
156	Mountain chickadee	*Parus gambelli*	C	K	
157	Plain titmouse	*Parus Inornatus*	K	P	
158	Bushtit	*Psaltriparus minimus*	C	P	
159	White-breasted nuthatch	*Sitta carolinensis*	C	P	
160	Red-breasted nuthatch	*Sitta canadensis*	C	P	
161	Pygmy nuthatch	*Sitta pygmaea*	C	U	
162	Brown creeper	*Certhia americana*	C	P	
163	American dipper	*Cinclus mexicanus*	C	U	
164	House wren	*Troglodytes aedon*	C	P	
165	Rock wren	*Salpinctes obsoletus*	C	K	
166	Canyon wren	*Catherpes mexicanus*	C	K	
167	Bewick's wren	*Thryomanes bewickii*	C	P	
168	Long-billed marsh wren	*Cistothorus palustris*	L	U	
169	Mockingbird	*Mimus polyglottos*	U	U	
170	Gray catbird	*Dumetella carolinensis*	U	U	
171	Sage Thrasher	*Oreoscoptes montanus*	C	L	
172	American robin	*Turdus migratorius*	C	K	
173	Hermit thrush	*Catharus gattatus*	C	P	
174	Swainson's thrush	*Catharus ustulatus*	C	K	
175	Veery	*Catharus fuscescens*	U	U	
176	Western bluebird	*Stali mexicana*	K	U	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
177	Mountain bluebird	*Sialia currucoides*	K	K	
178	Townsend's solitaire	*Myadestes townsendi*	C	K	
179	Blue-gray gnatcatcher	*Polioptila caerulea*	C	P	
180	Golden-crowned kinglet	*Regulus satrapa*	U	K	
181	Ruby-crowned kinglet	*Regulus calendula*	C	K	
182	Water pipet	*Anthus spinoletta*	C	U	
183	Bohemian waxwing	*Bombycilla garrulus*	U	U	
184	Cedar waxwing	*Bombycilla cedrorum*	C	U	
185	Northern shrike	*Lanius excubitor*	U	P	
186	Loggerhead shrike	*Lanius ludovicianus*	C	P	C2
187	Starling	*Sturnus vulgaris*	C	L	
188	Solitary vireo	*Vireo solitarius*	U	U	
189	Warbling vireo	*Vireo gilvus*	C	K	
190	Orange-crowned warbler	*Vermivora celata*	C	K	
191	Nashville warbler	*Vermivora ruficapilla*	U	U	
192	Virginia's warbler	*Vermivora virginiae*	C	P	
193	Yellow warbler	*Dendroica petechia*	C	K	
194	Magnolia warbler	*Dendrocia magnolia*	U	U	
195	Yellow-rumped warbler	*Dendroica coronata*	C	K	
196	Black-throated gray warbler	*Dendroica nigrescens*	K	P	
197	Townsend's warbler	*Dendroica townsendi*	U	P	
198	Northern waterthrush	*Seiurus noveboracensis*	U	U	
199	MacGillivray's warbler	*Oporomis tolmiei*	C	P	
200	Common yellowthroat	*Geothlypis trichas*	L	U	
201	Yellow-breasted chat	*Icteria virens*	C	P	
202	Wilson's warbler	*Wilsonia pusilla*	C	P	
203	American redstart	*Setophaga ruticilla*	U	U	
204	House sparrow	*Passer domestious*	C	L	
205	Western meadowlark	*Stumella neglecta*	C	L	
206	Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	C	N	
207	Red-winged blackbird	*Agelaius phoeniceus*	C	U	
208	Northern oriole	*Icterus galbula*	C	U	
209	Brewer's blackbird	*Euphagus evanocephalus*	C	U	
210	Common grackle	*Quiscalus quiscula*	A	N	
211	Brown-headed cowbird	*Molthrus ater*	C	U	
212	Western tanager	*Piranga ludoviciana*	C	K	
213	Black-headed grosbeak	*Pheucticus melanocephalus*	C	K	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
214	Blue grosbeak	*Guiraca caerulea*	O	U	
215	Lapland longspur	*Calcarius lapponicus*	R	N	
216	Indigo bunting	*Passerian cyanea*	R	U	
217	Lazuli bunting	*Passerian amoena*	C	P	
218	Green-tailed towhee	*Pipilo chlorurus*	C	K	
219	Rufous-sided towhee	*Pipilo erythophthalmus*	C	K	
220	Lark bunting	*Calamospiza melanocorys*	O	U	
221	Savannah sparrow	*Passercules sandwichensis*	C	U	
222	Grasshopper sparrow	*Ammocramus savannarum*	K	U	
223	Vesper sparrow	*Pooecetes gramineus*	C	U	
224	Lark sparrow	*Chondestes grammacus*	C	P	
225	Sage sparrow	*Amphispiza belli*	U	U	
226	Dark-eyed junco	*Junco hyemalis*	C	K	
227	Grey-headed junco	*Junco caniceps*	C	K	
228	Tree sparrow	*Spizella arborea*	U	U	
229	Chipping sparrow	*Spizella passerina*	C	K	
230	Brewer's sparrow	*Spizella breweri*	C	P	
231	Harris sparrow	*Zonotrichia querula*	U	U	
232	White-crowned sparrow	*Zonotrichia leucophrys*	C	P	
233	Fox sparrow	*Passerella iliaca*	K	U	
234	Lincoln's sparrow	*Melospiza lincolnii*	U	U	
235	Song sparrow	*Melospiza melodia*	C	K	
236	Black-throated sparrow	*Amphispiza bilineata*	U	U	
237	Evening grosbeak	*Coccothraustes vespertinus*	C	U	
238	Cassin's finch	*Carpodacus cassinii*	C	P	
239	House finch	*Carpodacus mexicanus*	C	P	
240	Pine grosbeak	*Pinicola enucleator*	U	P	
241	Rosy finch	*Leucosticte arctoa*	C	U	
242	Pine siskin	*Carduelis pinus*	C	K	
243	American goldfinch	*Carduelis tristis*	C	P	
244	Lesser goldfinch	*Carduelis psaltria*	C	P	
245	Red Crossbill	*Loxia curvirostra*	U	U	
Mammals - 103 species total in SE Utah					
1	Dwarf shrew	*Sorex nanus*	L	P	
2	Water shrew	*Sorex palustris*	C	P	
3	Merriam's shrew	*Sorex merriami*	U	U	
4	Vagrant shrew	*Sorex vagrans*	C	U	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
5	Masked shrew	*Sorex cinereus*	C	P	
6	Dusky shrew	*Sorex monticolus*	C	P	
7	Little brown myotis	*Myotis lucifugus*	C	P	
8	Fringed myotis	*Myotis thysanodes*	U	U	C2
9	Long-eared myotis	*Myotis evotis*	C	U	C2
10	Long-legged myotis	*Myotis volans*	C	U	C2
11	Yuma myotis	*Myotis yumanensis*	U	U	C2
12	California myotis	*Myotis californious*	C	U	
13	Small-footed myotis	*Myotis leibii*	U	U	C2
14	Silver-haired bat	*Lasioncteris noctivagans*	C	P	
15	Western pipistrelle	*Pipistrellus hesperus*	C	P	
16	Big brown bat	*Eptesicus fuscus*	C	P	
17	Red bat	*Lasiurus borealis*	L	U	
18	Hoary bat	*Lasiurus cinereus*	U	U	
19	Townsend's big-ered bat	*Plecotus townsendii*	C	P	
20	Spotted bat	*Euderma maculatum*	L	U	C2
21	Pallid bat	*Antrozous pallidus*	C	U	
22	Mexican free-tailed bat	*Tadarida brasiliensis*	C	U	
23	Pika	*Ochotona princeps*	C	U	
24	White-tailed jackrabbit	*Lepus townsendii*	C	L	
25	Snowshoe hare	*Lepus americanus*	L	U	
26	Black-tailed jackrabbit	*Lepus californicus*	C	U	
27	Nuttall's cottontail	*Sylvilagus nuttallii*	C	K	
28	Desert cottontail	*Sylvilagus audubonii*	C	K	
29	White-tailed prairie dog	*Cynomys leucurus*	C	U	
30	Red squirrel	*Tamiasciurus hudsonicus*	C	L	
31	Rock squirrel	*Spermophilus variegatus*	C	K	
32	Uintah ground squirrel	*Spermophilus armatus*	C	P	
33	Golden-mantled grd. squirrel	*Spermophilus lateralis*	C	L	
34	Whitetail antelope squirrel	*Ammospermophilus leucurus*	C	P	
35	Yellow-bellied marmot	*Marmota flaviventris*	C	L	
36	Northern flying squirrel	*Glaucomys sabrinus*	K	U	
37	Least chipmunk	*Tamias minimus*	C	K	
38	Uinta chipmunk	*Tamias umbrinus*	C	K	
39	Cliff chipmunk	*Eutamius dorsalis*	U	U	
40	Northern pocket gopher	*Thomomys talpoides*	C	P	
41	Botta pocket gopher	*Thomomys bottae*	C	U	

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
42	Ord kangaroo rat	*Dipodomys ordii*	C	P	
43	Beaver	*Castor canadensis*	C	P	
44	Western harvest mouse	*Reithrodontomys megalotis*	C	U	
45	Canyon mouse	*Peromyscus crinitus*	C	P	
46	Deer mouse	*Peromyscus maniculatus*	C	K	
47	Brush mouse	*Peromyscus boylei*	C	P	
48	Piñon mouse	*Peromyscus truei*	C	P	
49	Desert woodrat	*Neotoma Lepida*	C	P	
50	Bushy-tailed woodrat	*Neotoma cinerea*	C	K	
51	Muskrat	*Ondatra zibethicus*	C	U	
52	Montane vole	*Microtus montanus*	C	P	
53	Long-tailed vole	*Microtus longicaudus*	C	P	
54	Black rat	*Rattus rattus*	C	P	
55	Norway rat	*Rattus norvegicus*	C	P	
56	House mouse	*Mus musculus*	C	P	
57	Porcupine	*Erethizon dorsatum*	C	P	
58	Coyote	*Canis latrans*	C	K	
59	Red fox	*Vulpes vulpes*	K	P	
60	Kit fox	*Vulpes macrotis*	K	P	
61	Gray fox	*Urocyan cinereoargenteus*	C	P	
62	Gray wolf	*Canis lupus*	E	N	Endgrd.
63	Black bear	*Ursus americanus*	C	K	
64	Grizzly bear	*Ursus horribilis*	X	N	Thrtnd.
65	Ring-tailed cat	*Bassariscus astutus*	C	P	
66	Raccoon	*Procyon lotor*	K	P	
67	Short-tailed weasel	*Mustela erminea*	K	U	
68	Long-tailed weasel	*Mustela frenata*	C	P	
69	Mink	*Mustela vison*	L	U	
70	Wolverine	*Gulo gulo*	L	N	C2
71	Black-footed ferret	*Mustela nigripes*	E	N	Endgrd.
72	Marten	*Martes americana*	R	U	
73	Badger	*Taxidea taxus*	C	P	
74	Striped skunk	*Mephitus mephitus*	C	P	
75	Spotted skunk	*Spilogale gracilis*	C	P	
76	River otter	*Lutra canadensis*	L	N	C2
77	Bobcat	*Felis rufus*	L	P	
78	Canada lynx	*Felis lynx canadensis*	L	U	C2

* Status in West Tavaputs Plateau; K = Unknown; C = Common; U = Uncommon; R = Rare; O = Occasional; A = Accidental; E = Endangered; T-Threatened; L = Limited; X = Extirpated; P = Protected; N = Unprotected

** Likelihood in Mine Plan Area: K = Known; L = Likely; P = Possible; U = Unlikely; N = None

TABLE 3.3-1
POTENTIAL WILDLIFE SPECIES OF THE WEST TAVAPUTS PLATEAU

(From Dalton et al., 1978. Species List of Vertebrate Wildlife that Inhabit Southeastern Utah. UDWR Publication 78-16.)

Life Form	Common Name	Scientific Name	Status in West Tavaputs Plateau*	Likelihood in Mine Plan Area **	Federal Status
79	Mountain lion	*Felis concolor*	C	P	
80	Mule deer	*Odocoileus hemionus*	C	K	
81	Rocky mountain elk	*Cervus elaphus*	C	P	
82	Pronghorn antelope	*Antilocapra americana*	L	U	
83	Rocky mountain bighorn sheep	*Ovis canadensis*	L	U	

* Status in West Tavaputs Plateau; K = Unknown; C=Common; U=Uncommon; R=Rare; O=Occasional; A=Accidental; E=Endangered; T-Threatened; L=Limited; X=Extirpated; P=Protected; N=Unprotected

** Likelihood in Mine Plan Area: K=Known; L=Likely; P=Possible; U=Unlikely; N=None

Breeding habitat consists of any water body where the gilled young can survive to adulthood. Any such areas would be considered high-priority use areas for this species. However, its important to note that the tiger salamander is not afforded legal protection and its interest to the state is primarily "aesthetics".

Reptiles

Fifteen species of reptiles, as listed on Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. However, only eleven reptile species are categorized as possible inhabitants of the permit area. Three of these eleven species, sagebrush, side-blotched, and short-horned lizards, are known inhabitants of the permit area based on visual observations. Of the two potential high-interest species, the collared lizard has the greatest likelihood of occurrence. This species would be a yearlong resident and substantial value habitat would be comprised of dry rocky gullies, canyons, and mountain slopes where vegetation is relatively sparse and large boulders provide sun-basking opportunities. The other high-interest species is the milk snake, also a potential yearlong resident of the permit area. Its substantial value use area encompasses all wildlife habitats from the cold desert to the montane ecological association. The milk snake is extremely secretive, nocturnal, and typically can only be found by investigating under rotten logs, stumps, brush piles, and related hiding places during diurnal periods.

Birds

Nearly 200 species of birds, as listed by Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. However, only 104 bird species are categorized as potential inhabitants of the permit area. Forty of the 104 species are known inhabitants of the mine plan area based on visual observations during site reconnaissance surveys in 1994 or previous site-specific efforts by other researchers. Of the 74 potential State high-interest species possible in the region, several are either known, likely, or possible in the permit area.

The great blue heron, though an unlikely inhabitant of the permit area, could be a yearlong resident of nearby areas on the Price River. Likelihood is based on the substantial value habitat need for open water where this species feeds on aquatic species. Such habitat is not known to occur in the permit area, therefore, occurrence of the blue heron in the permit area would likely be incidental to habitation and use of nearby areas. Critical habitat for the great blue heron would exist in the form of a rookery due to the fidelity shown such breeding habitat features, however, no rookeries are known to occur in the immediate area and the only potentially suitable rookery areas would be downstream along the Price River.

Waterfowl (ducks and geese), all of which are considered to be of high interest to the State of Utah due to their status as "game birds", are represented by 23 species that may, on occasion or seasonally, occur as minor inhabitants or transients in the permit area. Of these, only five species could reasonably be expected to occur in the permit area, other than on an occasional basis. In general, the limited riparian and wetland vegetation types encompassed by the proposed permit area and adjacent areas provide marginally suitable habitat values for these five and possibly other waterfowl species. Each species has different life requisites and nature and frequency of use of the riparian and wetland habitats found in the area may vary significantly, The importance, however, of these habitats for breeding purposes results in their being ranked as high-priority if utilized during the breeding period though such use is not expected.

The mine plan area provides substantial potential habitat for a variety of raptor species including the: turkey vulture, golden eagle, prairie falcon, American kestrel, northern goshawk, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, Swainson's hawk, northern harrier, barn owl, screech owl, flammulated owl, great-horned owl, northern pygmy owl, long-eared owl and northern saw-whet owl. Many of these species are of high Federal interest pursuant to 43 CFR, 3461.1 (n-1), and all are considered of high interest to the State of Utah. In addition to these species there is some potential, though minimal, for incidental use of the permit area by bald eagles and American peregrine falcons, both Federally listed Endangered or Threatened species as further discussed in Section 3.3.4.2. High-priority and/or critical habitat for certain raptor species exists within the permit area during the nesting/breeding period (February - July). For these species, construction activities within one-half mile of a nest site during the species specific nesting/breeding period should be avoided.

Because certain raptor species may be sensitive to disturbance during their active nesting period, surveys of those portions of the permit area where surface disturbance has or is anticipated to occur have been implemented intermittently during the period from 1979 through 1994. As a result of these efforts several nest sites (both active and inactive) have been located in and near the permit area. Locations for these sites are provided on Map 7, Regional Wildlife Map. As indicted on Map 7, two nests were observed in the left fork of Cordingly Canyon. Both nests were inactive in 1994. Three golden eagle nests were observed in an unnamed canyon north of Kenilworth Town one in Section 10, Township 13 South, Range 10 East and two additional nests were identified in Section 9, Township 13 South, Range 10 East. All three nests were inactive in 1994. Three golden eagle nests were observed on the cliff face in Castle Canyon in Section 31, Township 12 South, Range 10 East. All three nests were inactive in 1994. Three golden eagle nests are located on the cliff face in Eagle Canyon, in Section, 31, Township 12 South, Range 10 East. All three nests were inactive in 1994. At this same general location two old, dilapidated nests also exist which have not been active for many years. One old golden eagle nest is located on the cliff face of Barn Canyon in Section 36, Township 12 South, Range 9 East; this nest has not been active for several years. One golden eagle nest is located on the cliff face in Price Canyon in Section 36, Township 12 South, Range 9 East; this nest has not been active for several years.

Golden eagles are common yearlong residents in the general area. Depending on the individual characteristics of eagle pairs, sensitivity to disturbance within one-half mile of their nest site may be extreme on occasion, but more typically would be low to moderate. Proposed surface disturbance activities within the proposed permit area will occur within one-half mile of the golden eagle nest sites in Eagle Canyon (Section 31, T12S, R10E) and in Castle Canyon also in Section 31, based on ground reconnaissance and aerial raptor surveys during 1994. Future verification of nesting activity will occur prior to construction in 1996/1997 and appropriate mitigation measures will be implemented in consultation with both UDOGM and UDWR. Specific mitigation measures are discussed under Section 4.3.4.2, Compliance With the Bald (and Golden) Eagle Protection Act.

Prairie falcons are common yearlong residents of the general area and utilize cliffs for nesting sites. However, no known nesting sites have been identified in the permit area despite the classification of this area as substantial value. Suitable nesting habitat for prairie falcon is widespread and non-limiting along the Tavaputs Plateau. While occupied (April 15th to June 30th) prairie falcon nests and a one-half mile buffer would be considered critical habitat for the maintenance of prairie falcon populations.

Blue grouse, as yearlong residents of the West Tavaputs Plateau, prefer open stands of conifers which serve as the principal source of forage. In the warmer months, blue grouse are found in the lower elevation sagebrush, piñon-juniper, and mixed brush habitats where they can obtain newly developing buds and other tender vegetation. At various times during the breeding and brooding seasons, insects and berries become an important dietary component and habitats which supply these requisites are classified as high-priority. During the colder months, young needles and buds from Douglas-fir and spruce trees at higher elevations provide the necessary forage for survival. Therefore, high elevation coniferous stands rank as critical habitat during the months of December through February for blue grouse.

The ruffed grouse is also a yearlong resident of the West Tavaputs Plateau frequenting the continuum of habitats between shrublands and aspen woodlands. During the winter, however, ruffed grouse are often found roosting in conifers and during this period they feed entirely on staminate aspen buds, thus aspen woodland is ranked as being of critical value for survival of ruffed grouse populations. During the warmer months, when breeding and brooding take place, ruffed grouse can be found within 1/4 mile of water (usually streams), and such areas are classified as high-priority for this species.

Like the two previously discussed grouse species, sage grouse are year-round residents of the high plateau and adjacent portions of the permit area which lie above the cliffs. However, within their substantial use area are locations of critical value winter range, leks (strutting grounds), brooding areas, and high-priority summer range. Sage grouse only occur in sagebrush dominated vegetation types or communities in close proximity to sagebrush types within the submontane life zone. Open areas (e.g., wet meadows) surrounded by sagebrush are often utilized as strutting grounds during the critical breeding period from March 15 through June 15. Sagebrush stands within a two-mile radius of such sites are also classified as critical value areas due to their use as brooding habitat following nesting. Following the brooding period, the sage grouse disperse over the entire substantial use area until about mid-November. During this period, use areas are considered as high-priority summer range. As indicated by the Wildlife Habitat Map, (Map 3-5), the closest designated sage grouse habitat occurs near the limit of the northern permit area boundary.

Riparian areas and adjoining brush lands associated with the Price River provide yearlong, substantial value habitat for California quail. Because the quail is completely dependent on riparian systems during its life cycle, especially for wild grains and insects, this habitat type is ranked as critical for this species.

Chukar, introduced from Asia in the 1950s, are yearlong residents of the West Tavaputs Plateau preferring open rocky areas in the submontane and cold desert ecological associations. The cliffs and talus slopes along with the associated desert scrub and/or mixed brush vegetation types offer substantial value habitat. Winter ranges and sources of water are ranked as critical to maintenance of chukar populations.

Mourning doves occupy the permit area (which represents substantial value habitat for this species) during the summer months with two peaks in breeding activity occurring during early July and early August. Piñon-juniper woodland and riparian habitats are ranked as high-priority value for nesting and water sources are ranked as critical. Mourning doves do not winter in the area so there is no associated designation for winter habitat values. Similarly, the yellow-billed cuckoo may be found as a summer resident of the proposed permit area's riparian communities, however, little is known of this species' life requisites so it can only be assumed that riparian habitats would be considered critical for its perpetuation.

The belted kingfisher is a yearlong resident of the West Tavaputs Plateau, but it is only found along riverain systems such as the Price River and possibly along Willow Creek. These riparian associations represent a high-priority use area as the kingfisher only feeds on small fish and nests immediately adjacent to streams in burrows along the bank. During the nesting season, these areas are of critical value to the kingfisher.

Purple martins are occasional summer residents known to inhabit the biogeographic area that surrounds the permit area. In Utah the martin's substantial value use area is represented by open spruce-fir, aspen, or ponderosa forest habitats of the montane ecological association.

Like the purple martin, the western bluebird is an occasional summer resident of the general region, however, the mountain bluebird is a common year-round resident of the permit area. The western bluebird nests within a zone extending from the piñon-juniper woodland of the submontane ecological association up into the lower forest habitats of the Canadian life zone (montane ecological association). The mountain bluebird utilizes the same continuum of habitats for nesting, but also extends its nesting use across the Canadian and Hudsonian life zones into the Alpine. During winter, both species variably migrate to lower elevations or warmer areas to the south. For those individuals remaining in the area during the colder months, cold desert habitats are utilized and may be considered high-priority use areas. In this regard, the substantial value use area for each species spans a broad continuum of habitats.

The grasshopper sparrow is a rare transient species known to occasionally inhabit the West Tavaputs Plateau. However, this species only frequents dry grasslands in the desert scrub habitat of the cold desert ecological association during the spring and fall migratory periods. Such habitats are typically found immediately below the proposed permit area. Therefore, habitats at the periphery of the Project area would be classed as limited value use areas.

Mammals

Seventy-eight species of mammals, as listed by Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, are believed to be potential inhabitants of the biogeographic area in which the permit area is located. However, only 50 mammal species are classified as possible residents of the permit area. Ten of these 50 species are known inhabitants of the mine plan area based on visual observations during site reconnaissance surveys in 1994 or previous site-specific efforts by other researchers. Of the 31 potential State high-interest species possible in the region, the occurrence of 17 are either known, likely, or possible in the permit area.

The dwarf shrew is a yearlong inhabitant of the West Tavaputs Plateau and its substantial use area is defined as any open grassland in the submontane or montane ecological associations. Because of limited population numbers, occupied habitats should be ranked as being high-priority for this species.

The red bat is a summer resident of the West Tavaputs Plateau and utilizes wooded areas (riparian and piñon-juniper woodlands) of the submontane ecological association for roosting. Therefore, these areas are classed as substantial

value use areas for the red bat. Occasionally a few individuals may utilize caves for roosting, and in this circumstance it would not be unexpected for these individuals to hibernate over winter.

The western big-eared bat is a year-round resident of the West Tavaputs Plateau which roosts and hibernates in caves, mine tunnels, or suitable buildings located in the piñon-juniper woodland, mixed brush, and low elevation spruce-fir habitats of the submontane and montane ecological associations. These areas represent this species' substantial value use area.

The snowshoe hare is also a yearlong resident of the West Tavaputs Plateau, however, its relative abundance has been determined to be limited. Its substantial use area is also limited to the spruce-fir, aspen, and riparian habitats of the montane ecological association, but due to limited populations these areas are classified as high-priority during the breeding season. Cottontail rabbits (mountain cottontail above 7,000 feet elevation and Nuttall's cottontail below 7,000 feet) are also yearlong residents and the entire proposed permit area would be ranked as a substantial value use area for these species. During the breeding period between April and July the use area would be considered to be critical for maintenance of viable cottontail populations.

The northern flying squirrel is a yearlong resident of the West Tavaputs Plateau, however, its relative abundance is unknown. Its substantial use area is restricted to spruce-fir or mixed conifer habitats of the montane ecological association. Critical use periods occur during the bi-modal breeding season, from April through May and from August to September.

Beaver are yearlong residents of the West Tavaputs Plateau region, however, their substantial value use area is restricted to riparian and adjacent aspen habitats (within 100 meters of the riparian zone) in the cold desert, submontane, and montane ecological associations. Dams and lodges are of critical value to the maintenance of viable beaver populations as are riparian zones and flowing water.

Red fox and kit fox are year-round inhabitants of the West Tavaputs Plateau. Substantial value use areas for red fox extend through all habitats from the cold desert to the montane ecological associations. Substantial value use areas for kit fox are restricted to the habitats of the cold desert ecological association plus some of the sagebrush and piñon-juniper habitats of the submontane ecological association. Critical periods for both species occur during breeding and pup rearing.

Black bears inhabit much of the West Tavaputs Plateau as well as the proposed permit area and substantial value habitat includes all natural floral associations and physical circumstances in the submontane and montane ecological associations. Winter months, when the animals are in a state of semi-hibernation, are a critical period and dens are critical habitat features when occupied.

Several members of the mustelid family inhabit (or potentially inhabit) much of the West Tavaputs Plateau, and all are classified as furbearers. Members of this family include short- and long-tailed weasels, mink, black-footed ferret, marten, badger, striped and spotted skunks, river otter, and wolverine. Although not mustelids, raccoon and muskrat are also furbearers found in the West Tavaputs Plateau. All furbearers are of high interest to the State of Utah due to their commercial value. Substantial value habitat for weasels, mink, muskrat, and raccoons is the riparian vegetation association. Weasels also make use of other habitats proximal to riparian areas, with the long-tailed weasel occupying ecological associations from the cold desert into the montane and the short-tailed weasel (as well as mink) occupying ecological associations from the submontane to the montane. Muskrats and raccoons are restricted to riparian habitats of the cold desert and submontane ecological associations. The river otter is not known to inhabit the general vicinity of the permit area. The substantial use area for marten and wolverine is the montane ecological association, although the wolverine can be found in subalpine and alpine ecological associations. Of these two, only the wolverine has potential to exist in the proposed permit area, however, the potential for this to occur is extremely small. The black-footed ferret, a Federally listed Endangered species, is primarily dependent upon prairie dogs as a prey source, therefore, the substantial value use area for this species is restricted to prairie dog colonies (which do not occur within the permit area). Substantial value use areas for badger and skunks span all wildlife habitats, other than dense forest, from the cold desert to the montane ecological association. The period of time for breeding and young-rearing is critical for all furbearers.

Bobcat, Canada lynx, and mountain lion are also known to variably inhabit the West Tavaputs Plateau, and critical periods for these species are also breeding and kitten-rearing intervals. The substantial value use area for bobcats extends from the cold desert into the montane ecological association. Bobcats are normally associated with very

rugged terrain, but may frequent all wildlife habitats within the Canadian life zone. The substantial value use area for Canada lynx is restricted to the Canadian and Hudsonian life zones of the montane ecological association. Habits are similar to those of the bobcat, however, the potential for lynx to occur in the proposed permit area is extremely remote. Mountain lion substantial use areas extend from the submontane into the montane ecological associations and parallels the seasonal distribution of local mule deer herds due to the dependency of lions on deer as their principal prey.

Mule deer (herd units 27b and 32) are common yearlong inhabitants of the West Tavaputs Plateau with substantial value use areas spanning all wildlife habitats from the cold desert to the montane ecological associations. Some vertical migration occurs in response to seasonal changes, resulting in concentration of deer populations in lowland areas during winter months. These concentration areas, known as winter range, are variably utilized depending on the severity of the winter. In all cases, this winter range is defined as high-priority for mule deer. During more severe winters and certain times of any given winter, the most concentrated use defines the most critical winter range for the general maintenance of the mule deer population. These critical winter range areas, with regard to the permit area, are shown on the Regional Wildlife Map (Map 7). In addition to winter range areas, the permit area offers high-priority summer range for herd unit 32. Although no specific areas are known, fawning grounds for this herd unit likely occur within the permit area. Use of fawning grounds during critical periods (June), would be considered to be of critical value to the mule deer population.

Rocky mountain elk are occasional inhabitants of the West Tavaputs Plateau with substantial use areas spanning all wildlife habitats from the submontane through the montane ecological association. The local elk population does not exhibit as strong a vertical migration as mule deer, however, such a migration does exist resulting in some concentration during the winter months. These concentration areas, known as winter range, are variably utilized depending on the severity of the winter. In all cases, winter range is defined as high-priority for elk. During more severe winters and certain times of any given winter, the most concentrated use defines the most critical winter range for the maintenance of the elk population. These critical winter range areas, with regard to the proposed permit area, are represented on the Regional Wildlife Map (Map 7). Based on the mapping information, almost the entire permit area lies within the designated critical elk winter range. Although no specific areas are known, calving grounds for this herd unit likely occur within the permit area. Use of calving ground during critical periods (June), would be considered to be of critical value to the elk population.

3.3.2.3 Wildlife Summary

While the permit area occupies only a small portion of the West Tavaputs Plateau, it has essentially the same characteristic associated habitats and faunal resource potentials and is a typical representation of the Transitional and Canadian life zones in this part of Utah. Given these associations and characteristics, the permit area provides potential habitat for approximately 312 species of vertebrate wildlife, including; 18 fish species, 5 amphibians, 15 reptile species, 196 birds, and 78 mammals. Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, identifies those species known to occur in this general area as well as the likelihood of occurrence in the permit area. Included on this list are several species of wildlife considered to be of "high interest" to the State of Utah. High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific, or educational significance. Included in this category are those species of wildlife listed as Federally Endangered or Threatened.

Although wildlife occurrence and habitat values in the general permit area are typical for this part of Utah, the surface disturbance areas (main facilities area and monitoring well locations) have generally been extensively disturbed by previous mining and other related activities. Therefore, the value and utility of these areas to indigenous wildlife has already been substantially reduced if not entirely precluded. In effect, the potential for any adverse impacts to wildlife habitats in the previously disturbed areas has already been largely realized and redisturbance of these areas is not expected to result in any significant incremental impacts.

3.3.3 Fish and Aquatic Information

3.3.3.1 Aquatic Communities

Game Fish

Willow Creek is considered to be a Class 4 fishery by UDWR, which is defined as a stream with low recreational fishing potential. Game fish species expected to occur in Willow Creek include rainbow trout (*Oncorhynchus mykiss*), Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), and brown trout (*Salmo trutta*). Based on the electro-shocking survey conducted at six locations on October 12, 1994, only one rainbow trout (total length = 8.5 inches) was collected at WC-3. Results of the 1994 fish sampling efforts are summarized by Table 3.3-2, Number of Fish Collected in Willow Creek. Discussions with UDWR indicated that trout species likely occur in relatively low numbers in Willow Creek (Christopherson 1994; Phippen 1994). Since spawning conditions are poor in this section of Willow Creek, the primary use by trout species is considered to be as a migration route (Phippen 1994). The sporadic occurrence of trout in lower Willow Creek is primarily related to the seasonal spawning migrations and habitat limitations. Rainbow and Yellowstone cutthroat trout are suspected to move from the Price River into Willow Creek and other tributaries during their spring spawning periods (usually early May through June for Yellowstone cutthroat and mid-March through June for rainbow). Brown trout move into tributary streams in October. After spawning, adult fish migrate back to the Price River.

Trout in Willow Creek also may originate from upstream sources. Prior to 1994, fingerling rainbow trout were stocked in the upper portions of Willow Creek, although the UDWR has indicated that stocking of rainbow trout in Willow Creek may be discontinued (Christopherson 1994). During high flow periods, trout may be washed downstream into the lower portions of Willow Creek.

The Price River is also considered a Class 4 fishery. Game fish populations in the Price River downstream of the Willow Creek confluence are comprised of both warm water and cold water species. Game fish species include brown trout, Yellowstone cutthroat trout, rainbow trout, and channel catfish (*Ictalurus punctatus*). The section of the Price River from Helper to Price is characterized by relatively low flows due to irrigation diversions. UDWR surveys have shown that trout numbers are relatively low in this stretch. Based on an electro-shocking survey conducted near Helper in 1987, 7 and 28 trout were collected at two sampling locations (Janssen and Donaldson 1987). The highest catch was dominated by rainbow trout. The numbers of Yellowstone cutthroat and brown trout ranged from 1 to 4. Population studies were completed for a section of the Price River upstream of the Willow Creek confluence, which resulted in a trout density of 64 ± 6 for the sampled reaches (UDWR 1981). This population estimate would also be representative of the Price River from the Willow Creek confluence downstream to Helper. As a result of return flows, a more diverse fish community exists downstream of Wellington. Trout and channel catfish numbers are higher in this section of the Price River, compared to the section from Helper to Price (Christopherson 1994). Fingerling rainbow trout and brown trout are stocked in the Price River by UDWR. Yellowstone cutthroat trout, an introduced species, occurs in the small tributaries to the Price River. This species is no longer stocked in the Price River drainage.

Non-game Fish

Non-game fish species in Willow Creek consist of speckled dace (*Rhinicthys osculus*) and mountain sucker (*Catostomus platyrhynchus*). The results of the October 1994 survey indicated that species abundance varied from 5 to 30 individuals/300-ft section at the six sampling locations as shown by Table 3.3-2, Number of Fish Collected in Willow Creek. During years with higher flows, other minnow species that are found in the region may occur in Willow Creek as documented by Table 3.3-2.

Non-game fish species in the Price River downstream of the Willow Creek confluence are similar to regional lists. UDWR surveys have collected flannelmouth sucker, mountain sucker, bluehead sucker, mottled sculpin, carp, Utah chub, longnose dace, speckled dace, and redside shiner (UDWR 1981; Janssen and Donaldson 1987).

TABLE 3.3-2
NUMBER OF FISH COLLECTED IN WILLOW CREEK, OCTOBER 12, 1994

Common Name	Scientific Name	WC-1R	WC-2	WC-3	WC-4	WC-5	WC-6
Mountain sucker	*Catostomus platyrhynchus*	26	18	28	14	13	5
Speckled dace	*Rhinichthys osculus*	30	12	17	13	12	9
Rainbow trout	*Oncorhynchus mykiss*	0	0	1	0	0	0

Macroinvertebrates

The results of the October 1994 macroinvertebrate sampling in Willow Creek are summarized in Table 3.3-3, Summary of Macroinvertebrate Survey in Willow Creek, October 1994. Detailed results are provided for each sample in Exhibit 6, Vegetation, Fish and Wildlife Information. The October sampling revealed relatively low macroinvertebrate densities and number of taxa at all locations. Total densities ranged from 12.5 individuals/ft^2 at WC-5 to 53 individuals/ft^2 at WC-1R. These densities are similar to the results of a macroinvertebrate survey that was conducted near Helper (25 individuals/ft^2) (Janssen and Donaldson 1987). Using the rating criteria developed for fish food (i.e., macroinvertebrate) abundance by Binns (1982), total densities represented a rating of 0 (<25 individuals/ft^2 at WC-4, WC-5, and WC-6; and a rating of 1 (25 to 99 individuals/ft^2) at WC-1R, WC-2, and WC-3. The lowest number of macroinvertebrate taxa was found at two of the downstream locations (7 at WC-4 and 9 at WC-5). The other four locations supported 13 to 20 taxa, which is still considered a low number of taxa in a Surber sample. The number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa (referred to as the EPT Index) and the EPT abundances also were low at all locations. Since relatively low densities and few taxa were shown for these indicator groups, water quality and habitat conditions were considered low quality. The drought conditions in 1994 also likely contributed to the low macroinvertebrate productivity.

Shannon species diversity indices were calculated for each sampling location, which provided an indication of the density distribution among the various taxa. Diversity values less than 2 generally indicate a possible stressed biological community, as shown by the dominance of relatively few, tolerant taxa. In the Willow Creek study, the upstream locations (WC-1R, WC-2, and WC-3) showed mean diversities ranging from 1.78 to 2.31 as summarized by Tables 3.3-4, 3.3-5, and 3.3-6, Benthic Macroinvertebrate Densities and Composition (Locations WC-1R through WC-3). In contrast, diversity indices at the downstream locations (WC-4, WC-5, and WC-6) were lower, with values from 1.15 to 1.66 as shown on Tables 3.3-7, 3.3-8, and 3.3-9, Benthic Macroinvertebrate Densities and Composition (Locations WC-4 through WC-6).

The most abundant taxon at five of the six sampling locations was the mayfly, *Tricorythodes*, which comprised about 18 to 45 percent of the total macroinvertebrate densities. This particular mayfly is tolerant of silt conditions by modifications in its gill structures (Merritt and Cummins 1984). Other dominant taxa (i.e., taxa comprising >5 percent of the total densities at a location) included Tanypodinae chironomid midges, oligochaetes (worms), caddisflies (*Hydropsyche* and *Baetis* spp.), mayflies (*Heptagenia*), Elmidae beetles (*Optioservus*), and dragonflies (*Argia*). The midges, oligochaetes, and beetles also are able to tolerate silt conditions.

3.3.3.2 Aquatic Habitat

The portion of Willow Creek located within the mining and related activities study area is characterized as a narrow, high gradient stream that receives drainage from numerous steep canyons and washes. The majority of the channel adjacent to the proposed mine facilities area exhibits only slight meanders; several large meanders exist in the lower portion of the stream just upstream of the confluence with the Price River. Mean stream widths vary from about 5 to 7 feet during the low flow period.

TABLE 3.3-3
SUMMARY OF MACROINVERTEBRATE SURVEY IN WILLOW CREEK
OCTOBER 10 AND 11, 1994

Type of Information	Sampling Locations					
	WC-1R	WC-2	WC-3	WC-4	WC-5	WC-6
Total Number of Taxa	15	17	20	7	9	13
EPT Index[1]	5	7	8	1	4	5
EPT Abundance (No./Ft^2)	27.5	23.5	22.0	8.0	9.5	7.5
Total mean Density (No./Ft^2)	53.0	34.5	39.5	18.5	12.5	16.5
Mean Species Diversity	1.78	1.90	2.31	1.29	1.15	1.66
Dominant Taxa[2]	*Tricorythodes* (mayfly) [44.3 %] *Tanypodinae* (midges) [13.2 %] *Optiodervus* (Elmid bettle) [9.4 %] *Ceratopogonidae* (Biting midges) [7.5 %]	*Tricorythodes* (mayfly) [44.9 %] *Baetis sp. 2* (caddisfly [11.6 %] *Tanytarsini* (midges) [7.2 %] *Optiodervus* (Elmid bettle) [7.2 %]	*Hydropsyche* (caddisfly) [19.0 %] *Oligochaetes* (worms) [16.5 %] *Tricorythodes* (mayfly) [8.9 %] *Heptagenia* (mayfly) [8.9 %] *Baetis sp 2* (mayfly) [6.3%] *Tanypodinae* (midges) [6.3 %]	*Tricorythodes* (mayfly) [43.2 %] *Optiodervus* (Elmid bettle) [27.0 %] *Tanypodinae* (midges) [8.1 %] *Oligochaetes* (worms) [8.1 %]	*Tricorythodes* (mayfly) [28.0 %] *Heptagenia* (mayfly) [24.0 %] *Baetis sp. 2* (mayfly) [20.0 %] *Tanypodinae* (midges) [8.0 %]	*Tricorythodes* (mayfly) [18.2 %] *Hydropsyche* (caddisfly) [15.2 %] *Oligochaetes* (worms) [12.1 %] *Tanypodinae* (midges) [9.1 %] *Heptagenia* (caddisfly) [6.1 %] *Argia* (dragonfly) [6.1 %]

[1] EPT Index = Number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) taxa.
[2] Dominant Taxa = Comprised ≥5 percent of the total macroinvertebrate density.

TABLE 3.3.4
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-1R (REFERENCE) IN WILLOW CREEK
OCTOBER 11, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-1R Rep 1 No./ft^2	WC-1R Rep 2 No./ft^2	WC-1R Mean No./ft^2	WC-1R %
Ephemeroptera (Mayflies)						
Baetidae	*Baetis sp. 2*	CG	1	1	1.0	1.89%
Tricorythidae	*Tricorythodes*	CG	27	20	23.5	44.34%
Total Ephemeroptera			28	21	24.5	46.23%
Trichoptera (Caddisflies)						
Hydropsychidae	*Hydropsyche*	FC	2	1	1.5	2.83%
Hydroptilidae	*Ochrotrichia*	PH	0	1	0.5	0.94%
Leptoceridae	*Oecetis*	P	2	0	1.0	1.89%
Total Coleoptera			4	2	3.0	5.66%
Coleoptera (Beetles)						
Elmidae (larvae)	*Optiodervus*	Sc	4	6	5.0	9.43%
Total Coleoptera			4	6	5.0	9.43%
Diptera (Flies, Mosquitos, Midges)						
Ceratopogonidae		P	7	1	4.0	7.55%
Chironomidae	*Chironomini*	CG	5	0	2.5	4.72%
Chironomidae	*Orthocladiinae*	Sc	1	2	1.5	2.83%
Chironomidae	*Tanytarsini*	FC	2	0	1.0	1.89%
Tipulidae	*Limnophila*	P	0	1	0.5	0.94%
Tipulidae	*Tipula*	Sh	0	1	0.5	0.94%
Total Diptera			28	6	17.0	32.08%
Total Chironomidae			21	3	12.0	22.64%
Amphipoda (Scuds)						
Taltridae	*Hyalella*		1	0	0.5	0.94%
Total Amphipoda			1	0	0.5	0.94%
Ogligochaeta (Worms, Polychaetes)			2	4	3.0	5.66%
TOTAL DENSITIES			67	39	53.0	100.0%
TOTAL TAXA			12	11		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

TABLE 3.3-5
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-2 IN WILLOW CREEK
OCTOBER 11, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-2 Rep 1 No./ft^2	WC-2 Rep 2 No./ft^2	WC-2 Mean No./ft^2	WC-2 %
Ephemeroptera (Mayflies)						
Baetidae	*Baetis sp. 1*	CG	2	1	1.5	4.35%
Baetidae	*Baetis sp. 2*	CG	2	6	4.0	11.59%
Ephemerellidae	*Ephemerella*	CG	0	1	0.5	1.45%
Heptageniidae	*Heptagenia*	Sc	1	0	0.5	1.45%
Tricorythidae	*Tricorythodes*	CG	23	8	15.5	44.93%
Total Ephemeroptera			28	16	22.0	63.77%
Plecoptera (Stoneflies)						
Perlodidae	*Isoperla*	P	1	0	0.5	1.45%
Trichoptera (Caddisflies)						
Hydropsychidae	*Hydropsyche*	FC	1	1	1.0	2.90%
Total Coleoptera			1	1	1.0	2.90%
Coleoptera (Beetles)						
Elmidae (larvae)	*Optiodervus*	Sc	3	2	2.5	7.25%
Total Coleoptera			3	2	2.5	7.25%
Diptera (Flies, Mosquitos, Midges)						
Ceratopogonidae		P	1	0	0.5	1.45%
Chironomidae	*Chironomini*	CG	2	1	1.5	4.35%
Chironomidae	*Orthocladiinae*	Sc	0	3	1.5	4.35%
Chironomidae	*Tanytarsini*	FC	2	3	2.5	7.25%
Psychodidae	*Pericoma*	CG	0	1	0.5	1.45%
Tipulidae	*Tipula*	Sh	0	1	0.5	1.45%
Total Diptera			6	9	7.5	21.74%
Total Chironomidae			5	7	6.0	17.39%
Collembola (Springtails)			1	0	0.5	1.45%
Oligochaeta (Worms, Polychates)			1	0	0.5	1.45%
TOTAL DENSITIES			41	28	34.5	100.0%
TOTAL TAXA			13	11		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

TABLE 3.3-6
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-3 IN WILLOW CREEK
OCTOBER 11, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-3 Rep 1 No./ft^2	WC-3 Rep 2 No./ft^2	WC-3 Mean No./ft^2	WC-3 %
Ephemeroptera (Mayflies)						
Baetidae	*Baetis sp. 1*	CG	0	4	2.0	5.06%
Baetidae	*Baetis sp. 2*	CG	0	5	2.5	6.33%
Ephemerellidae	*Ephemerella*	CG	0	2	1.0	2.53%
Heptageniidae	*Heptagenia*	Sc	2	5	3.5	8.86%
Tricorythidae	*Tricorythodes*	CG	0	7	3.5	8.86%
Total Ephemeroptera			2	23	12.5	31.65%
Trichoptera (Caddisflies)						
Hydropsychidae	*Hydropsyche*	FC	3	12	7.5	18.99%
Leptoceridae	*Oecetis*	P	2	0	1.0	2.53%
Limnephilidae	*Onocosmoecus*	Sh	0	2	1.0	2.53%
Total Trichoptera			5	14	9.5	24.05%
Odanata (Dragonflies and Damselflies)						
Coenagrionidae	*Argia*	P	0	2	1.0	2.53%
Gomphidae	*Ophogomphus*	P	1	0	0.5	1.27%
Total Odanata			1	2	1.5	3.80%
Coleoptera (Beetles)						
Elmidae (larvae)	*Optiodervus*	Sc	0	5	2.5	6.33%
Elmidae (adults)	*Optioservus*	Sc	0	1	0.5	1.27%
Total Coleoptera			0	6	3.0	7.59%
Diptera (Flies, Mosquitos, Midges)						
Chironomidae	*Chironomini*	CG	1	0	0.5	1.27%
Chironomidae	*Tanytarsini*	FC	1	2	1.5	3.80%
Chironomidae	*Tanypodinae*	P	1	4	2.5	6.33%
Simuliidae	*Simulium*	CG	0	1	0.5	1.27%
Tipulidae	*Hexatoma*	P	1	0	0.5	1.27%
Tipulidae	*Tipula*	Sh	0	1	0.5	1.27%
Total Diptera			4	8	6.0	15.19%
Total Chironomidae			3	6	4.5	11.39%
Gastropoda (Snails)						
Lymneeidae	*Lymnaea*	Sc	1	0	0.5	1.27%
Oligochaeta (Worms, Polychates)		CG	3	10	6.5	16.46%
TOTAL DENSITIES			**16**	**63**	**39.5**	**100.0%**
TOTAL TAXA			**10**	**15**		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

TABLE 3.3-7
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-4 IN WILLOW CREEK
OCTOBER 11, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-4 Rep 1 No./ft^2	WC-4 Rep 2 No./ft^2	WC-4 Mean No./ft^2	WC-4 %
Ephemeroptera (Mayflies)						
Tricorythidae	*Tricorythodes*	CG	1	15	8.0	43.24%
Total Ephemeroptera			1	15	8.0	43.24%
Odonata (Dragonflies and Damselflies)						
Coenagrionidae	*Argia*	P	1	2	1.5	8.11%
Total Odonata			1	2	1.5	8.11%
Coleoptera (Beetles)						
Elmidae (larvae)	*Optiodervus*	Sc	6	4	5.0	27.03%
Elmidae (adults)	*Optioservus*	Sc	0	1	0.5	2.70%
Total Coleoptera			6	5	5.5	29.73%
Diptera (Flies, Mosquitos, Midges)						
Chironomidae	*Tanypodinae*	P	1	2	1.5	8.11%
Tipulidae	*Tipula*	Sh	1	0	0.5	2.70%
Total Diptera			2	2	2.0	10.81%
Total Chironomidae			1	2	1.5	8.11%
Oligochaeta (Worms, Polychaetes)		CG	0	3	1.5	8.11%
TOTAL DENSITIES			**10**	**27**	**18.5**	**100.0%**
TOTAL TAXA			**5**	**6**		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

TABLE 3.3-8
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-5 IN WILLOW CREEK
OCTOBER 10, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-5 Rep 1 No./ft²	WC-5 Rep 2 No./ft²	WC-5 Mean No./ft²	WC-5 %
Ephemeroptera (Mayflies)						
Baetidiae	*Baetis sp. 2*	CG	2	3	2.5	20.0%
Heptageniidae	*Heptagenia*	Sc	1	5	3.0	24.0%
Tricorythidae	*Tricorythodes*	CG	7	0	3.5	28.0%
Total Ephemeroptera			10	8	9.0	72.0%
Trichoptera (Caddisflies)						
Hydropsychidae	*Hydropsyche*	FC	1	0	0.5	4.0%
Total Trichoptera			1	0	0.5	4.0%
Coleoptera (Beetles)						
Elmidae (larvae)	*Optiodervus*	Sc	0	1	0.5	4.0%
Total Coleoptera			0	1	0.5	4.0%
Diptera (Flies, Mosquitos, Midges)						
Ceratopogonidae		P	1	0	0.5	4.0%
Chironomidae	*Tanypodinae*	P	2	0	1.0	8.0%
Total Diptera			3	0	1.5	12.0%
Total Chironomidae			1	0	0.5	4.0%
Gastropoda (Snails)						
Lymnaeidae	*Lymnaea*	Sc	0	1	0.5	4.0%
Planorbidae	*Gyraulus*	Sc	1	0	0.5	4.0%
Total Gasropoda			1	1	1.0	8.0%
TOTAL DENSITIES			**15**	**10**	**12.5**	**100.0%**
TOTAL TAXA			**7**	**4**		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

TABLE 3.3-9
BENTHIC MACROINVERTEBRATE DENSITIES AND COMPOSITION AT LOCATION WC-6 IN WILLOW CREEK
OCTOBER 10, 1994

Order/Family (Common Name)	Genus/Species (or Tribe)	Feeding Group*	WC-6 Rep 1 No./ft^2	WC-6 Rep 2 No./ft^2	WC-6 Mean No./ft^2	WC-6 %
Ephemeroptera (Mayflies)						
Baetidiae	*Baetis sp. 1*	CG	0	1	0.5	3.03%
Baetidae	*Baetis sp. 2*	CG	1	0	0.5	3.03%
Heptageniidae	*Heptagenia*	Sc	1	1	1.0	6.06%
Tricorythidae	*Tricorythodes*	CG	3	3	3.0	18.18%
Total Ephemeroptera			5	5	5.0	30.30%
Trichoptera (Caddisflies)						
Hydropsychidae	*Hydropsyche*	FC	3	2	2.5	15.15%
Total Trichoptera			3	2	2.5	15.15
Odonata (Demselflies and Dragonflies)						
Coenagrionidae	*Argia*	P	0	2	1.0	6.06%
Total Odonata			0	2	1.0	6.06%
Coleoptera (Beetles)						
Dryopidae (adults)	*Helichus*	Sc	0	1	0.5	3.03%
Elmidae (larvae)	*Optiodervus*	Sc	2	3	2.5	15.15%
Total Coleoptera			2	4	3.0	18.18%
Diptera (Flies, Mosquitos, Midges)						
Ceratopogonidae		P	1	0	0.5	3.03%
Chironomidae	*Tanypodinae*	P	1	2	1.5	9.09%
Chironomidae	*Tanytarsini*	FC	0	1	0.5	3.03%
Tabanidae	*Chrysops*	CG	0	1	0.5	3.03%
Total Diptera			2	4	3.0	18.18%
Total Chironomidae			1	0	0.5	3.03%
Oligochaeta (Worms, Polychaetes)		CG	2	2	2.0	12.12%
TOTAL DENSITIES			**14**	**19**	**16.5**	**100.0%**
TOTAL TAXA			**8**	**11**		

* Feeding Groups: Collector Gatherers (CG), Filterer Collectors (FC), Predators (P), Scrapers (Sc), Piercers Herbivores (PH), and Shredders (Sh).

The overall quality of aquatic habitat in this section of Willow Creek is limited due to erosion, siltation, and relatively low flows during most months, except during spring runoff and after large thunderstorm events. Based on a habitat characterization survey conducted on October 10 and 11, 1994, a thick silt/clay layer was evident on the rock surfaces in both pools and riffles. The dominant substrate sizes in pools were clay, silt, and rubble (cobble), while riffle substrates were dominated by clay, silt, rubble, and boulder sized materials as shown on Table 3.3-10, Summary of Habitat Characteristics in Willow Creek, October 1994. Riffles represented the major type of habitat at most of the habitat characterization locations. Due to the relatively low flow conditions at the time of the survey (approximately 1.5 cubic ft/sec), depths and velocities were relatively low in both pools and riffles. Maximum depths in most pools ranged from about 1 to 2 ft. Pool habitat is created by the presence of numerous large boulders at scattered locations throughout the stream. A series of five pools occur immediately downstream of an existing road culvert (approximately 400 ft upstream of location H-5), which collectively represent the largest quantity of deep, pool habitat in the proposed mining and related activities study area. The total length of the pools was approximately 100 ft, with maximum depths of approximately 1 to 3.5 ft. A series of concrete steps were constructed by UDWR in this area to serve as a fish ladder.

The quality of cover for fish communities also is limited due to relatively low flows during most months. During the October 1994 survey, limited amounts of cover were provided by rubble and boulder substrates, overhanging riparian vegetation (mainly small willows and grasses), and instream debris such as tree limbs. Undercut banks were generally absent throughout this section of Willow Creek. The accumulation of boulders at several locations in the stream create vertical drops of about 1 to 2 ft. These drops would restrict upstream fish movement during low flow periods. However, increased depths during spring runoff and after storm events would allow upstream fish movement. The quantity of substrate cover for fish also would increase in response to increased water volumes during high flow periods. As a result of the silt and clay layer on the bottom substrate, aquatic vegetation growth is limited.

Using the habitat rating system developed by Binns (1982), habitat attributes in Willow Creek were considered to be low quality. Based on a scale of 0 (lacking) to 5 (excellent), the following ratings (shown in parentheses) were made for the selected habitat attributes:

- Substrate (1) - Little submerged aquatic vegetation;
- Cover (1) - Cover ranging from about 10 to 25 percent of the total area surveyed;
- Width (1) - Widths ranging from about 2 to 6 feet; and
- Velocity (1) - Average velocities ranging from 0.25 to 0.49 ft/sec.

3.3.3.3 Aquatic Biota and Habitat Information Summary

Aquatic habitat in the lower portion of Willow Creek is limited due to the presence of a silt/clay layer on the rock surfaces, small size of the stream, relatively low flows during most months, and limited amounts of cover provided by substrates, instream debris, and overhanging riparian vegetation. Increased surface flows in average and wet years would provide some additional cover and habitat for fish and macroinvertebrate communities, although cover is still expected to be limited.

The abundance and diversity of fish and macroinvertebrate communities in Willow Creek are a reflection of the limiting habitat conditions. Game fish populations are represented by trout (brown, rainbow, and Yellowstone cutthroat) that are suspected to move into Willow Creek during the spring and fall spawning migrations. Trout also may be washed downstream into the lower portion of Willow Creek during high flow periods. Resident fish populations are comprised of non-game species such as speckled dace and mountain sucker. Macroinvertebrate communities in October 1994 exhibited relatively low densities, number of taxa, and species diversities. Macroinvertebrate densities, diversity indices, and the EPT Index were slightly higher at the upstream locations (WC-1R, WC-2, and WC-3) compared to the downstream locations (WC-4, WC-5, and WC-6). Although these data suggested slight improvements in habitat and water quality conditions in the upper portion of the study area, the overall quality rating would still be considered low. The presence of the thick silt/clay layer on the stream substrates limited the development of a productive and diverse macroinvertebrate community. Drought conditions in 1994 also likely contributed to the low fish and macroinvertebrate numbers and diversity.

TABLE 3.3-10
SUMMARY OF HABITAT CHARACTERISTICS IN WILLOW CREEK
OCTOBER 10 AND 11, 1994

Habitat Features	Reference (H-1R)	Proposed Bridge Crossing (H-2)	Adjacent to Cemetery (H-3)	Upper Diversion Segment (H-4)	Lower Diversion Segment (H-5)	Possible Road Crossing (H-6)	Lower Willow Creek (H-7)
Pool/Riffle Ratio (Length)	0.44	0.54	0.74	0.34	0.64	0.64	0.86
Pool/Riffle Ratio (Area)	0.19	0.52	1.02	0.24	0.72	0.67	1.18
Pools							
Range in Length (Ft)	5-48	6-45	5-30	8-28	4-55	5-28	8.38
Mean Length (Ft)	19	16	16	16	21	14	16
Range in Mean Depth (Ft)	0.5-1.4	0.4-1.5	0.8-2.8	0.7-1.4	0.5-1.2	0.6-1.3	0.6-1.6
Mean Width (Ft)	6	7	7	5	6	6	7
Velocity Range (Ft/Sec)	<0.1-0.3	<0.1-0.3	<0.1-0.3	<0.1-0.2	<0.1-0.3	<0.1-0.1	<0.10-0.1
Riffles							
Range in Length (Ft)	18-128	20-88	3-38	10-132	4-78	20-78	2-65
Mean Length (Ft)	58	40	17	47	27	36	19
Range in Mean Depth (Ft)	0.5-0.6	0.4-0.6	0.3-0.5	0.3-0.5	0.3-0.6	0.4-0.5	0.2-0.3
Mean Width (Ft)	7	7	6	6	5	6	6
Velocity Range (Ft/Sec)	0.7-1.4	0.5-1.4	0.6-1.8	0.6-1.2	0.4-2.0	0.2-0.4	0.3-0.6
Dominant Substrate							
Pools	Clay, silt, and rubble (cobble) at all locations						
Riffles	Clay, silt, and rubble	Clay, silt, and rubble	Clay, silt, and boulder	Clay, silt, and boulder	Clay, silt, and boulder	Clay, silt, and rubble	Clay, silt, and rubble

3.3.4 Threatened, Endangered, and Sensitive Species

3.3.4.1 Consultation Process

The Endangered Species Act of 1973 (the Act) requires Federal agencies to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species." Section 4 of the Act (Determination of Endangered Species or Threatened Species) grants the Secretary of the Interior power to determine whether any species is considered threatened or endangered. While Section 7 of the Act (Interagency Cooperation) specifies that all other Federal departments and agencies shall, take such action necessary to insure that actions authorized, funded, or carried out by them (Federal departments and agencies) do not jeopardize the continued existence of any listed species (pursuant to Section 4) or result in the destruction or modification of critical habitat of such species."

The consultation process is designed to assist Federal agencies when complying with the Act, and authority of consultation has been delegated by the Secretary of the Interior to the Director of the U.S. Fish and Wildlife Service (USFWS). The consultation process involves several phases. First, a general description of the proposed action and a formal request for a listing of proposed and listed endangered and threatened species potentially affected by the proposed action is submitted to the USFWS by the affected agency (or entity). The USFWS responds with a list of proposed, candidate, and listed species within the proposed permit area. When the project is a construction project, the agency (or entity) then prepares a Biological Assessment which identifies the project, details the biology of the species on the list submitted by the USFWS, analyzes the cumulative effects of the project, and determines if there is likely to be an effect (either beneficial or adverse) on any listed or proposed species. If a "may affect" determination is made, the responsible federal agency must request formal consultation with the USFWS.

Formal consultation involves USFWS consideration of the proposed project and how it may affect the biology of any listed threatened or endangered species, including the magnitude of such effects and potential cumulative effects. Based on this information, a Biological Opinion is issued by the USFWS which states one of three possible conclusions: the proposed action (1) may promote the continued existence of the species, (2) is not likely to jeopardize the continued existence of the species, or (3) is likely to jeopardize the continued existence of the species. Reasonable and prudent alternatives must be addressed by the USFWS as part of the Biological Opinion when a determination is made that the proposed project is likely to jeopardize the continued existence of the species.

3.3.4.2 Threatened, Endangered, and Sensitive Species Occurrence and Use of Area

In 1989, the UDOGM Abandoned Mine Reclamation Program (AMR) group initiated informal consultation with the USFWS regarding any listed threatened, endangered, or candidate species potentially occurring within AMR's Willow Creek reclamation project area which occurs within the primary facilities area of CPMC's proposed action . In response, a listing of Federal threatened, endangered, and candidate species potentially occurring in the vicinity of the AMR project area was provided by the U.S. Fish and Wildlife Service. Those species formally listed as threatened or endangered (or candidates) and potentially subject to project impacts, were identified as follows:

Listed Species

Bald Eagle	*Haliaeetus leucocephalus*
Humpback Chub	*Gila cypha*
Bonytail Chub	*Gila elegans*
Colorado Squawfish	*Ptychocheilus lucius*
Razorback Sucker	*Xyrauchen texanus*
Uinta Basin Hookless Cactus	*Sclerocactus glaucus*

Candidate Species

Creutzfeldt Catsyee	*Cryptantha creutzfeldtii*
Yellow Blanketflower	*Guilardia flava*
Canyon Sweetvetch	*Hedysarum occidentale* var. *conone*

Subsequently, Cedar Creek Associates, Inc., on behalf of CPMC, will request from the USFWS an updated listing of threatened, endangered, or candidate species potentially occurring within the proposed permit area. Those species formally listed as threatened or endangered and potentially subject to impacts from the project at that time, will be sufficiently evaluated through the process of a biological assessment, if necessary, as opposed to detailed effects analyses in this document. Development of such a biological assessment (if necessary) would occur following submittal of this application to UDOGM and will ensure compliance with any applicable provisions of the Endangered Species Act of 1973, P.L. 93-205 (87 Stat. 884), as amended.

Terrestrial

With regard to the permit area, potential habitat for 13 Federal candidate (Category 2) species and 5 listed threatened or endangered species exists according to UDWR records and based on current listings. The 13 candidate species are indicated on Table 3.3-1, Potential Wildlife Species of the West Tavaputs Plateau, and have previously been discussed in Section 3.3.2.1 as appropriate. The five listed species include: 1) Bald eagle; 2) Peregrine falcon; 3) Gray wolf; 4) Grizzly bear; and 5) Black-footed ferret. As indicated previously, the black-footed ferret's habitat (prairie dog colonies) does not exist within the proposed permit area, therefore, there is no potential for existence of this species in this area. The grizzly bear has been eliminated from this part of Utah for many years, despite the existence of potential habitat. Therefore, the potential for this species to exist within the proposed permit area is also non-existent. The gray wolf was an historic resident of the West Tavaputs Plateau, however, at present its numbers are so low that occurrence within the proposed permit area would be incidental at best, and given the animal's mobility, the proposed mining and related activities would have little or no effect if a transient animal happened to take up residence in the region. The American peregrine falcon could potentially exist in the mine plan area, and the steep escarpments of the Bookcliffs offer nesting habitat, however, the UDWR has indicated that no nests or resident falcons are known to exist in the vicinity of the proposed permit area.

With regard to the northern bald eagle, critical wintering areas exist a few miles to the southwest of the permit area as shown on the Regional Wildlife Map, (Map 7). At present, there are no known high-priority concentration areas or critical roost trees within proposed permit area boundaries, however, the proposed permit area has been classified as substantial value use area to wintering eagles due to foraging opportunities presented. No historical nesting by bald eagles is known to have occurred in this part of Utah, and foraging requisites for nesting activity are not available in the immediate area.

Aquatic

Potential habitat for two Federal candidate (Category 2) fish species, roundtail chub (*Gila robusta*) and leatherside chub (*G. copei*) exists in Willow Creek. Although these species historically occurred in the Price River and its tributaries, neither species has been recently identified or observed in Willow Creek (Christopherson 1994). Leatherside chub has been collected recently in the Price River upstream of the Willow Creek confluence.

Seven Federally listed or candidate fish species occur or could potentially occur in the Price River below the Willow Creek confluence. Potential habitat exists for three Federal candidate Category 2 species: roundtail chub, leatherside chub, and flannelmouth sucker (*Catostomus latipinnis*). The lower portions of the Price River near the Green River confluence contain potential habitat for four Federally listed endangered species: humpback chub (*Gila cypha*), bonytail chub (*G. elegans*), Colorado squawfish (*Ptychocheilus lucius*), and the razorback sucker (*Xyrauchen texanus*). Critical habitat also has been designated in the Green River downstream of the Price River confluence for the bonytail chub (Gray Canyon), humpback chub (Gray Canyon), Colorado squawfish (entire section between the Yampa and Colorado River confluences), and razorback sucker (entire section between the Yampa and Colorado River confluences) (US Fish and Wildlife Service 1994). Additional critical habitat reaches also have been designated in the Colorado River downstream of the Green River confluence.

CYPRUS
Plateau Mining

Cyprus Plateau Mining Corporation
P.O. Drawer PMC
Price, Utah 84501
(801) 637-2875

May 17, 1995

Mr. Bill Bates
Utah Division of Wildlife Resources
455 West Railroad Avenue
Price, UT 84501

Dear Mr. Bates,

RE: 1995 RAPTOR SURVEY - WILLOW CREEK MINE

On May 9, 1995 Mr. Ben Morris of your office and I conducted a raptor survey of the proposed Willow Creek Mine Site and area including the area encompassed by a half-mile radius circle around 6 drill sites as shown on the attached map.

There was very little activity, the attached table documents the results of the survey.

We are working on completing a Goshawk survey of the half-mile radius areas around the drill sites as required. When this survey is completed, we will forward the report to you.

Respectfully,

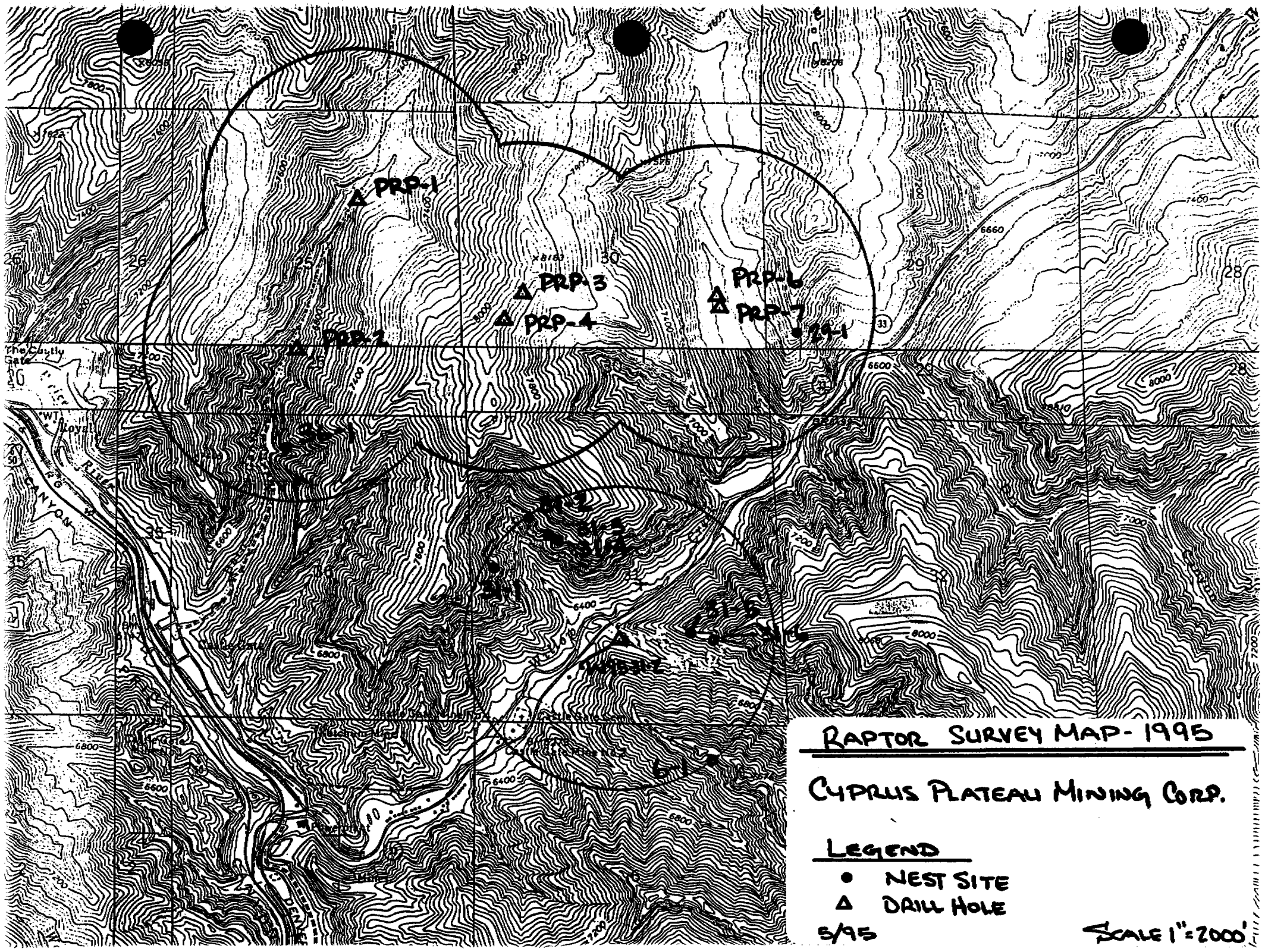
Ben Grimes
Sr. Staff Project Engineer

Attachments
File: WCENV 2.5.5.1.1
Chron: BG950506

Table 1
1995 Survey Results

Nest No.	Species	Status	No. of Young	Comments
36-1	Golden Eagle	I	0	Old dilapidated nest
31-1	Golden Eagle	I	0	3 nests, 2 are old
31-2	Golden Eagle	T	0	
31-3	Golden Eagle	I	0	
31-4	Golden Eagle	I	0	
31-5	Golden Eagle	I	0	
31-6	Golden Eagle	I	0	2 nests
6-1	Golden Eagle	I	0	2 old nests
29-1	Redtail or Raven	--	--	Small stick nest - not found

Key: I = Inactive
T = Tended
A = Active


PRP-1
PRP-2
PRP-3
PRP-4
PRP-6
PRP-7
29-1
RAPTOR SURVEY MAP- 1995
CYPRUS PLATEAU MINING CORP.
LEGEND
• NEST SITE
Δ DRILL HOLE
5/95
SCALE 1"=2000'

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
Robert G. Valentine
Division Director

Southeastern Region
455 West Railroad Avenue
Price, Utah 84501-2629
801-637-3310
801-637-7361 (Fax)

December 13, 1994

Ben Grimes, Environmental Engineer
Cyprus Plateau Mining
P.O. Drawer PMC
Price, Utah 84501

Dear Ben:

On October 20, 1994, Bill Bates of our staff assisted with a raptor survey of areas within the 0.5 mile buffer zone of 4 proposed core hole drilling sites in Price Canyon and Willow Creek. The following nest sites were located during that survey:

Species	Location	Condition
Golden Eagle	T 12 S, R 9 E, Sec. 36, NW NW	Used in past several years
Golden Eagle	T 12 S, R 9 E, Sec. 36, NE NW	Old and dilapidated
Buteo	T 12 S, R 10 E, Sec. 29, SW SW	Used in past several years

The first golden eagle nest is located on the opposite side of a ridge approximately 0.5 miles from drill site PRP-2. The buteo nest is within 0.5 miles of PRP-6 and 7. These nests should be checked for activity next spring if drilling activities are to occur during the nesting season, from February 15 to July 15.

Thank you for the opportunity to assist with this survey. If you have questions please contact Bill Bates, Habitat Manager.

Sincerely,

Miles Moretti
Regional Supervisor

copy: Ralph Miles

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
Robert G. Valentine
Division Director

Southeastern Region
455 West Railroad Avenue
Price, Utah 84501-2829
801-637-3310
801-637-7361 (Fax)

June 17, 1994

Keith H. Sieber
Vice President and General Manager
Cyprus Plateau Mining Corporation
P.O. Box PMC
Price, Utah 84501

Attn: Ben Grimes

Dear Mr. Sieber,

The following are the results of the annual raptor survey conducted on lands operated by Cyprus Plateau. The survey was conducted on June 6, 1994, by Bill Bates, Habitat Manager, and Ben Grimes, and included the mining property at Wattis and areas within a half-mile radius of proposed well monitoring sites in Dry Canyon, Panther Canyon, and Allrad Canyon.

Two active golden eagle nests were found near the Wattis mine. One was in Mudwater Canyon, and had a single nestling. The other active nest was on the cliff wall at Star Point. This was a new nest built underneath one of the fenced nests on the cliff face impacted by subsidence. As you recall, the fencing was removed from the two existing nests in September, 1992. This is the first successful nest on this wall since 1986. This pair did successfully fledge young from alternate nests in the area in 1987, 1990 and 1992.

No active nests were found within a half-mile of any of the proposed monitoring wells. One inactive golden eagle nest and an inactive raven nest was found near the proposed well site in Allrad Canyon. No nests were found in the half-mile radius of the well sites at the other locations during the survey. However, survey conditions were hampered by strong winds that may have resulted in observers missing one old golden eagle nest mapped in 1991. The location of this nest is included on the attached map. Although the status of this nest was not determined this year, it should not be impacted by drilling activities as it is shielded by a cliff wall. If a helicopter is used to access the site the status of the nest could be determined, or the flight path of the helicopter could avoid the area near the nest. Please inform us if it is found to be active.

The opportunity to cooperate with Cyprus Plateau on this project, and the information obtained has been valuable in evaluating the impact of longwall mining on raptors. As in the past, we appreciate the support and cooperation of your personnel.

Sincerely,

Miles Moretti
Regional Supervisor

copy: Robert Williams, U.S. Fish and Wildlife Service
John Kimball, DWR
Jim Karpowitz, DWR

ANNUAL RAPTOR SURVEY

Territory	Species	Number of Nests	Status	Number of Young
Serviceberry Canyon	Sharp-shinned hawk	Observed		
Serviceberry Canyon	Golden Eagle	7	Tended	
North Spring Canyon	Prairie Falcon	White Washed	Occupied	
Canyon East of Mud-Water	Golden Eagle	3	Inactive	
Mudwater Canyon	Golden Eagle	6	Active	1
Mudwater Canyon	Buteo	1	Inactive	
Los Angeles Canyon	Raven	1	Inactive	
Seeley Canyon	Golden Eagle	3	Tended	
Star Point	Golden Eagle	5	Active	1
Dry Canyon		No Nests Found		
Panther Canyon		No Nests Found, but 1 golden eagle nest mapped in 1991		
Allrad Canyon	Golden Eagle	1	Inactive	
Allrad Canyon	Raven	1	Inactive	

STAR POINT MINE

WILLOW CREEK

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
Robert G. Valentine
Division Director

Southeastern Region
455 West Railroad Avenue
Price, Utah 84501-2829
801-637-3310
801-637-7361 (Fax)

December 13, 1994

Ben Grimes, Environmental Engineer
Cyprus Plateau Mining
P.O. Drawer PMC
Price, Utah 84501

Dear Ben:

On October 20, 1994, Bill Bates of our staff assisted with a raptor survey of areas within the 0.5 mile buffer zone of 4 proposed core hole drilling sites in Price Canyon and Willow Creek. The following nest sites were located during that survey:

Species	Location	Condition
Golden Eagle	T 12 S, R 9 E, Sec. 36, NW NW	Used in past several years
Golden Eagle	T 12 S, R 9 E, Sec. 36, NE NW	Old and dilapidated
Buteo	T 12 S, R 10 E, Sec. 29, SW SW	Used in past several years

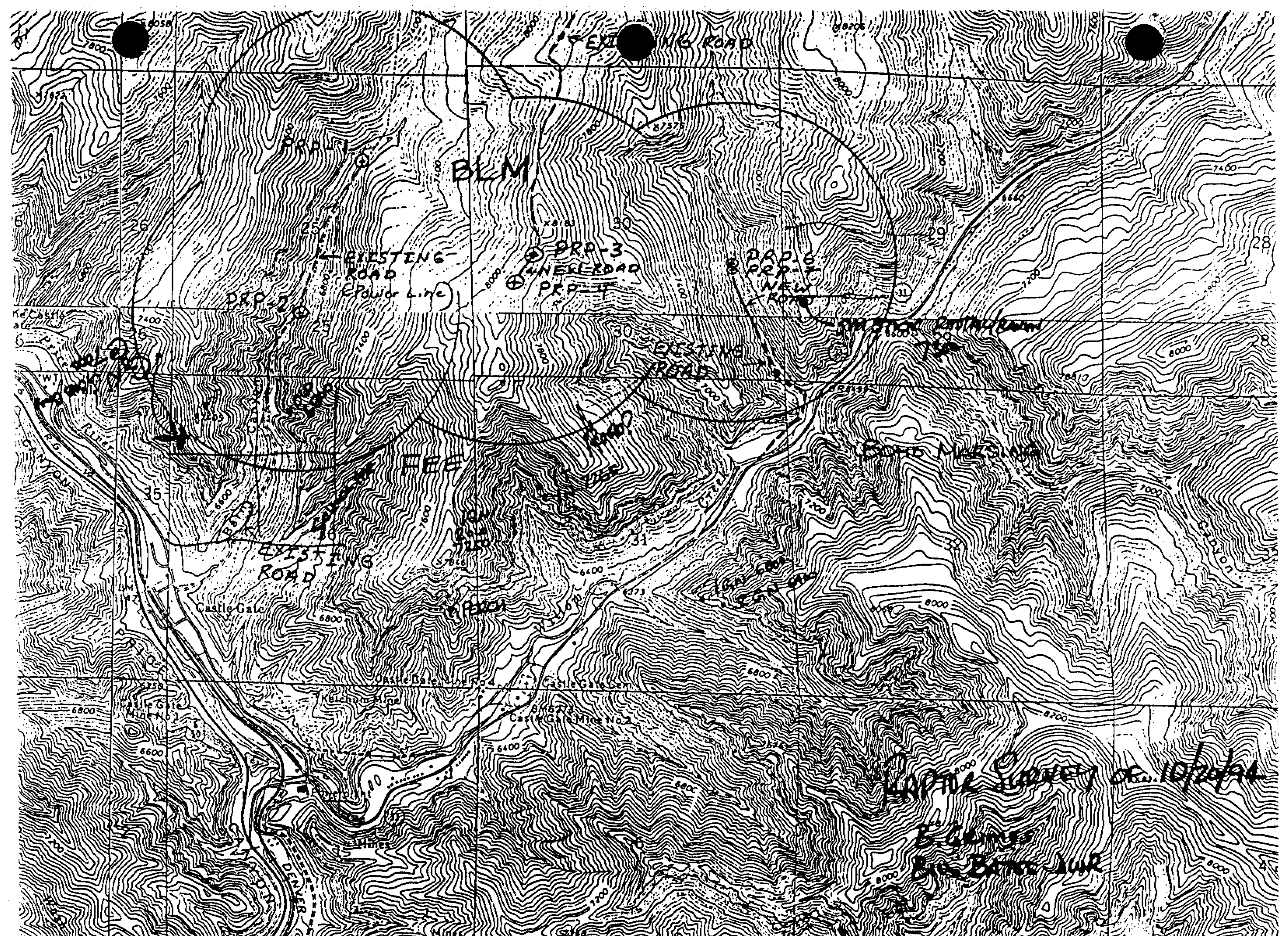
The first golden eagle nest is located on the opposite side of a ridge approximately 0.5 miles from drill site PRP-2. The buteo nest is within 0.5 miles of PRP-6 and 7. These nests should be checked for activity next spring if drilling activities are to occur during the nesting season, from February 15 to July 15.

Thank you for the opportunity to assist with this survey. If you have questions please contact Bill Bates, Habitat Manager.

Sincerely,

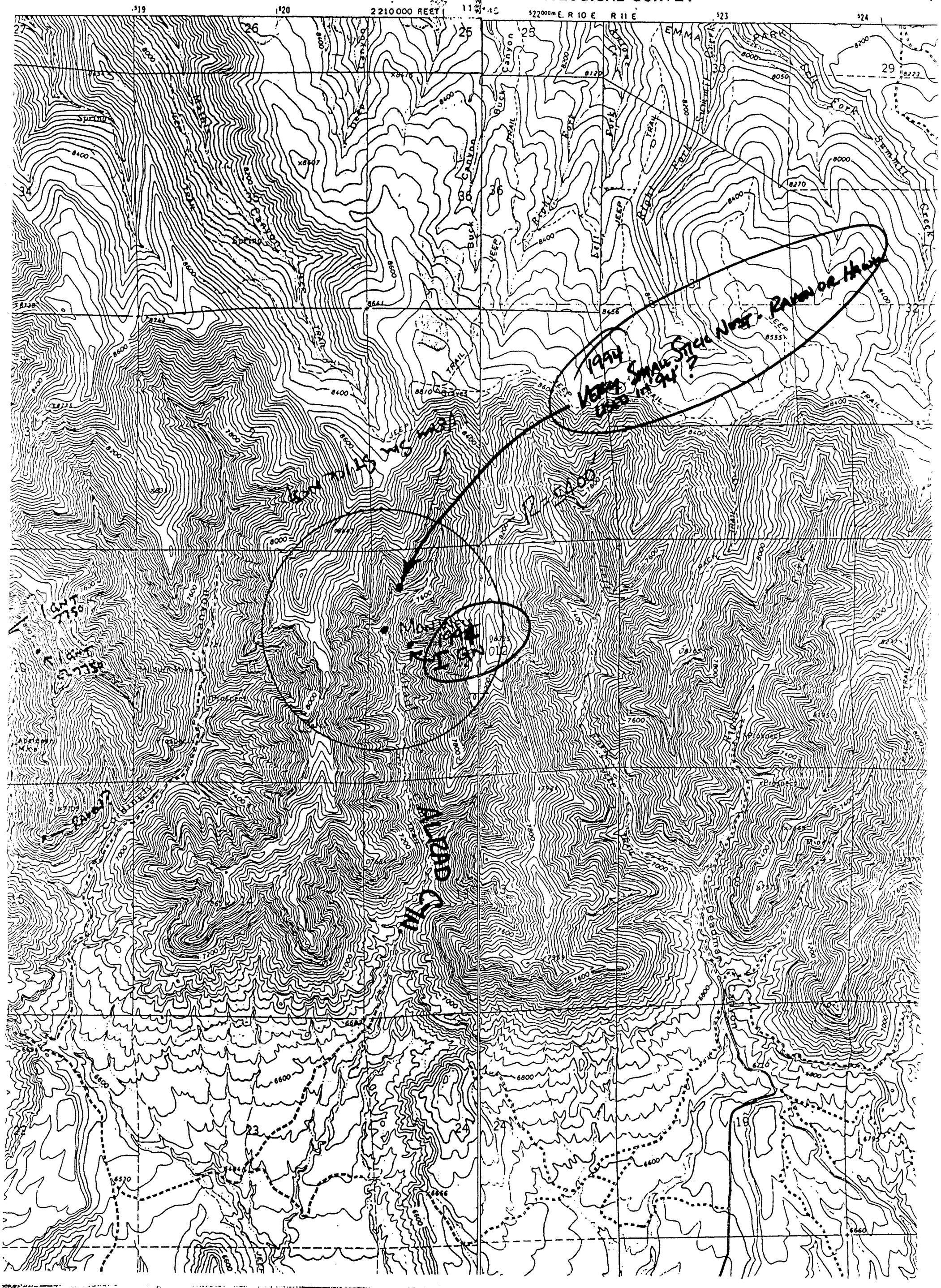
Miles Moretti
Regional Supervisor

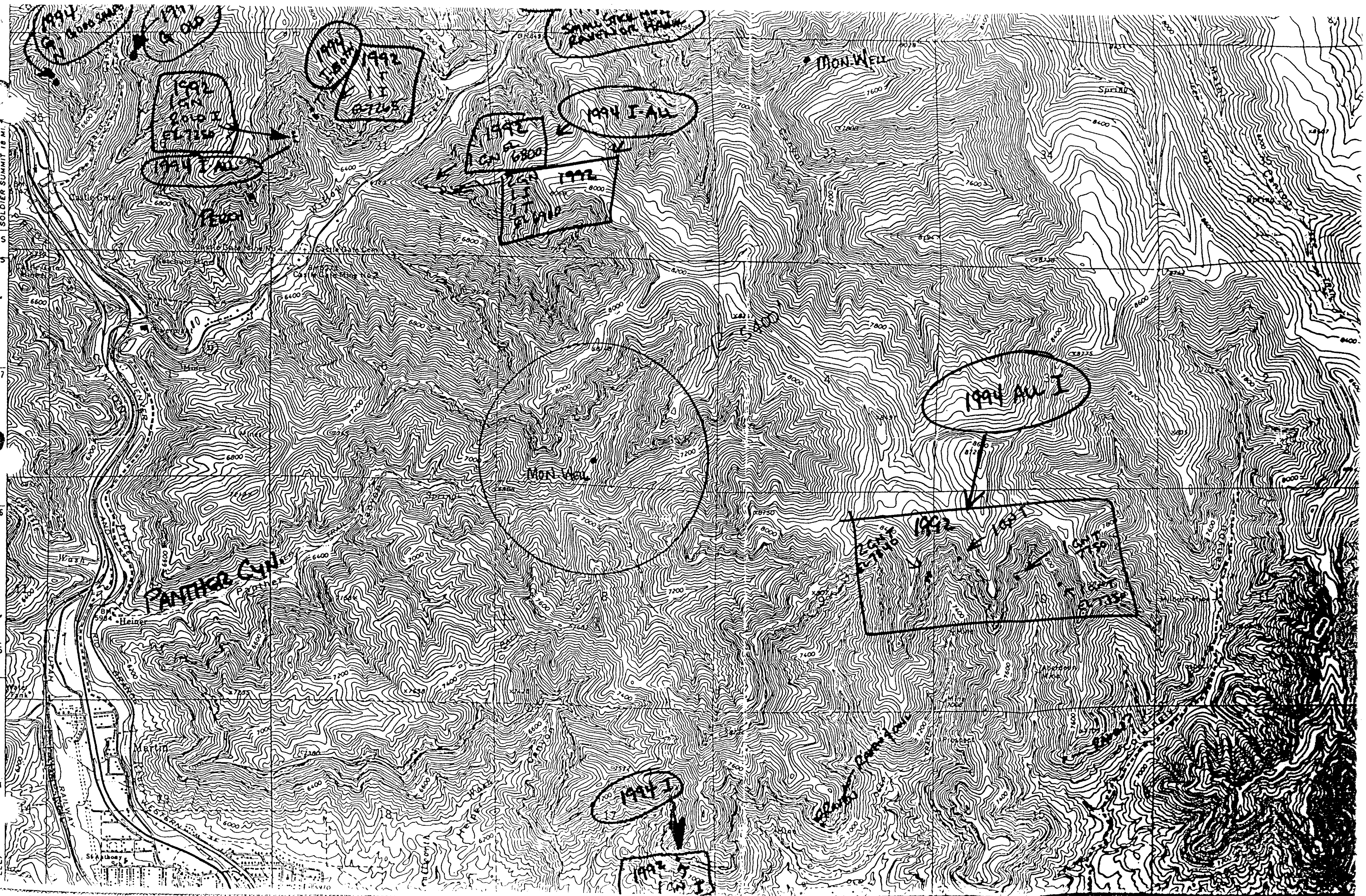
copy: Ralph Miles


EXISTING ROAD
BLM
PRP-1
EXISTING ROAD
Power Line
PRP-2
PRP-3
NEW ROAD
PRP-4
PRP-6
PRP-7
NEW ROAD
EXISTING ROAD
FEE
EXISTING ROAD
Castle Gate
Castle Gate Mine No 4
Castle Gate Cem
Castle Gate Mine No 2
RAPTOR SURVEY

UTAH—CARBON CO.
7.5 MINUTE SERIES (TOPOGRA
NE/4 CASTLE GATE 15' QUADRANGLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY




SOLDIER SUMMIT 18 MI.
MON. WELL
1994 I-ALL
1994 I ALL
1994 ALL I
1994 I
1992
MON. WELL
PANTHER CYN.
Castle Gate
Heiner
Martin
RAILWAY
Spring

GOLDEN EAGLE POPULATION ECOLOGY IN EASTERN UTAH

GOLDEN EAGLE (*AQUILA CHRYSAETOS*) POPULATION ECOLOGY IN EASTERN UTAH

J. William Bates and Miles O. Moretti

Reprinted from the
GREAT BASIN NATURALIST
Volume 54, No. 3
July 1994

Great Basin Naturalist 54(3), © 1994, pp. 248–255

GOLDEN EAGLE (*AQUILA CHRYSAETOS*) POPULATION ECOLOGY IN EASTERN UTAH

J. William Bates[1] and Miles O. Moretti[1]

ABSTRACT.—Golden Eagle population ecology was studied from 1982 to 1992 in eastern Utah where over 47% of 233 territories monitored during the study period were active. Golden Eagle use of four habitat types was compared. Talus territories were used less often than expected; valley, aspen-conifer, and pinyon-juniper territories were used as expected. Number of young produced per territory averaged 0.612 and was correlated with rabbit abundance. Observations on the impacts of coal mining at two locations are discussed.

Key words: Aquila chrysaetos, *Golden Eagle, population, habitat use, prey relationships.*

The Golden Eagle (*Aquila chrysaetos*) is a year-round resident of eastern Utah but is most common during the nesting season. Golden Eagle nests in the area are found at elevations of 1546 m (5070 ft) to 3000 m (9800 ft). Most are located on cliffs, while others are located in cottonwood (*Populus fremontii*) and Douglas fir (*Pseudotsuga menziesii*) trees. Golden Eagle eyries are found in riparian areas, shadscale-clay hills, pinyon-juniper hills with sandstone cliffs, steep talus slopes with large cliffs, and aspen-conifer areas in trees or on smaller cliffs (Jensen and Borchert 1981).

Many nests are located on prominent escarpments found in the Castle Valley area. These escarpments are part of the Castle Gate and Hiawatha formations, which are rich in coal deposits (McGregor 1985). Coal mining is a major industry in the area, and mining activities have the potential to impact nesting Golden Eagles. As a result, federal land-management agencies have required mining companies to monitor eagle nests on their properties.

The primary objective of this project was to monitor Golden Eagle and eagle prey populations in a variety of habitats in eastern Utah. The secondary objective was to summarize data collected by mining companies required to monitor raptor nests.

STUDY AREA

Golden Eagle nests monitored during this study were located in Carbon and Emery counties in eastern Utah (Fig. 1). The study area includes territories from Scofield and Emma Park south to Quitchipah Creek, and from Horse Canyon on the east to Huntington Canyon on the west. Elevations in the study area range from 1546 m (5070 ft) to 3000 m (9800 ft). Vegetative zones include riparian, saltbush (*Atriplex* sp.), sagebrush (*Artemisia* sp.), pinyon-juniper (*Pinus edulis, Juniperus osteosperma*), and mixed aspen-conifer.

The study area was classified into four habitat types that typify eagle use in the area: (1) **valley territories**, located on saltbush flats, on clay hills, or along riparian areas, with nests in cottonwood trees, on conglomerate pinnacles, or on clay ledges; (2) **pinyon-juniper territories**, with nests found on sandstone cliffs; (3) **talus territories**, where eyries were located on thick sandstone cliffs; and (4) **aspen-conifer territories**, where one nest was located in a Douglas fir and all others were on sandstone cliffs.

METHODS

The U.S. Fish and Wildlife Service, in cooperation with the Utah Division of Wildlife Resources (UDWR), conducted extensive helicopter surveys in 1981 and 1982 to locate Golden Eagle nests in the area. Over 250 nests were located and monitored during these surveys. Beginning in 1986 several mining companies were required to monitor approximately 26 territories within a 10-mile radius of the areas affected by mining to assess the impacts of coal mining on the local Golden Eagle population. In 1990 the UDWR began monitoring

[1]Utah Division of Wildlife Resources, 455 West Railroad Avenue, Price, Utah 84501.

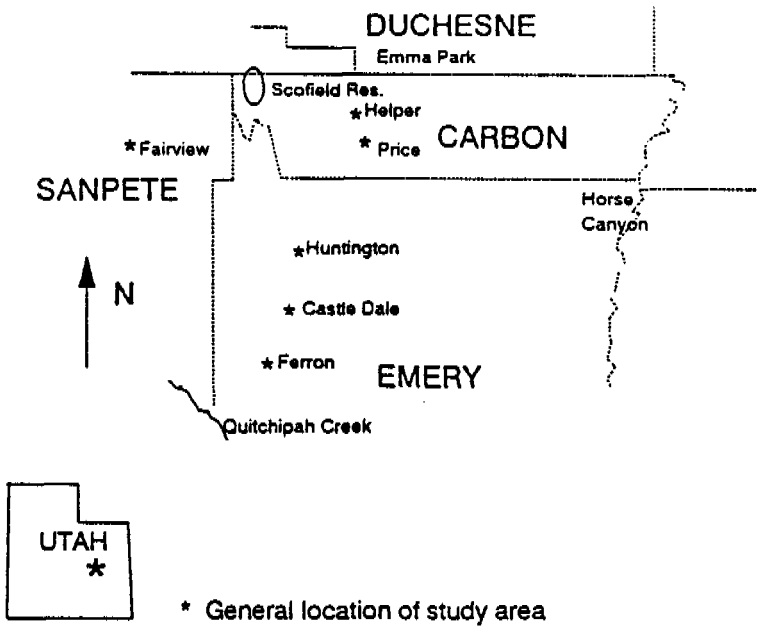


Fig. 1. Map showing Golden Eagle study area.

an additional 13 territories beyond the 10-mile radius impact area. A total of 39 territories were monitored in 1992.

A Bell Jet Ranger helicopter with a pilot and two observers was used to check all known nests in the area affected by mining. Previously unknown nests occasionally were found and recorded during these flights. Normally, the helicopter was able to fly close enough to allow direct observation of the nest. Adult eagles usually would remain in the nest as the helicopter passed, although occasionally they flushed. Adult eagles also left the nest area when they were viewed from the ground.

Eyries in nonimpacted areas were observed from a distance to determine whether eagles were present. If adult eagles, greenery, or fresh mutes were present, the nest site was classified as occupied. If young or eggs were present, it was classified as active. The nest was classified as inactive if no sign of eagle use was present. If eggs were present but failed to hatch, or if all nestlings were observed to die before fledging, it was classified as failed. Due to commitments to other projects, we had insufficient time to return to each territory to determine the number of successfully fledged young. Therefore, these data cannot be interpreted to indicate Golden Eagle recruitment or nesting success.

Rabbit populations were monitored in the area to determine prey base trends during 1986–91. Eleven 5-mile transects were completed each year in the study area. Transects were conducted just after dusk or just before dawn by mounting a spotlight on a vehicle and recording all rabbits seen on one side of the road. Transects were completed in desert shrub, pinyon-juniper, sagebrush, and aspen-conifer habitat types.

Data were analyzed using descriptive statistics, contingency table analysis, and linear regression in the Number Cruncher Statistical System (Hintze 1990). The Bonferroni Z test (Neu et al. 1974) was used to analyze utilization data.

RESULTS

Habitat Use

Of 233 Golden Eagle territories checked from 1981 to 1992 (average/year = 26), 109 (47%) were active and produced young. Almost 78% of the territories were occupied. The year with the most active territories (56%) was 1990 (Fig. 2). In that same year 94% of monitored territories were occupied. The year with the fewest known active territories (33%) was 1988.

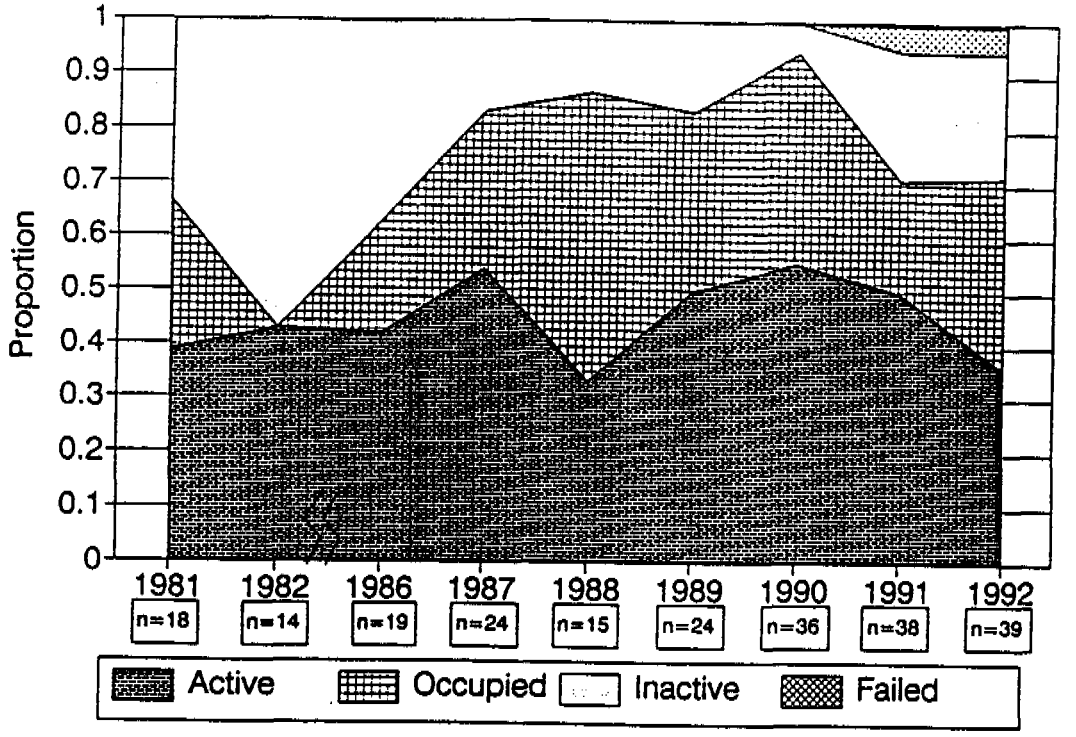


Fig. 2. Status of Golden Eagle territories in eastern Utah.

Of 185 territories checked in consecutive years, over 28% (52) were active. Five territories were observed to produce young for 3 consecutive years. One territory was active 4 consecutive years, while another produced young 5 consecutive years. One territory failed 3 years in a row. Generally, eagles use different nest sites within the same territory in consecutive years, but in our study eagles used the same nest as the previous year 11 times (21%).

Golden Eagle nesting activity was analyzed by habitat type. A significant difference was found between the four habitat types (chi-square = 20.6, $P < .015$). The number of active territories in each habitat type was compared to the expected number active using the Bonferroni Z statistic (Neu et at. 1974). Talus territories were active less frequently than expected, accounting for almost 37% of available habitat, but only 24% of active territories (Table 1, Fig. 3). The number of active nests in valley, pinyon-juniper, and aspen-conifer territories did not differ significantly from the number expected.

Talus eyries had their highest incidence of use in 1982, 1987, 1990, and 1991, with over 40% of territories active. In 1989 only one of nine talus territories was active. Over 75% were active in 1986, 1987, 1989, 1991, and 1992. Six of nine were active in 1990, seven of nine in 1991 (although two eyries failed), and seven of nine in 1992. Two or fewer valley territories were checked in 1981, 1982, and 1988. Over 57% of aspen-conifer territories were active each year, with the exception of 1982, 1986, and 1992, when only one of three, one of four, and three of nine, respectively, were active.

Nesting was relatively late in 1991 because of an unusually wet and cold spring; precipitation was 4.34 cm (1.71 in) greater than normal and temperatures were 1.65°C (3°F) cooler than the 30-year average at the Hiawatha weather station. Golden Eagles also showed a shift in habitat use in 1991. All known valley tree nests were active ($n = 9$). Talus territories were used less than expected and were initiated up to 4 weeks later in 1991 than in 1990. In spite of the cool spring, all four known aspen-conifer territories over 2400 m in elevation near Joe's Valley Reservoir were active and began incubation earlier than lower talus territories and close to the time incubation began at this elevation in previous years.

TABLE 1. Active Golden Eagle eyries [illegible] habitat type in eastern Utah, 1982–92.

Habitat type	Sample points	Proportion of habitat	Territories active	Expected active	Prop. of active territories	95% confidence interval
Valley	51	0.219	32	24	0.294	$.196 < p < .392$
Pinyon/juniper	41	0.176	22	19	0.202	$.116 < p < .288$
Talus	85	0.364	26	40	0.239	$.147 < p < .331$*
Aspen/conifer	56	0.241	29	26	0.266	$.171 < p < .361$
Total	233	1	109	109	1.001	

*Fewer territories active than expected.

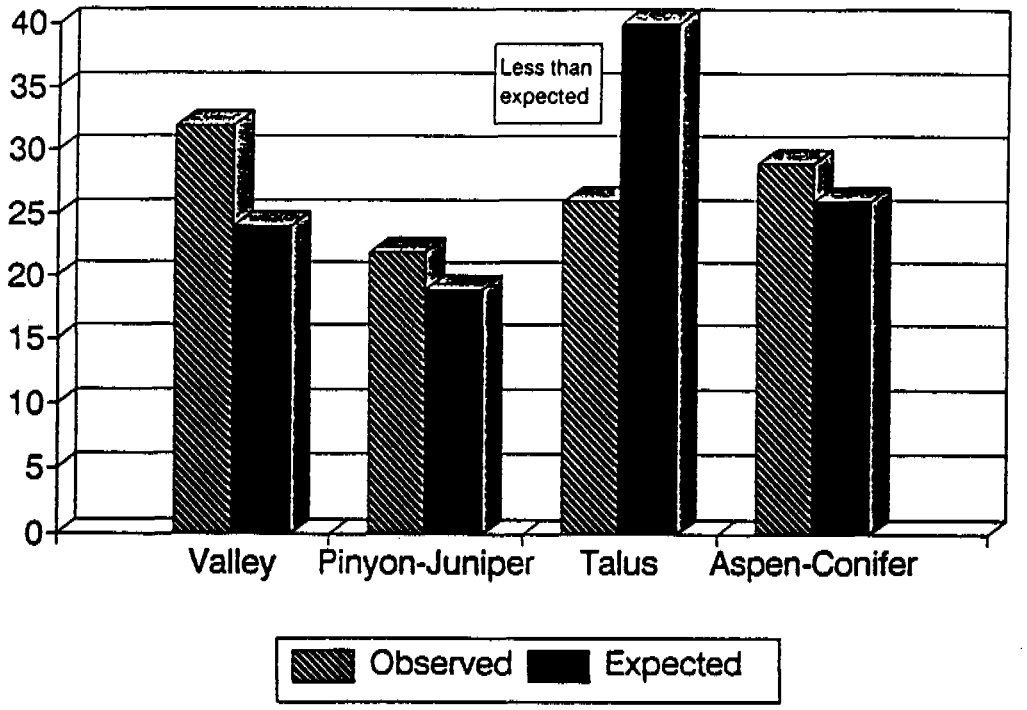


Fig. 3. Active Golden Eagle eyries by habitat type in eastern Utah.

Only 2 of the maximum 39 territories monitored in any one year were documented as being impacted by mining activities. Energy West Mining applied for and received a permit from the U.S. Fish and Wildlife Service to 'take' eagle nests in Newberry Canyon. This was necessary because of coal removal directly under a major escarpment that had four eagle nests on it; a major spauling was a possibility. Plateau Mining faced a similar situation at Star Point and also obtained a U.S. Fish and Wildlife Service permit to take two nests because of escarpment failure.

To keep Golden Eagles from using the two nests at Star Point, both nests were covered with chain-link fencing in 1989. From 1985 to 1988 this territory was active twice, occupied once, and inactive one year. In 1989 the eagle pair built a new nest in a pine tree about 300 m from the cliff nests but produced no young. In 1990 and 1992 the pair used an alternative cliff nest about 500 m from the fenced cliff nests and produced one young each year. In 1992 this nest was tended, but nesting did not occur. This territory produced young 2 of 4 years before and 2 of 4 years after the nests were fenced.

Escarpment failure in Newberry Canyon resulted in the loss of three nests in 1989. One nest remained in 1989 and was used to produce two young. This nest fell before the spring of 1990. This territory produced young

2 of 4 years before the nests were lost and 1 of 4 years after the escarpment failure. Five other Golden Eagle territories are located within 8 km airline distance of Newberry Canyon. These territories produced young 39% of the time before the spauling, compared to 55% after. Although Newberry Canyon territory was not active again until 1993, these territories averaged 2.25 pairs active/year producing young before the nests fell, and 3 active/year after the spauling.

Productivity

Rabbit transects were conducted in the area from 1986 to 1991 (Bates 1989). Data on rabbit populations prior to 1986 are available through harvest statistics compiled by the UDWR (Mitchell and Roberson 1992). Number of cottontail rabbits harvested per hunter day was highest in 1982 and declined dramatically in 1984 (Table 2). Rabbit populations remained low until 1987, when they began to increase.

Average number of eaglets produced per territory was 0.612 (SE = 0.059) over the period 1981–92. Number of young produced per territory was above average in 1982, 1989, 1990, and 1991 (Fig. 4), although there was not a significant difference in number of young produced among years ($P = .27$). Except for 1991, these years coincided with increased rabbit populations (Table 2). Years with the highest number of young produced per active territory were 1982 and 1989, which were years with peak rabbit numbers. Although, based on transects, rabbit populations declined in 1990 and 1991, the number of young per territory was above average (Fig. 4) because the percentage of active territories was above average (Fig. 2).

TABLE 2. Rabbit indices in eastern Utah, 1982–91.

Year	Cottontails per hunter day	Cottontails and jackrabbits/mile
1982	1.81	
1983	1.79	
1984	0.9	
1985	0.77	
1986	0.93	0.17
1987	1.37	0.39
1988	1.55	0.75
1989	0.93	0.86
1990	1.28	0.56
1991	1.5	0.43

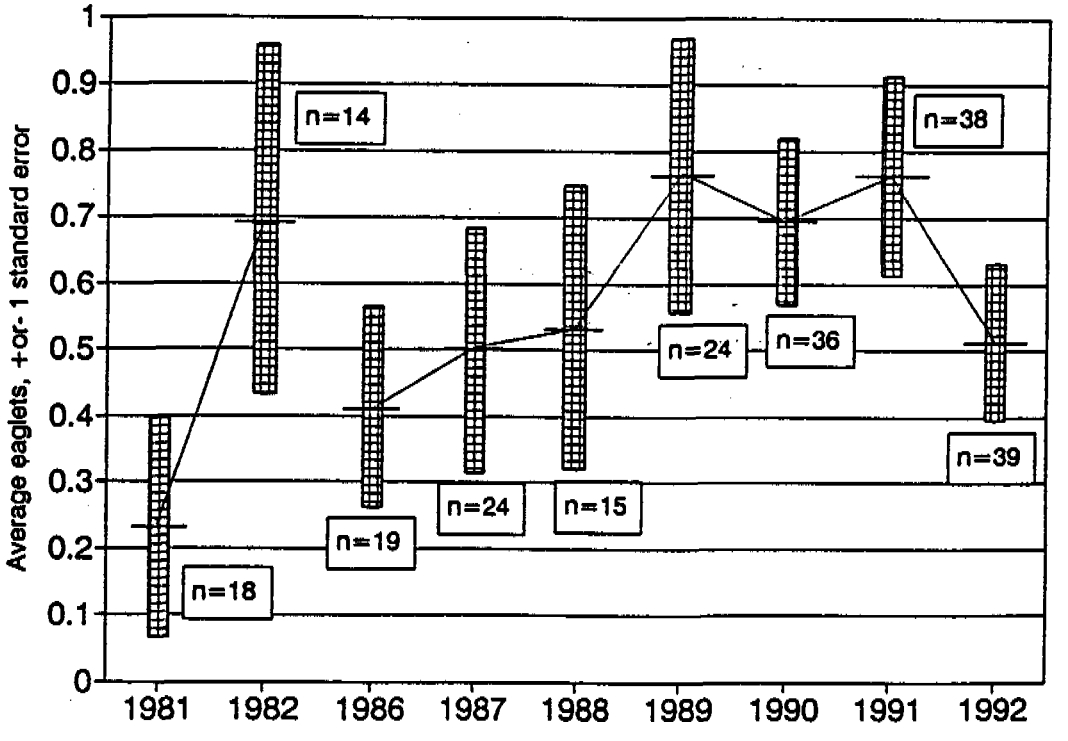


Fig. 4. Average number of young per territory in eastern Utah.

Linear regression was used to determine if there was a relationship between number of rabbits seen per mile during rabbit transects in 1986–91 and number of eaglets per territory. A weak relationship was found ($R^2 = .33$, $P = .24$), indicating that part of the variability in Golden Eagle productivity was explained by rabbit population levels. The data indicated a lag effect, with productivity higher the year after rabbit populations increased (Fig. 5). By using linear regression to test this hypothesis, we found a near-significant relationship between number of rabbits the previous year and number of eaglets per territory ($R^2 = .63$, $P = .058$; Fig. 6). A significant relationship was also found between number of rabbits/mile and number of young produced per active territory in the same year, indicating higher production in years when rabbits were more abundant ($R^2 = .83$, $P = .01$; Fig. 7). These data demonstrate that Golden Eagles produce more young in the same year that rabbit populations increase, but a higher proportion of territories are active the year following an increase in rabbits (Fig. 5).

DISCUSSION

Number of young produced per territory and proportion of active territories in southeastern Utah were similar to those of other studies. Phillips et al. (1990) found 0.78 young produced per occupied territory in Montana and Wyoming from 1975 to 1985, compared to 0.82 in this study. They also found 1.46 young produced per successful territory, compared to 1.39 per active eyrie in this study. Results from southeastern Utah are inflated as the Phillips study was based on number of fledged birds and this study recorded only the number present in nests. However, most eaglets in this study were approaching fledging age when observed. Murphy (1975) found 0.69 young fledged per occupied territory in central Utah.

Number of eaglets produced was associated with rabbit population densities in the study area. Although other prey, such as white-tailed prairie dogs, are available, correlations with rabbit populations were quite high.

High rabbit populations seemed to influence Golden Eagle nesting in two ways. First, number of young produced per active nest was

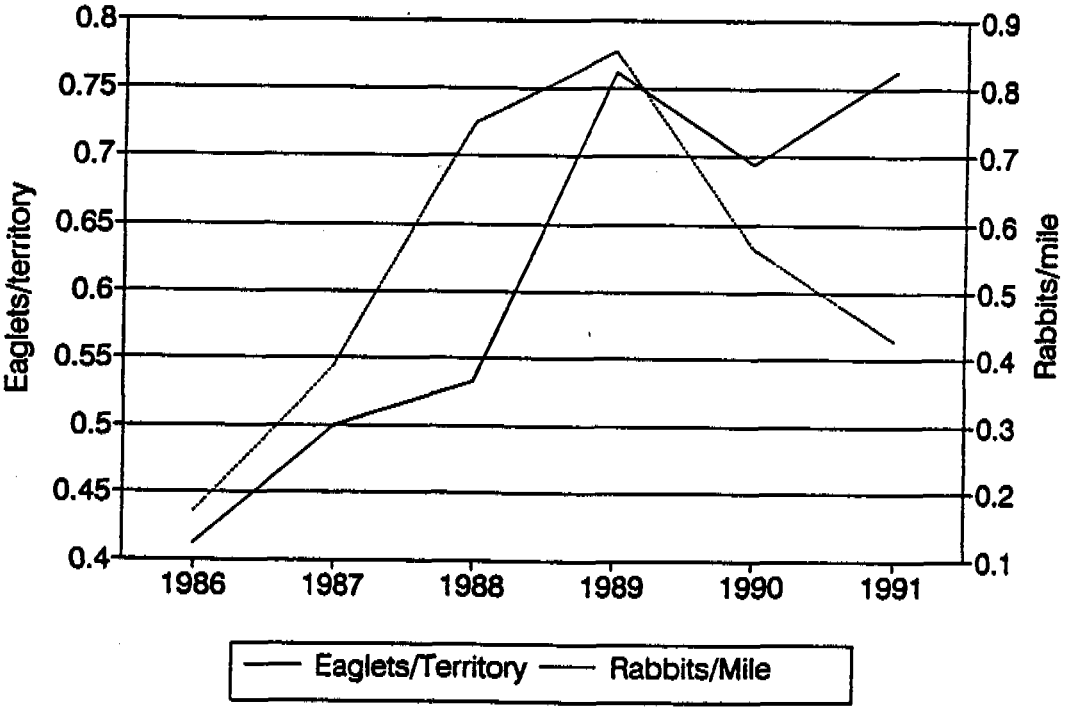


Fig. 5. Golden Eagle production and rabbit population trends.

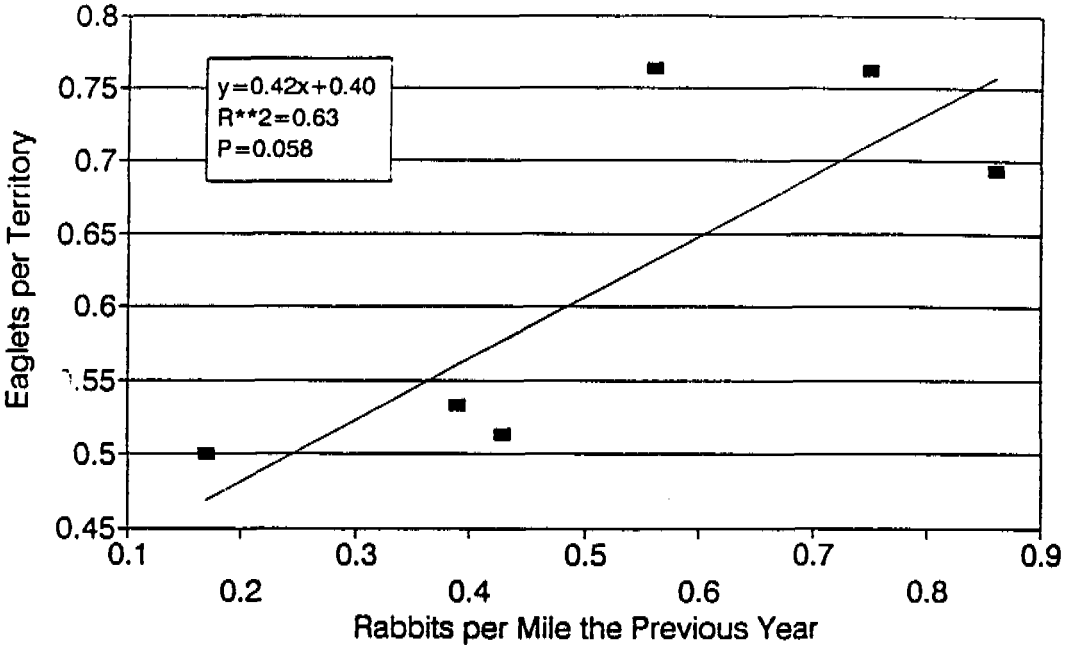


Fig. 6. Eaglets per territory as a function of rabbits the previous year.

affected by number of rabbits in the area that year; i.e., more eaglets were produced in years with higher rabbit populations. This relationship has also been found in other studies (Murphy 1975, Phillips et al. 1990). Second, there appeared to be a lag effect on number of eagles that attempted to nest. There was a significant correlation between number of young produced per territory and number of rabbits the previous year. High rabbit populations may have allowed more pairs in the area to nest, or enticed more eagles into the area, resulting in an increased number of active territories.

Use of valley territories increased in years with higher rabbit populations. Golden Eagles may have selected nest location to minimize the energy required to obtain food. In years with higher rabbit populations, eagles may have spent more time hunting in valley locations. The 2 years with the fewest active talus eyries, 1988 and 1989, were years of relatively high rabbit abundance. Eagles possibly avoided talus eyries in years of high rabbit populations because they were too far from an abundant food source. In years with fewer cottontail and jackrabbits they may have used these territories to take advantage of other prey, such as snowshoe hares or woodrats.

Data on mining impacts caused by cliff spaulings are too few to draw empirical conclusions. However, we offer some observations. When ample suitable habitat is nearby, there appeared to be no net loss in production. The territory at Star Point was active 2 of 4 years before and after the escarpment failure. Although the pair at Newberry Canyon did not re-nest in the canyon for 3 years after the original nests fell, they may have been using alternate nests of adjoining pairs. The five territories in the area averaged 2.25 pairs active/year before and 3 active/year after the escarpment failure.

In consideration of these observations, we offer several recommendations to protect against loss of birds or territories. First, if spauling can be controlled, it should be done in the nonnesting season. Otherwise, physically fencing may help prevent loss of nestlings. The two fenced nests were not used; however, the pair built a new nest below a fenced nest on a cliff that was failing. The pair did not attempt to raise young in that nest. Second, there must be ample suitable nesting habitat to allow other nests to be built. In Newberry Canyon a sheer wall was the result of escarpment failure and may not provide suitable nesting structure. This pair built a new nest 150 m east of a

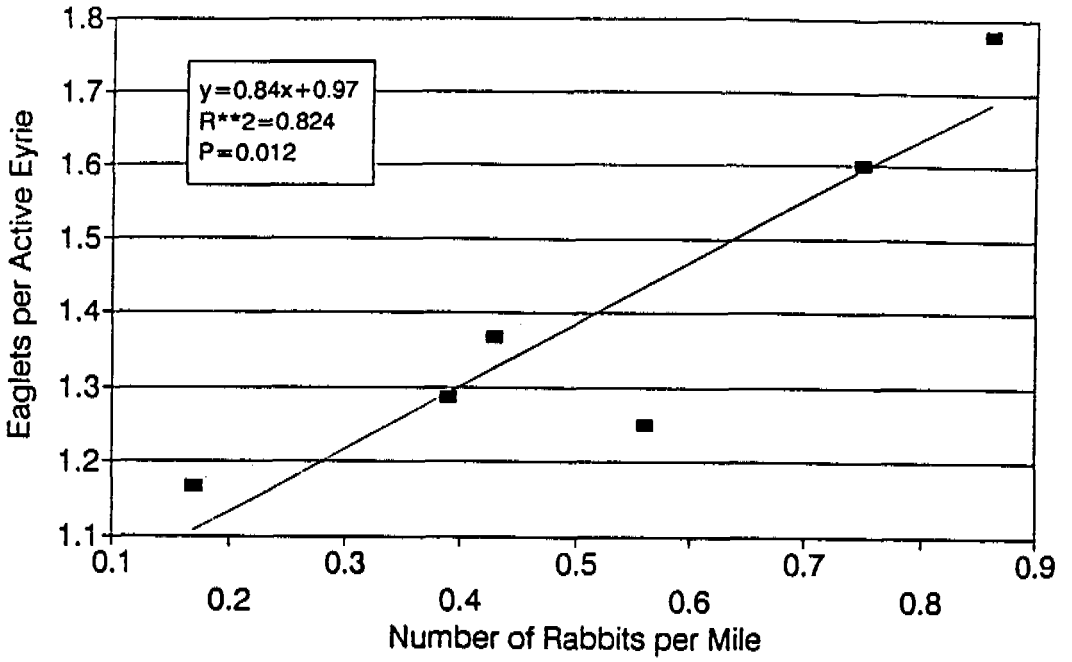


Fig. 7. Eaglets per active eyrie as a function of rabbits, eastern Utah.

fallen nest on a ledge that did not fail. Loss of nesting structure could be a consideration in areas with limited cliff habitat where the whole face fails.

ACKNOWLEDGMENTS

We thank Energy West Mining and Cyprus Plateau Mining for providing helicopter flight time to obtain much of these data. We also extend special thanks to V. Payne and B. Grimes for their interest and support. J. Bingham of Helicopter Services proved to be a skilled pilot and a valuable observer. Appreciation is also given to F. Howe and J. Felice for reviewing this manuscript.

LITERATURE CITED

BATES, J. W. 1989. Utah furbearer harvest report. Utah Division of Wildlife Resources Publication 89-7. Salt Lake City, Utah. 27 pp.

HINTZE, J. L. 1990. Number cruncher statistical system, version 5.03. Kaysville, Utah. 442 pp.

JENSEN, E. H., AND J. W. BORCHERT. 1981. Soil survey of Carbon area, Utah. U.S. Geological Survey Publication. 294 pp.

MCGREGOR, E. E. 1985. Engineering geology of surficial materials in the Price 30′ × 60′ quadrangle, Carbon, Duchesne, Wasatch, and Utah counties, Utah. U.S. Geological Survey Open-file Report 85-356.

MITCHELL, D. L., AND J. A. ROBERSON. 1992. Utah upland game annual report. Utah Division of Wildlife Resources Publication 92-11. Salt Lake City, Utah. 223 pp.

MURPHY, J. R. 1973. Status of a Golden Eagle population in central Utah. Pages 91–96 *in* J. R. Murphy, C. M. White, and B. E. Harrell, eds., Population status of raptors. Proceedings of the Conference on Raptor Conservation Technical Research Report 3.

NEU, C. W., C. R BYERS, AND J. M. PEEK. 1974. A technique for analysis of utilization-availability data. Journal of Wildlife Management 38: 541–545.

PHILLIPS, R. L., A. H. WHEELER, J. M. LOCKHART, T. P. MCENEANEY, AND N. C. FORRESTER. 1990. Nesting ecology of Golden Eagles and other raptors in southeastern Montana and northern Wyoming. U.S. Fish and Wildlife Service Technical Report 26. Washington, D.C. 13 pp.

Received 8 March 1993
Accepted 18 January 1994

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

APR 18

April 14, 1989

Mr. Clark Johnson
U.S. Fish and Wildlife Service
2078 Administration Building
1745 West 1700 South
Salt Lake City, Utah 84104-5110

Dear Mr. Johnson:

Re: Willow Creek Reclamation Project AMR/007/912

In response to your letter of March 9, 1989, I have the following comments regarding listed species:

1. The Bald Eagle is a migratory winter resident of the Willow Creek area arriving as early as November and remaining through March. Birds should not be present in the vicinity during our proposed period of construction work, July through November. The proposed work should not affect this species.

2. The Uinta Basin Hookless Cactus, Sclerocactus glaucus, is not known to exist in Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, staff from the Division of Oil, Gas and Mining with botanical training (Luci Malin, MS in Range Management, University of California, Davis; and Bob O'Brien, BS in Botany, Weber State College) will survey the site for any evidence of this species. If any individuals of this species are found, the Division will notify you immediately and change the plan of work accordingly. However, the proposed work should not affect this species.

3. The fish that are listed, the Humpback Chub, Gila cypha; the Bonytail Chub, Gila elegans; and the Colorado Squawfish, Ptychocheilus lucius; do not occur in the Price River or Willow Creek. These species could be indirectly affected through sediment loading caused during construction, or dewatering of either stream resulting from a need to suppress dust during construction. Some riparian work is scheduled for Willow Creek. Protection measures in the form of silt fencing and straw bales, (suggested by Utah Division of Wildlife Resource personnel), as well as rip-rap and gabians will be utilized during construction activities.

Additionally, work in the riparian zone will be scheduled to occur during periods of low stream flow. Results of the above mentioned protection should prevent turbidity due to construction activities from exceeding the 10% increase from background as measured in nephelometric turbidity units as stipulated by Utah Division of Wildlife Resources. Finally, stream alteration permits pursuant to 73-3-29, Utah Code Annotated, 1953, will be completed showing construction plans and filed with the Utah Division of Water Rights for approval prior to the work commencing. The proposed work should not adversely affect these species.

Regarding species which are candidates for listing:

1. The Razorbacked Sucker, Xyrauchen texanus, would not be affected for the same reasons discussed in the previous paragraph regarding the listed fish species.

2. The Yellow Blanketflower, Gaillardia flava, is not known to occur in Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, Division personnel will survey the site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

3. The Creutzfeldt Catseye, Cryptantha creutzfeldtii, is known to occur in the western portion of Carbon County (The Atlas of the Vascular Plants of Utah, 1988; Albee, Beverly J., Leila M. Schulz and Sherel Goodrich, Utah Museum of Natural History, and A Utah Flora, 1987: Welsh, Stanley L., N. Duane Atwood, Sherel Goodrich and Larry C. Higgins, Brigham Young University). Prior to work, Division personnel will survey the project site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

4. The Canyon Sweetvetch, Hedysarum occidentale var. canone, may occur in Hardscrabble Canyon. This species has been found in north-south trending canyons, in xeric communities, primarily on the west facing slopes. Prior to work, Division personnel will survey the project site for any evidence of this species. If any individuals of this species are found, you will be notified immediately and the plan of work changed accordingly. However, the proposed work should not affect this species.

5. Regarding Migratory Birds of High Federal Interest, our work is not planned to start until mid July. This start date should alleviate any conflicts with nesting birds, specifically the Williamson's Sapsucker, the Flammulated Screech Owl, Prairie Falcon, Cooper's Hawk, and Golden Eagle.

I believe that by taking these considerations the AMR Program has complied with Section 7 (c) of the Endangered Species Act of 1973 and has adequately addressed the needs of high interest, rare, and endangered species in its planning for the Willow Creek Project.

By signature of this letter you concur with the above and give clearance to the Division of Oil, Gas & Mining, Abandoned Mine Reclamation Program to proceed with the reclamation slated for the Willow Creek Project. A signature block is provided for you. Please return a signed copy. Thank you.

Sincerely,

Mark Mesch
Reclamation Specialist
Abandoned Mine Reclamation Program

CONCURRENCE:

Robert H. Ruesink 5/16/89
U.S. Fish & Wildlife Service Date

vmn
AM65/26-28

Evaluation of NEPA Document Coverage
for
PROPOSED 1989 ABANDONED MINE RECLAMATION PROJECTS

PROJECT NAME: Willow Creek Project

PROJECT NUMBER: AMR/007/912

LOCATION:
COUNTY: Carbon
CADASTRAL: T12S, R9E, Sec 26, 35, 36
T13S, R9E, Sec 1,10.
T12S, R10E, Sec 31.
Localized areas within these sections (see map)

USGS QUADS:
Kyune Quad 7.5'
Standardville 7.5'
Helper 7.5'

Sites are located in Price Canyon, Willow Creek Canyon, and Hardscrabble Canyon. The sites are accessible by US 6 and State Route 33.

PROPOSED ACTION: Project sites in Price Canyon consist of open adits, a large concrete coal loadout bin, scrap iron and fencing materials, a burning coal refuse pile, and sediment ponds. Sites in Willow Creek Canyon consist of coal haulage tunnels, coal refuse piles, (one of these piles is currently burning), and a previously disturbed disposal site. The sites in Hardscrabble Canyon consist of open adits. The proposed action calls for mitigation of all serious safety hazards, major environmental problems, and esthetic problems. Reclamation will include mine portal closures, mitigation of hazardous structures, in place stabilization and/or removal and burial of coal refuse piles, stabilizing and armoring sediment ponds, and revegetation of areas disturbed by reclamation construction.

AFFECTED ENVIRONMENT:

A general description of the Rocky Mountain/Northern Great Plains natural environment, including Utah, is found on page III-3 of the Office of Surface Mining's Final Environmental Impact Statement on the Approval of State and Indian Reclamation Program Grants Under Title IV of the Surface Mining Control and Reclamation Act (OSM-EIS-11). The effects of abandoned mine features on the environment (the status quo) are described in pages III-17 through III-62. Important specific features of the proposed project are as follows:

Land Features and Vegetation Cover: The project areas are located in steep-sided mountain canyons at elevations of 6,000 to 7,000 feet. Soils are thin and rocky on the slopes. Vegetation is cold desert shrub, (sagebrush, rabbitbrush) and grasses, with pinyon-juniper on the upper slopes. Vegetation is in poor condition due to the thin soils, low moisture, and industrial activity in the area. The abandoned coal refuse piles have extremely sparce vegetative cover, mostly weedy annuals and some grasses. Much of the riparian vegetation along Willow Creek has been covered by coal refuse sloughing into the creek.

Water and Air Quality: The coal piles in the lower portion of Willow Creek Canyon comprise the southern stream bank. During high water years coal fines from these piles slough into the creek and are carried down stream. Currently a layer of coal fines from these piles exists in the stream bed. Willow Creek flows into the Price River. The disposal area in Willow Creek Canyon is a previsously disturbed site and drainage controls are currently in place. The Castle Gate Sediment Ponds are located on the floor of the Price Canyon and are adjacent to the Price River. The potential exists that during spring flooding scouring may occur causing the material in these ponds to be washed into the Price River.

Fish and Wildlife: No special features. The project area contains habitat for mule deer, raptors, and other game and nongame species. The Price River is considered a class III fishery and Willow Creek a class IV. Coal piles adjacent to stream channels are degrading stream quality for fish and aquatic invertebrates.

Threatened and Endangered Species: The U.S. Fish and Wildlife Service has identified five listed and four candidate threatened and endangered species that may occur in the general project area. They are:

Haliaeetus leucocephalus	Bald Eagle
Gila cypha	Humpback Chub
Gila elegans	Bonytail Chub
Ptychocheilus lucius	Colorado Squawfish
Sclerocactus glaucus	Uinta Basin Hookless Cactus

Hedysarum occidentale var. canone	Canyon Sweetvetch
Cryptantha creutzfeldtii	Creutzfeldt Catseye
Guilardia flava	Yellow Blanketflower
Xyrauchen texanus	Razorbacked Sucker

The U.S. Fish and Wildlife Service and the Utah Division of Wildlife Resources are being consulted to determine whether these species and other species of special concern actually occur on the specific project sites, to determine whether they will be affected by the reclamation work, and to develop mitigation plans, if necessary. No reclamation work will be commenced until cleared by the U.S. Fish and Wildlife Service.

Cultural Resources: The project area and vicinity were the site of coal mining activity in the first half of this century. Most of the project area was surveyed by a professional historian in 1985. The Utah AMR Program is currently in the process of consultation with state and federal historical agencies to obtain cultural clearances for these sites.

Land Use/Socioeconomics: Land uses of adjacent areas are primarily wildlife habitat, recreation and industrial.

ENVIRONMENTAL CONSEQUENCES OF THE ACTION: The environmental impacts of the proposed reclamation and alternative actions, including the no action alternative, at the Willow Creek Project area are adequately addressed in the EIS cited above.

Techniques and impacts of the proposed reclamation are described in the EIS as follows:

Hazard	Technique	Reference (pages)
mine openings	backfill constructed seal	III-22, IV-8&9 III-22, IV-9
structures	demolition; burial or removal	III-64&65, IV-28
unstable materials and erosion (coal waste piles)	removal, land treatment (regrading or burial)	III-38, 59 IV-16, 25-27
fires (surface)	excavation (spread, cool, cover)	III-44&45, IV-17-19

Attachments: U.S. Fish and Wildlife Service letter
Statement of Cultural Resources Review Procedures
USGS Quad Maps

Prepared by: _____ Date: _____

Approved by: _____ Date: _____

AM65/13-15

STATE OF UTAH
NATURAL RESOURCES
Wildlife Resources

Norman H. Bangerter, Governor
Dee C. Hansen, Executive Director
William H. Geer, Division Director

596 West North Temple • Salt Lake City, UT 84116-3154 • 801-533-9333

March 31, 1989

Dr. Dianne Nielson, Director
Utah Division of Oil, Gas & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Attention: Mary Ann Wright and Mark Mesch

Ref: Willow Creek (Carbon County) AMR Project

Dear Dianne:

In regards to the Abandoned Mine Reclamation Project planned for Willow Creek Canyon, Price Canyon and Hardscrabble Canyon (Sec. 1 and 10, T 13 S, R 9 E; Sec. 26, 35 and 36, T 12 S, R 9 E; Sec. 31, T 12 S, R 10 E; and Sec.6, T13S, R10E, Carbon County) a myriad of wildlife species inhabit the area. As you know, the Willow Creek Project will remove, regrade, and/or bury a number of coal refuse piles in Price Canyon and along Willow Creek in the vicinity of Castle Gate. Two mine portal closures in Hardscrabble Canyon are also planned. The following discussion is oriented toward only those species having high state or federal interest. Additionally, the following definitive descriptions are provided as clarification.

Critical valued wildlife use areas are followed in respective importance by high priority, substantial and limited valued areas. Loss or disturbance to critical valued use areas should be avoided since it usually represents a direct reduction in wildlife population size. One for one in-kind mitigation is expected for impacts in critical areas. Damage to high priority valued areas is acceptable only when suitable mitigation can be provided. Minimal mitigation, usually in the form of rehabilitation of disturbed areas, is expected for damage to substantial and limited valued use areas.

High interest species are so denoted due to economic, aesthetic, educational, scientific or ecological values. Generally speaking, game species and others with low relative abundances are placed in this category. Classifications that elicit concern due to low numbers are rare, threatened and endangered. Animals classified as rare typify a sensitive situation in that they still occur in numbers adequate for survival, but their populations have been greatly depleted. In some instances they only occur in limited areas. Animals with a threatened status have populations so depleted in numbers that they are likely to become endangered within the foreseeable future. Animals with an endangered status face imminent extinction without special management consideration.

Wetland habitats (marsh lands, mesic meadows, riparian lands, streams and lakes) associated with the project area are ranked as being of critical value to all of the local areas wildlife. Such areas should be protected from project impacts during any season of the year. If the project will impact or enhance riparian wetlands, the prescriptions in Figures 3 and 4 are recommended.

Hardscrable Canyon does not support a fishery. However, Willow Creek and the Price River support a fisheries. The stream section of the Price River that could be influenced by the project is a high priority valued, Class III fishery that supports rainbow, cutthroat and brown trout. Willow Creek is a Class IV fishery that supports cutthroat trout. The fish and their habitat need yearlong protection from degrading influences of sedimentation. Turbidity from man- caused impacts cannot exceed a 10% increase as measured in nephelometric turbidity units from background measurements.

The Sonora mountain kingsnake and the milk snake are each rare species that inhabit environs of the project area. Their populations are sensitive to habitat degradation. Taking of these reptile specie are disallowed, therefore, project activities must be designed such that individual specimens are not destroyed. Also, project personnel should be advised not to take these snakes.

An array of raptors (Goshawk, sharp-shinned hawk, Cooper's hawk, redtailed hawk, Swainson's hawk, golden eagle, bald eagle, prairie falcon and peregrine falcon) have potential to inhabit the environs of the project area. The level of inventory data for raptors in the project area is considered to be poor, since recent inventory has not been conducted. The enclosed map (Figure 1) identifies known raptor nests in the project area. Our lack of current knowledge points out a need to identify nest locations within a 0.5 mile radius of project activities.

An on-the-ground raptor survey will be required for non cliff nesting species. It must be conducted by a qualified raptor ecologist during the first week of June. Also, a helicopter survey for cliff nesting raptors must be made of the entire project area. It should be conducted by a qualified raptor ecologist during mid May. Both inventories should search an area within a one/half mile radius of project activities. This would include work areas as well as vehicle or aerial travel corridors. Note that a "certificate of registration" issued by the Division is required by an ecologist conducting raptor nest inventories.

Nesting habitat for the peregrine falcon, which is a federally listed endangered species, is not believed to be located within or proximal to the project area.

Raptor nest sites and an adjacent one/half mile buffer zone are considered as critical valued use areas needing protection from disturbance when occupied. For planning purposes, breeding pair activity with an affinity for the aerie territory and nesting are generally timed as follows:

Goshawk, 4-15 to 7-20	sharp-shinned hawk, 6-20 to 8-15
Cooper's hawk, 5-1 to 8-15	redtailed hawk, 4-10 to 6-30
Swainson's hawk, 4-20 to 6-25	golden eagle, 2-1 to 7-15
prairie falcon, 4-1 to 7-15	peregrine falcon, 2-1 to 7-31

Raptor nest inventory can be avoided if project activities occur outside the time blocks identified for aerie territory/nest use. If a nest is located, project activities can proceed if the nest is deemed inactive during that year.

The bald eagle, a species federally listed as being endangered with extinction, is only a winter resident of the project area. None are known to nest locally. It arrives as early as November and remains throughout March. No high priority valued concentration areas, or critical valued roost trees are known within or proximal to the project area. The level of inventory data is considered to be excellent, since annual inventory is made.

Several passerine birds that are of high interest inhabit the project area. They are considered to have relative abundances classified as rare and are listed as follows:

Yellow-billed cuckoo -	Its nest is constructed as an off-ground, frail platform in riparian areas.
Yellow breasted chat -	Its nest is constructed as a well developed off-ground cup in submontane riparian zones.
Black swift -	Its nest is constructed in moist algae/moss crevices of cliffs.
Williamson's sapsucker -	It nests in cavities of trees within conifer/ aspen forests.
Purple martin -	It nests in cavities of trees within conifer/ aspen forests.
Fox sparrow -	Its nest is constructed on or above ground, within shrub riparian zones.
Western bluebird -	It nests in cavities of trees within all forests, especially ponderosa.
Mountain bluebird -	It nests in cavities of trees within all forests.

Nests of these birds must be protected when occupied. Also, taking of the birds, eggs or nests is disallowed.

The red bat and spotted bat are crepuscular/nocturnal, solitary and insectivorous. Each species inhabits cold desert and submontane zones. They are considered to be rare. The pinyon/juniper and riparian ecosystems serves as roost areas for the red bat. The spotted bat, and to a lesser extent the red bat, roost in caves of precipitous areas. Both species are dependent upon wetland (marshland, mesic meadow, riparian land, stream and lake areas) ecosystems as foraging areas, although the red bat will feed over forested areas. Breeding for the red bat occurs in August and September. Fertilization, however, is delayed until spring. Females cluster in the hibernaculum and maintain its use until they give birth in June or July. Breeding for the spotted bat occurs soon after emergence from the hibernaculum, and birth occurs in late May or early June. The young of both species can fly after about three weeks. Neither species migrates and during winter a hibernaculum with a constant humidity and above freezing temperature is utilized. Breeding colonies or hibernaculums must not be disturbed or destroyed.

Nuttal's cottontail and desert cottontail inhabit cold desert, submontane and montane zones. Saltbush/grass, sagebrush/grass, pinyon/juniper, mountain brush and riparian ecosystems are where these animals are most numerous. Bolder strew and precipitous areas can be of importance as cover to these animals. They breed and give birth to two litters between February and July. Nests, which are typically a shallow depression lined with fur, should not be disturbed or destroyed.

Beaver inhabit cold desert, submontane and montane zones. Their critical valued habitats are perennial bodies of water with riparian zones evidencing a predominance of aspen, willow and/or cottonwood trees. Aspen and cottonwood trees situated within 300 meters of a perennial body of water are part of that critical valued habitat. These animals may construct a conical shaped lodge or burrow into the streambank. They also construct food caches of branches and green logs. A family group lives in the lodge throughout the year. Females breed when they are 2.5 years old. Afterward, one litter of kits is produced each year and they are born between late April and early July. Kits and yearlings co-inhabit the lodge with the adult pair. When kits attain 2.5 years of age, they are forced to leave. Lodges, burrows or food caches should not be disturbed or damaged. Individual animals can only be taken with an appropriate permit.

The red fox and gray fox are yearlong inhabitants of the project area. Locally, almost nothing is known of either foxes population dynamics. Without doubt, a crucial period for both species is when they are caring for young in the den. Dens, while being inhabited, are a critical use area and should not be disturbed or destroyed.

Black bears may inhabit the project area. Bears go into a semi hibernation during winter. During this crucial period, which may last from December through March, an animal secrets itself in a den to conserve body energy. The young are born in the den during January and February. Dens while being inhabited represent a critical valued use area for bears and should not be disturbed or destroyed.

Many members of the family mustelidae are known to inhabit the project area. They are all protected as furbearers. Short-tailed and long-tailed weasels, mink, badger, as well as striped and spotted skunks likely inhabit areas proximal to perennial water. A crucial period for all of these species is when they have young in a den or are foraging with their young. Dens and young animals must not be disturbed.

Bobcat and cougar are known to inhabit the project area. A crucial period for maintenance of their populations is when the female has her young secreted at a den site. Such sites are of critical value when being utilized. It is important that den sites not be disturbed and that a female accompanied by young not be harassed.

Mule deer are inhabitants of the project area. They show altitudinal migrations in response to winter conditions. Migration of mule deer from summer range to winter range is initiated during late October. Probably the annual disturbance of the fall hunting season coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the deer's urge to migrate and continued adverse weather keeps the deer on the winter range.

The canyon floors and adjacent hillsides vegetated with sagebrush/grass and pinyon/juniper represents critical valued winter range for mule deer. These areas are usually inhabited from December through April 15 each year. During years with severe snow conditions, portions of the winter range becomes unavailable to deer due to snow depth, and the animals move farther down the drainage. Winter range needs to be protected from man's disturbance when deer are present. Areas disturbed during other periods need to be revegetated with forage species having value to deer. The seed mix in Figure 2, and the technique in Figure 4, is recommended for non-riparian zones in the project area.

Deer begin their migration back to summer range by May and remain there throughout the summer and fall.

Mule deer fawn during the month of June -- peak fawning occurs around June 20. The continuum of wildlife ecosystems extending from the pinyon/juniper through the shrub land and into the aspen type probably represents the fawning area. All riparian areas are of a critical value for fawning and maintenance of the deer population. To date specific areas showing annual use for fawning

have not been inventoried. It is probable that such areas exist; they would be ranked as being of critical value to deer. It is important to note that May 15 through July 5 represents a crucial period for adult does as well as the fawn following parturition. Disturbance by man in this period should be disallowed.

Rocky Mountain elk are inhabitants of the project area. Elk do not show the strong altitudinal migration as mule deer do in response to winter conditions, but they do migrate to wintering areas.

Migration of elk from summer range to winter range is initiated during late October. Probably the annual disturbance of the fall hunting seasons coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the elk's urge to migrate, and continued adverse weather keeps elk on the winter range.

The project area represents winter range for elk. These ranges are all ranked as being of high priority value to elk, and are usually inhabited from December through April 15 each year. During winters with severe conditions, some portions of the winter range becomes unavailable to elk due to snow depth. At that time they move lower in the drainage. Elk winter ranges must be protected from man's disturbance when the elk are physically present on the range.

Elk begin their migration back to summer range by May, and remain there throughout summer and fall.

There are no other known high interest wildlife species or their habitat use areas on or adjacent to the project area.

Thank you for an opportunity to review and provide comment.

Sincerely,

Timothy H. Provan
Director

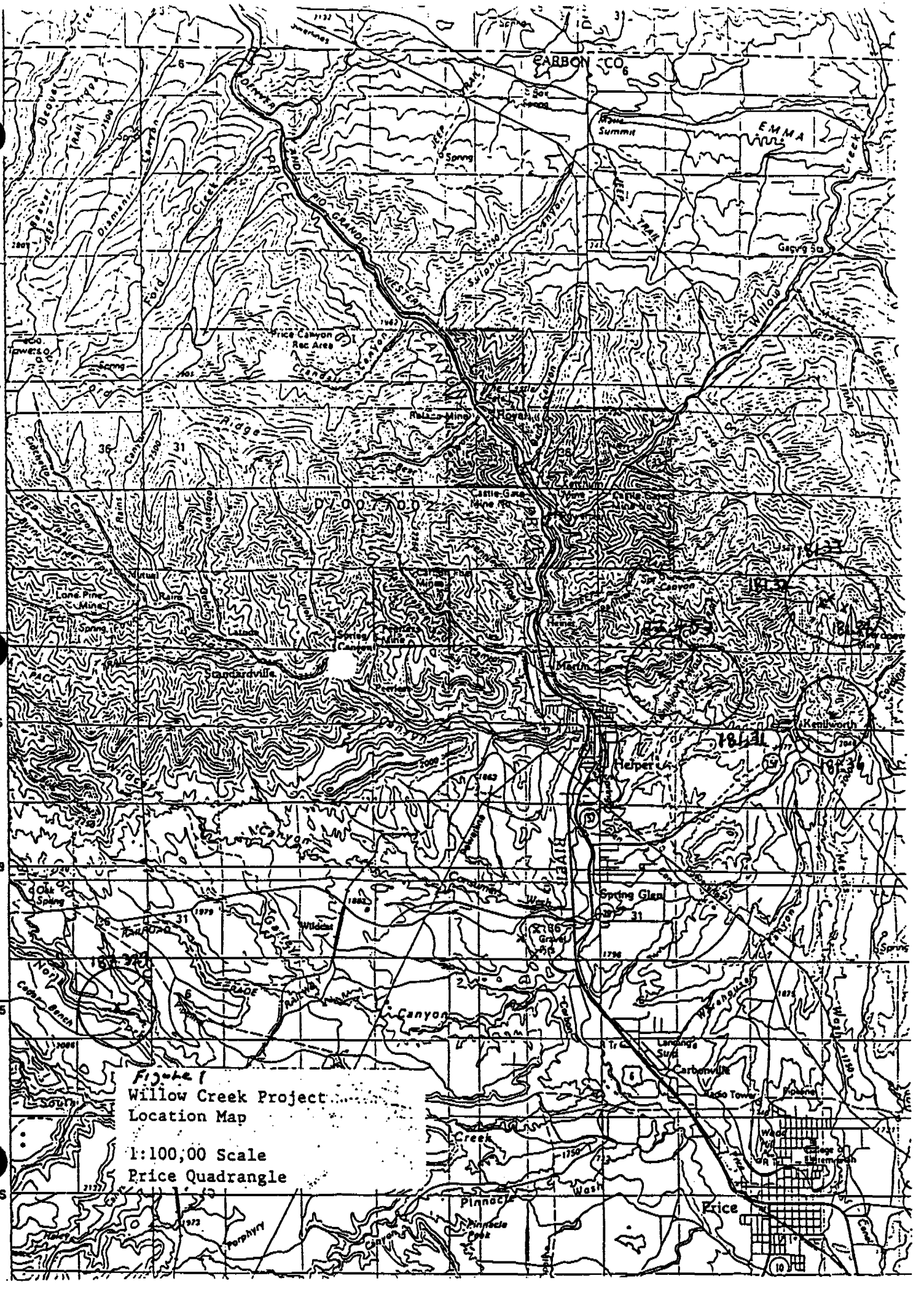


Figure 1
Willow Creek Project
Location Map

1:100,00 Scale
Price Quadrangle

Figure 2. Non riparian area seed prescription to be drilled that will benefit disturbed winter range for big game (deer and elk) and other wildlife. Fertilizer (33-16-8) applied at 100 lb/acre may be advisable.

Species	Lbs/Acre (PLS)
Indian ricegrass	1
Smooth brome (southern strain)	2
Paiute orchardgrass	1
Salina wildrye	1
Western wheatgrass	1
Intermediate wheatgrass	1
Alfalfa (ladak)	2
Yellowsweet clover	1
Palmer penstemon	1
Utah sweetvetch	1
Pacific aster	1
Whitestemmed yellow rabbitbrush	*1
Mountain sagebrush	*1 (20% purity)
Basin sagebrush	*1 (20% purity)
Wyoming sagebrush	*1 (20% purity)
Fourwing saltbush	2
Winterfat	1
Total	20
Gambel oak	bare root seedling (400/acre @ 25 per clump)

*These species should be broadcast seeded and not drill seeded.

Figure 3. Recommended seed mixtures and seedling, or larger sized transplants, that will restore a riparian wetland in the submontane ecological association. Seed should be drilled or broadcast and covered by chain dragging. Bared soil should be protected by tackifying (120 lbs/acre) and a wood fiber mulch (2,000 lbs/acre). Seed can also be hydrosprayed in an emulsion of tackifier and wood fiber mulch. Once seed is placed, fertilizer (33-16-8) may be applied (100 lbs/acre).

Preferred Species	Pounds Per Acre	Alternate Species
Grasses:		**Grasses**
Alkali salaton	1	Tall wheatgrass
Reed canarygrass	4	Slender wheatgrass
Meadow foxtail	2	Saltgrass
Kentucky bluegrass	1	Meadow barley
Smooth brome (northern strain)	2	Ovalhead sedge
Forbs:		**Forbs:**
Alfalfa (equal mix of ladax, nomad, rambler, and travois)	2	
Alsike clover	1	Alpine leafybract aster
Strawberry clover	2	Pacific aster
Yellow sweetclover	2	Belvedere summer express
Black medick	2	Fivehook bassia
Oregon checkermallow	2	Edible valerian
Total	21	

Shrubs & trees (seedlings or larger sized transplants:	Stems per acre (spacing):
Willow shoots (cut from local stock)	1,200 (6 feet apart) planted in two rows, at edge of high and low water lines.
Blueberry elder	400 (10 feet apart)
Cottonwood (*populus nigra* or *populus fremonti*)	400 (10 feet apart)
Golden currant	400 (10 feet apart)

Figure 4. Recommended guidelines for reclamation that utilizes willow transplants and/or bare root seedlings.

A. Willows:

1. Planting densities are dependent upon anticipated survival rates and post-planting objectives. Shoots spaced 2, 3, 6 and 10 feet apart will achieve 10,000, 5,000, 1,200, and 400 willow plants per acre, respectively. These plantings, along with others or existing shrub/tree cover, should achieve a condition of at least 60% canopy cover.

2. Cut 12 to 18 inch long willow stems from local wild stock that are 1 to 3 years old (0.5 to 1.0 inch in diameter). Note that the basal cut should be made at a 30° to 45° angle to the stem so that a maximum of bared stem will be exposed to the soil when planted. Multiple cuttings can come from a singular stem, but all lateral branches and leaves must be removed. Willow shoots can be immediately transplanted.

3. Highest survival rates are achieved when cutting occurs after dormancy. These shoots should be cold stored until the ground thaws. Dehydration during cold storage can be controlled by placing cuttings and two pounds of snow into a plastic bag.

4. Prior to planting, the basal end can be dusted with indolebutyric acid, which is believed to aid in root formation. The chemical should be allowed to dry for 30 to 60 minutes.

5. When planting, all of the stem except 1/4 inch should be pushed into the soil. Planting must be in moist soil but should not be at sites that will be inundated with water.

B. Bare Root Seedlings:

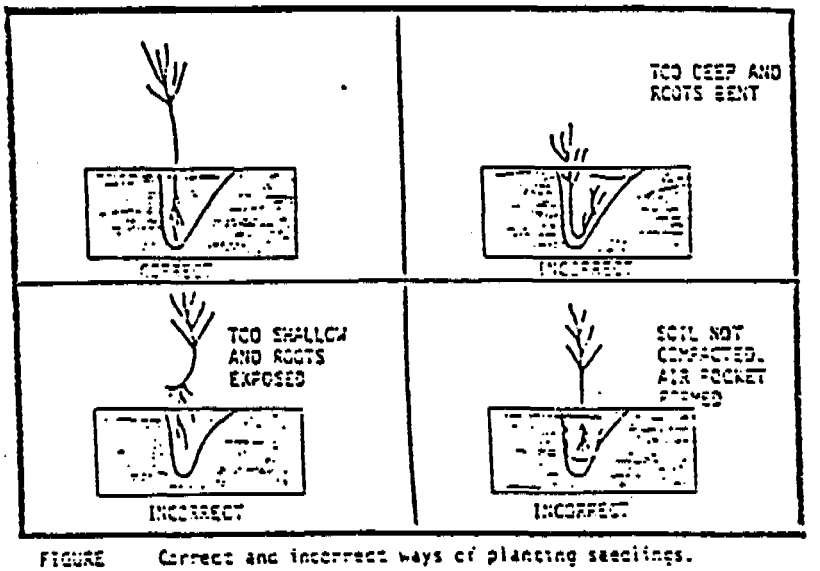


FIGURE Correct and incorrect ways of planting seedlings.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
UTAH STATE OFFICE
2078 ADMINISTRATION BUILDING
1745 WEST 1700 SOUTH
SALT LAKE CITY, UTAH 84104-5110

TAKE PRIDE IN AMERICA

In Reply Refer To
(FWE)

March 9, 1989

RECEIVED
MAR 10 1989
DIVISION OF
OIL, GAS & MINING

Diane Nielson, Director
Utah Department of Oil, Gas, and Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1230

Re: Willow Creek Project (AMR/007/912)

Dear Ms. Nielson:

We have examined the information provided by your letter of January 20, 1989 for the subject project. It appears that listed endangered or threatened species, species proposed for listing, or designated as proposed critical habitat may occur in the area of influence of this action. To comply with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies or their designees are required to obtain from the Fish and Wildlife Service (Service) information concerning any species or critical habitat, listed or proposed to be listed, which may be present in the area of a proposed construction project. Therefore, we are furnishing you the following list of species which may be present in the concerned area:

Bald Eagle	HALIAEETUS LEUCOCEPHALUS
Humpback Chub	GILA CYPHA
Bonytail Chub	GILA ELEGANS
Colorado Squawfish	PTYCHOCHEILUS LUCIUS
Uinta Basin Hookless Cactus	SCLEROCACTUS GLAUCUS

We would like to bring to your attention species which are candidates for official listing as threatened or endangered species (Federal Register Vol. 49, No. 100, May 22, 1984, Vol. 50, No. 181, September 18, 1985 and Vol. 50 # 188, September 27, 1985). While these species have no legal protection at present under the Endangered Species Act, we would ask that you take care to avoid them if they are found in the area. In addition, some of these candidate species may be added to the endangered species list during your planning process. You should contact this office prior to putting your plan into final form to determine if any of these candidate species have been officially listed. Candidate species that may occur in the area of your project are as follows:

Razorbacked Sucker	XYRAUCHEN TEXANUS
Creutzfeldt Catseye	CRYPTANTHA CREUTZFELDTII
Yellow Blanketflower	GUILARDIA FLAVA
Canyon Sweetvetch	HEDYSARUM OCCIDENTALE VAR. CONONE

Section 7(c) also requires the Federal agency proposing a major construction activity that significantly affects the quality of the human environment, to conduct and submit to the Service a biological assessment to determine the effects of the proposal on listed and proposed species. The biological assessment shall be completed within 180 days after the date on which initiated or a time mutually agreed upon between the agency and the Service. Before physical modification/alteration of a major Federal action is begun the assessment must be completed. If the biological assessment is not begun within 90 days, this list should be verified with us prior to initiation of the assessment. We do not feel that we can adequately assess the affects of the proposed action on listed and proposed species or critical habitat and proposed critical habitat without a complete assessment.

When conducting a biological assessment a thorough review of the project and the potential impacts of the project on threatened and endangered species within the immediate project area as well as the area of influence must be made.

After your agency has completed and reviewed the assessment, it is your responsibility to determine if the proposed action "may affect" any of the listed species or critical habitats. You should also determine if the action is likely to jeopardize the continued existence of proposed species or result in the destruction or an adverse modification of any critical habitat proposed for such species. If the determination is "may affect" for listed species you must request in writing formal consultation from the State Supervisor, Fish and Wildlife Enhancement, at the address given above. In addition, if you determine that the proposed action is likely to jeopardize the continued existence of proposed species or result in the destruction of adverse modification of proposed critical habitat, you must confer with the Service. At that time, you should provide this office a copy of the biological assessment and any other relevant information that assisted you in reaching its conclusion.

The Service can enter into formal Section 7 consultation only with another Federal agency. State, county or any other governmental or private organizations can participate in the consultation process, help prepare information such as the biological assessment, participate in meetings, etc. Your attention is also directed to Section 7(d) of the Endangered Species Act, as amended, which underscores the requirement that the Federal agency or the applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable and prudent alternatives regarding their actions on any endangered or threatened species.

The Service also calls to your attention that the following Migratory Birds of High Federal Interest could occur in the area of your planned work.

Prairie Falcon
Cooper's Hawk
Willimson's Sapsucker
Golden Eagle
Flammulated Screech Owl

Several of these species might occur in the riparian habitats situated in the canyon bottoms associated with your project area and may be impacted by planned restoration activities. The cliff nesting raptors could have nesting activities interrupted by disturbances if construction occurs during that period of time.

The Service representative who will provide you with technical assistance is Clark D. Johnson at (524-5649)

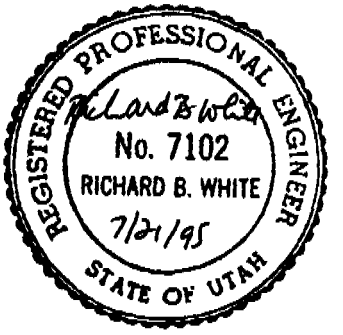
Sincerely,

Clark D. Johnson
Acting State Supervisor

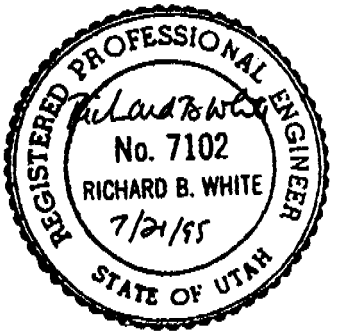
APPENDIX 12-4-1

CULTURAL RESOURCES EVALUATION

*(Under separate cover due to confidential content. See UDOGM library for copy of this appendix.)



APPENDIX 12-4-2
CORRESPONDENCE
AIR QUALITY



State of Utah

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY

Michael O. Leavitt
Governor
Dianne R. Nielson, Ph.D.
Executive Director
Russell A. Roberts
Director

150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820
(801) 536-4000 Voice
(801) 536-4099 Fax
(801) 536-4414 T.D.D.

July 11, 1995

DAQE-615-95

W. John Borla, P.E.
Cyprus Plateau Mining
P.O. Box PMC
Price, Utah 84501

Re: Willow Creek Refuse Removal Project

Dear Mr. Borla:

EarthFax Engineering Inc., submitted a Notice of Intent dated June 20, 1995, on behalf of Cyprus Plateau Mining, for the proposed removal of refuse from the Willow Creek Mine located in Carbon County, Utah. It is the Division of Air Quality's (DAQ) understanding that Amax Coal Company will remove refuse, comprised of underground development waste, from the Willow Creek Mine located approximately 1.5 miles east of the junction of routes US 6 and US 191, to the Castle Gate Preparation Plant, located approximately 1 mile southwest of the Willow Creek Mine.

This removal procedure will not require an Air Quality Approval Order. However, the DAQ does require the refuse removal plans to comply with R307-1-4.5.2 of the Utah Air Conservation Rules, which requires spraying of water, chemical stabilization or other approved techniques be used for control of fugitive dust emission into the atmosphere while refuse removal activities are in operation.

Thank you for informing the DAQ of this project. If you have additional questions or concerns, please contact Jon L. Black at (801) 536-4047.

Sincerely,

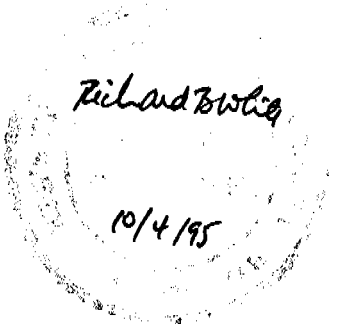
Lynn R. Menlove

Lynn R. Menlove, Manager
New Source Review Section

LRM:JLB:DN

cc: Ben Grimes (Cyprus Plateau Mining)
Vicky Bailey - EarthFax Engineering
7324 So. Union Park Ave. Suite 100
Midvale, Utah 84047

APPENDIX 12-5-1
GEOTECHNICAL REPORT



CYPRUS
Plateau Mining

WILLOW CREEK PROJECT

Geotechnical Investigation And Foundation Design Recommendations For MINE FACILITIES

January 1995

Prepared By:

TerraMatrix
Engineering & Environmental Services
Steamboat Springs, Colorado

Prepared for:

Cyprus Plateau Mining Company
P.O. Box PMC
Price, Utah 84501

DRAFT

PRELIMINARY GEOTECHNICAL INVESTIGATION AND FOUNDATION DESIGN RECOMMENDATIONS FOR MINE FACILITIES

January 1995

Prepared by:

TerraMatrix Inc.
P.O. Box 774018
1475 Pine Grove Road, Suite 109
Steamboat Springs, Colorado 80477

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

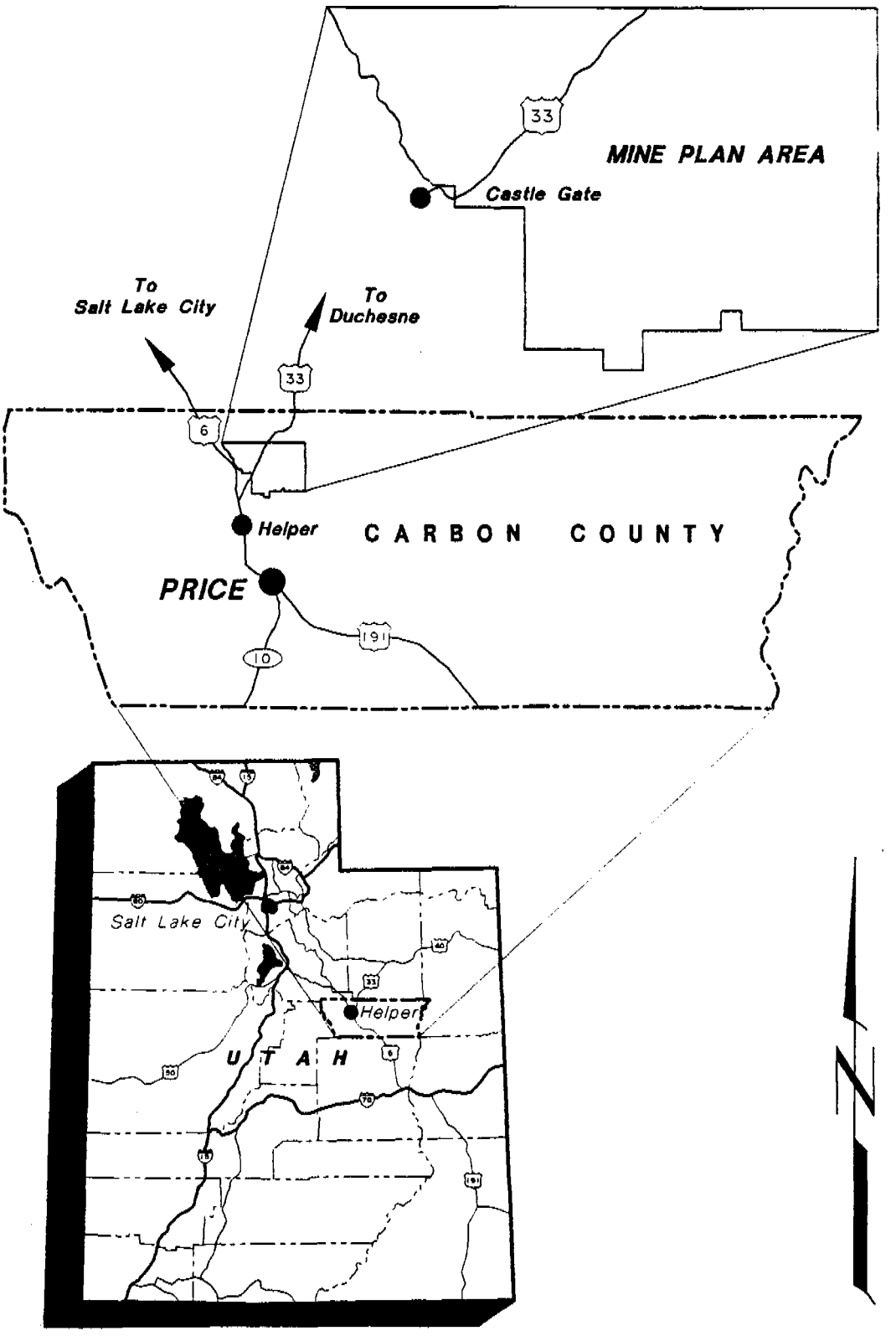
LIST OF APPENDICES

1.0 INTRODUCTION

This report presents the results of geotechnical investigations for proposed surface facilities associated with the Willow Creek Project (Project). The Project is being developed by Cyprus Plateau Mining Company (CPMC) to extract coal from underground mines in the Book Cliffs region of Utah. Specifically, the project is located approximately 4 miles north of Helper, Utah (see Figure 1) in an area which has been extensively disturbed by previous mining activities. Mine and Mill Engineering, Inc. (Mine and Mill) is responsible for the overall engineering and design of the Willow Creek facilities. TerraMatrix Inc. (TMI) under contract to CPMC, has conducted the geotechnical investigation for the surface facilities area. The geotechnical investigation was performed in accordance with our work plan dated October 6, 1994.

The purpose of the geotechnical investigations was to provide recommendations for foundation design and earthworks for the surface facilities. The scope of the study included exploring the subsurface conditions with a series of borings and determining the engineering properties of the subsurface materials through laboratory testing. Based on the results of the field and laboratory data, engineering analyses were conducted to develop recommendations for foundation design and earthworks at the site.

This report should be considered preliminary and we recommend that we review final foundation designs and grading plans prior to providing final design recommendations.



Project No.: 866-2200	Design By: J.NETTLETON	Scale: NOT TO SCALE
File: WCGLOC.DWG	Drawn By: K.CONRATH	Date: JANUARY 1995

CYPRUS Plateau Mining

TerraMatrix
Engineering & Environmental Services
1475 Pine Grove Road, P.O. Box 774018
Steamboat Springs, Colorado 80477

FIGURE 1

GENERAL LOCATION MAP

2.0 SITE AND PROJECT DESCRIPTION

The project site is located in a young stream valley which has a narrow stream channel and floodplain, and near vertical rocky valley slopes. The proposed facility locations are on floodplain terraces along the valley margins, existing cut benches on the lower transitional slopes, and on fill material placed in conjunction with previous historical mining operations. Naturally occurring surficial deposits consist of a sequence of interbedded sandstones, siltstones, and shales (Cretaceous Blackhawk Formation of the Mesa Verde Group) which underlie the alluvial/colluvial deposits of the valley floor and are exposed in the valley sidewalls. The alluvial/colluvial deposits occurring on the valley floor and terrace margins are coarse with significant quantities of gravel and large boulders resulting from mass wasting of the adjacent steep slopes.

The area has been extensively altered by previous construction and mining activities which include the following:

- Installation of two coal mine portals;
- Grading and road construction associated with former mine facilities;
- Construction of a railroad grade and excavation of two tunnels at the west end of the Willow Creek facilities area;
- Development of the Castlegate Cemetery;
- Cut/fill activities associated with construction of State Highway 191;
- Relocation of a portion of the Willow Creek stream channel (extending from above the proposed main access road to the bridge due west of the Castlegate Cemetery);
- Development of a new faceup area and placement of fill material on the north and west side of Willow Creek paralleling the relocated stream channel;
- Excavation of coal fines and refuse materials from the area surrounding the large rock outcrop at the south end of the Willow Creek facilities area and other sites, and placement, grading, and revegetation of approximately 450,000 cubic yards of refuse material in the faceup area.

The foundation material investigations and related evaluations address foundation conditions as a basis for design of the following major structures:

- Concrete bridge abutment for main access road crossing over Willow Creek (TH-01, alluvium/colluvium)
- Mine fan installation which will include two large axial-vane fans and associated drive motors, electrical control components and fan shroud structures (TH-02, alluvium/colluvium)

- Transfer point and associated support structure for main conveyor from mine to transfer conveyor running to coal storage stockpile (TH-03, alluvium/colluvium and coal refuse)

- Mine shop, warehouse, and administration/bathhouse buildings which will be conventional steel frame and siding buildings. Shop facility will have heavy reinforced slab floors in maintenance bay areas (TH-05, 08, and 09, alluvium/colluvium and coal refuse)

- Run-of-mine coal stockpile and associated coal handling structures including a vertical coal stacking tube, sub-grade feeders and reclaim tunnel, and conveyor structures and drives (TH-06, colluvium)

- Mine water storage tank (TH-10, colluvium)

- Electrical substation and ground field (TH-11, debris flow and weathered sandstone)

- Conveyor transfer points along with associated support structures and drives (TH-12, 13, 14, 15, 16, and 17, bedrock and alluvium/colluvium)

3.0. FIELD AND LABORATORY INVESTIGATIONS

3.1 GENERAL

Boreholes were completed to characterize the geological, geotechnical and hydrogeological conditions of the site to determine geotechnical engineering design parameters for the planned facilities. Typically, samples were taken from the boreholes for field identification and laboratory testing.

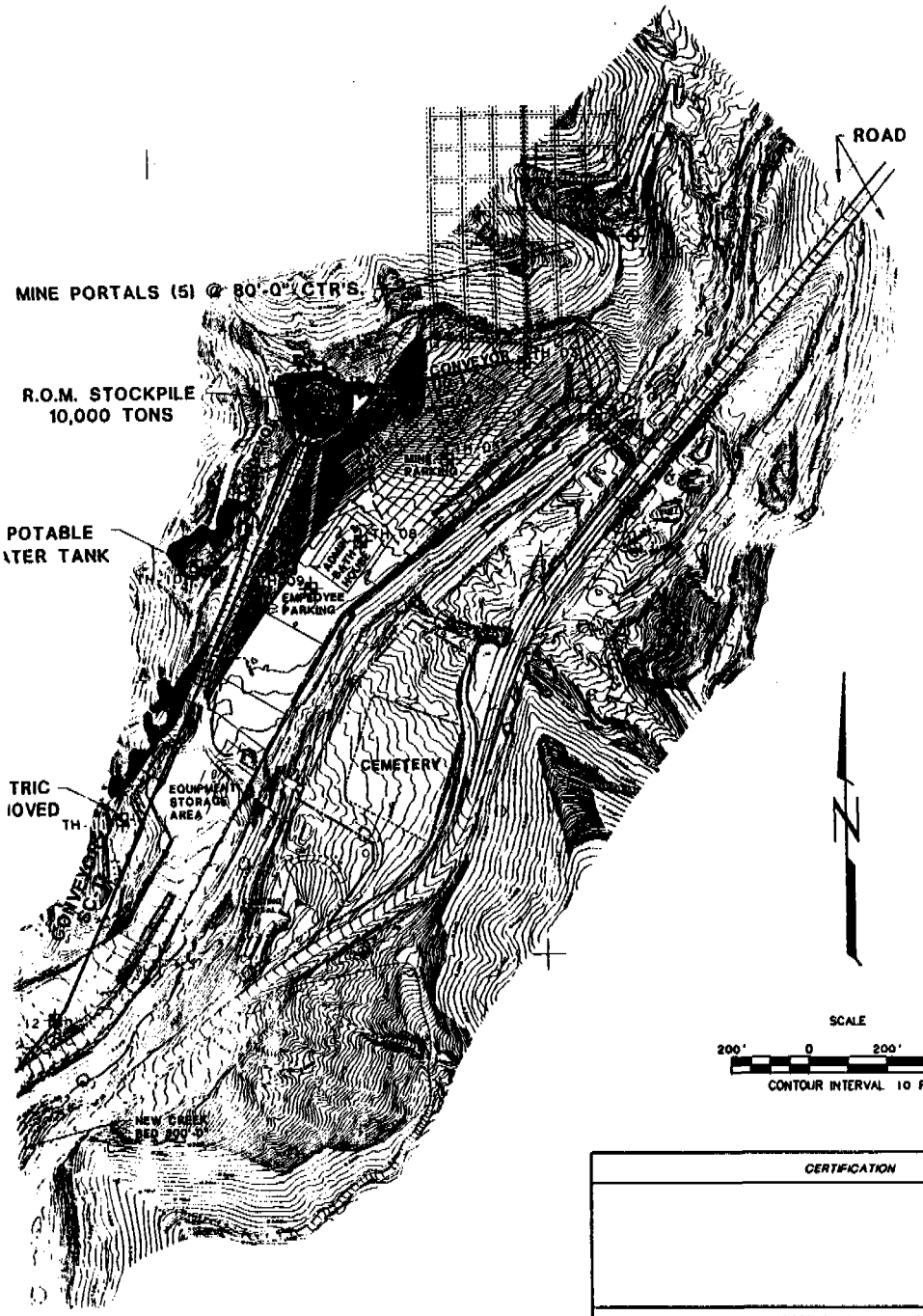
3.2 BOREHOLES

A total of 15 borings ranging in depth from 13.3 feet to 138.5 feet were drilled from November 2 through November 22, 1994. The locations of the borings are shown in Figure 2. These locations are based on field survey's performed by CPMC. Piezometers were installed in 2 of the 15 borings to monitor the presence of groundwater. Piezometers installations were completed according to the requirements of the Utah Division of Oil Gas and Mining (UDOGM). Piezometers installations consisted of 1-inch diameter Schedule 40 PVC casing. The annular space around the slotted interval was packed with filter sand, and a minimum 2-foot thick hydrated bentonite chip seal was placed above the filter sand. Cuttings were used to seal the annulus from the top of the bentonite seal to 5 feet below ground surface. The piezometers were covered with locking steel surface monuments contained in a cement pad. Well construction details are summarized on the borehole log summaries. The boring logs, which include coordinates, elevations, and well construction details, are included in Appendix A.

The drilling was performed by RB & G Engineering Inc. of Salt Lake City, Utah. Borings were drilled using a truck mounted CME-55. A TerraMatrix field geologist supervised the drilling and well installation, logged the borings, and obtained disturbed but representative soil samples. Samples were taken at 5 foot and 10 foot intervals. Cuttings were observed continuously and any changes were noted. The borings were advanced with 8.0 inch OD hollow stem augers until refusal or until the desired depth was reached. When rock (i.e large cobbles, boulders or bedrock) was encountered, a tricone rotary bit was used to advance the hole through the boulder zones or to confirm bedrock. In one hole (TH-02), an NQ coring bit was used to obtain continuous core through the bedrock zone and to locate a small coal seam.

Samples were obtained using a Standard Penetration Test (SPT) split spoon sampler with the dimensions in accordance with ASTM D1586-84. This test and sampling method consisted of driving the split spoon sampler 18 inches into the soil with a 140 pound hammer free falling 30 inches. The number of blows required to drive the sampler the final 12 inches was recorded as the blow count or "N" value. These values are presented on the boring log summaries.

The soil samples were classified in the field in accordance with the Unified Soil Classification System as described on the soil description index in Appendix A In addition, pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence, if any, were recorded. Table 1 is a summary of borehole exploration providing relevant data for each borehole location.



CERTIFICATION

REFERENCE DRAWINGS

DWG. NO.	TITLE

APPROVALS

DEPT.	DATE	SIGNATURE/TITLE

No.	REVISION	DATE	BY	CHKD
4				
3				
2				
1				
0	ISSUED FOR DRAFT REPORT	1/95	KLC	JMN

SCALE: AS SHOWN
DESIGN BY: J.NETTLETON
DRAWN BY: K.CONRATH
CHECK BY: J.NETTLETON
PROJECT No. 866-2200
FILE NAME: SITEPL.DWG

CYPRUS Plateau Mining

PROJECT: WILLOW CREEK

DRAWING TITLE: SITE PLAN AND SAMPLING LOCATIONS

TerraMatrix | Mine & Mill Engineering, Inc.

SHEET: 1 OF 1
DRAWING No.: FIG 2
REV.: 0

TABLE 1
SUMMARY OF BOREHOLE EXPLORATION

Borehole Number*	Location Description	Objective	Depth (ft)	Sampling	Water Conditions
TH-01	north bridge abutment	Foundation conditions for bridge	56.0	SPT	Water at 44.8'
TH-02	fan	Foundation conditions for fan and coal seam location exploration	138.5	SPT CORE	Water at 96.6'
TH-03	Conveyor 1, transfer point	Foundation conditions for transfer point and extent of coal refuse	72.0	SPT	No water
TH-05	shop	Foundation conditions for shop and extent of coal refuse	61.1	SPT	No water
TH-06	ROM pile	Foundation conditions for ROM pile	55.0	SPT	No water
TH-08	bath house	Foundation conditions for bath house and extent of coal refuse	40.3	SPT	No water
TH-09	bath house	Foundation conditions for bath house and extent of coal refuse	51.5	SPT PT	No water
TH-10	water storage tank	Foundation conditions for water tank	31.5	SPT	No water
TH-11	electrical substation	Foundation conditions for substation	51.5	SPT	No water
TH-12	conveyor belt	Foundation conditions for transfer point	50.9	SPT	No water
TH-13	conveyor belt transfer point	Foundation conditions for transfer point	13.3	SPT GB	No water
TH-14	conveyor belt transfer point	Foundation conditions for transfer point	18.0	SPT	No water
TH-15	conveyor belt transfer point	Foundation conditions for transfer point	40.3	SPT	No water
TH-16	conveyor belt transfer point	Foundation conditions for transfer point	26.0	SPT	No water
TH-17	tie to existing belt	Foundation conditions for transfer point	60.4	SPT	Water at 40.0'

*Borehole number TH-04 and TH-07 were not used

*TerraMatrix Inc. * P.O. Box 774018 * Steamboat Springs, Colorado 80477 * (303) 879-6260*

3.3 LABORATORY TESTING

Laboratory tests were completed to determine the index properties of the foundation and borrow soils. Index tests conducted on soil samples included the following:

- Moisture Content (ASTM D2216);
- Atterberg Limits (ASTM D4318-93);
- Mechanical Sieve (ASTM D422-63);
- Wash Sieve (ASTM D1140-92).

Results of these tests are presented in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 GEOLOGIC AND FOUNDATION CONDITIONS

In general, the geologic strata consists of alluvium, colluvium, coal refuse and fill underlain by bedrock. The alluvium/colluvium material is typically loose to dense, brown sandy silt, with gravels, cobbles and boulders (as a result of weathering and mass wasting of the parent rock materials at higher elevations). The boreholes revealed alluvium/colluvium thicknesses ranging from 10.0 feet to greater than 51.5 feet. Bedrock consists of alternating layers of sandstones and siltstones. The bedrock is strong and massive with little fracturing.

Coal refuse was logged in boreholes TH-03, TH-05, TH-09, TH-12 and TH-17. Coal refuse was recorded to a maximum depth of 60.6 feet below ground surface. The borehole logs indicate coal refuse thickness's ranging from 10.0 to 59.6 feet. Fill was logged in boreholes TH-01 and TH-02. The fill was recorded to a maximum depth of 22.5 feet below ground surface. Remaining boreholes are located on prior disturbance areas where cuts have exposed the underlying natural surficial materials and no fill was noted. See Figure 2 for approximate boundaries of the coal refuse and fill areas, and Appendix A for borehole logs.

4.2 HYDROGEOLOGIC CONDITIONS

Water was encountered in 3 of the 15 boreholes (TH-01, TH-02, and TH-17). Piezometers were installed in TH-02 and TH-17. The table below shows the depth to water encountered.

TABLE 2
SUMMARY OF GROUND WATER LEVELS*

Borehole Number	Piezometer Installed	Total Well Depth	Screen Interval	Water Level	Formation
TH-01	No	N/A	N/A	44.8′	Sand
TH-02	Yes	119.6′	119.6′-99.6′	96.6′	Sandstone
TH-~~03~~17	Yes	56.0′	56.0′-46.0′	38.2′	Sand

*As of November 20, 1994

See borehole logs for well construction details (Appendix A).

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

In general, the site is suitable for the proposed construction. Overall, the colluvial/alluvial deposits and weathered to fresh bedrock have a high bearing capacity. Detailed recommendations regarding footing design, drainage provisions, and excavation and earthworks are presented below.

5.2 FOUNDATIONS

It is our understanding that Mine and Mill plans on using several types of foundations for the facility which include; spread footings, drilled caissons, and slab on grade. We recommend that the proposed foundations be founded on the compact to very dense colluvium and alluvium, weathered to fresh bedrock, structural fill, existing fill, or coal refuse. Structural fill placed below foundations should be compacted to at least 95 percent of modified Proctor density (ASTM D1557).

Initially it was our understanding that coal refuse underlying buildings was to be overexcavated and replaced with structural fill. Currently, we understand that coal refuse excavation will be kept to a minimum and that refuse material may underly some buildings.

The following parameters are presented for footing design:

- Minimum Lateral Dimension
  Isolated Spread Footings - 2 feet
  Drilled Caissons - 2 feet

- Minimum Depth of Embedment
  Depth below lowest exterior grade for heated buildings - 3 feet

- Maximum Allowable Bearing Pressures
  Coal Refuse/Fill (Static) - 5,000 psf
  Coal Refuse/Fill (Dynamic) - 6,700 psf

  Colluvium/Alluvium (Static) - 4,000 psf
  Colluvium/Alluvium (Dynamic) - 5,300 psf

  Structural Fill (Static) - 4,000 psf
  Structural Fill (Dynamic) - 5,300 psf

  Rock (Static) - 12,000 psf
  Rock (Dynamic) - 16,000 psf

The static allowable bearing pressures are appropriate for all dead and live loads. The dynamic allowable bearing pressures are increased for transient loads such as wind and seismic loads.

In areas where footings are located on coal refuse or existing fill, we recommended that these areas be overexcavated a minimum of 3 feet and that the excavated material be replaced with compacted structural fill.

Provided that the footings are founded on native alluvium/colluvium, structural fill, or bedrock, total and differential settlements are expected to be less than approximately 1 inch. Most of the settlement should occur during construction or shortly thereafter.

5.3 CUT AND FILL SLOPES

Cut and fill slopes will be required in a number of areas and on the perimeter of the facilities area. It is expected that cut slopes will encounter both soil and bedrock.

Cut Slopes in Soil - We have assumed that all cut slopes in colluvium and alluvium will be consistent with the materials we encountered in our boreholes. We recommend that all cut slopes made in soil should be established at maximum slopes of 2.5H:1V which produces a factor of safety of 1.5. This assumes a maximum slope height of 100 feet.

Cut Slopes in Rock - Based on information obtained from our boreholes and existing rock slopes at the site, we recommend that rock slopes be cut at a maximum of 1H:2V. This configuration yields a safety factor of 1.5. This assumes a slope height of less than 100 feet.

This recommendation assumes that the cut slopes in bedrock do not encounter any adverse jointing that could daylight a wedge of rock and allow failure into the excavation. Therefore, we recommend that the bedrock slopes be mapped periodically during excavation to determine the presence of adverse jointing.

If slopes are cut to these angles, some ravelling of the rock at the surface should be expected. Therefore, it is recommended that sufficient space be left between the toe of the slope and the edge of any structure to allow construction of a small berm to catch any rocks which may roll downslope and to allow access for equipment to remove material, if required.

Fill Slopes - Our review of the proposed grading plan indicates there will be fill slopes throughout the facilities area. We recommend that fill slopes be placed at a maximum of 2.5H:1V. This slope geometry yields a factor of safety of 1.5. Steeper fill slopes could be placed; however, this would produce lower factors of safety. For example, 2H:1V fill slopes will have a factor of safety of 1.2. This assumes that all fill slopes will be constructed of granular fill and compacted to a minimum of 90 percent of maximum modified Proctor density (ASTM D1557). This assumes a maximum slope height of 100 feet.

Surface water diversion channels should be constructed along the crest of all cut and fill slopes to prevent water from running over the face of the slope.

5.4 EARTHWORKS AND CONSTRUCTION CONSIDERATIONS

Prior to construction, all topsoil, vegetation, or loose soils should be removed in areas where structures will be founded. If unsuitable soils are encountered during foundation excavation, this material should be overexcavated and replaced with structural fill. All structural fill should consist of granular material placed in 8 inch loose lifts and compacted to 95 percent of the soils maximum dry density determined by modified Proctor (ASTM D1557). We recommend a large steel drum vibratory roller or sheepsfoot roller to compact structural fill. If density tests conducted on the placed structural fill indicate that 95 percent compaction is not being achieved, the fill should be scarified, moisture conditioned to near the soils optimum moisture content, recompacted and retested. In areas where fill will not be supporting structures, conventional construction backfilling practices may be used to achieve desired grades. General fill should

consist of granular material placed in 8-inch loose lifts and compacted to 90 percent of the soils maximum dry density determined by modified Proctor (ASTM D1557).

The on-site colluvium and alluvium may be used as general and structural fill provided the maximum particle size does not exceed 5 inches and it is free of organics, debris or other deleterious materials. Frozen material should not be used as fill since it will thaw and compress. Compacted structural fill or subgrades which have been proof rolled prior to placement of structures should be protected from freezing. Any subgrades which have been frozen will require thawing and recompaction or replacement.

Borrow material for fill can be obtained and used as general and structural fill from any of the on-site excavations provided that the material is moisture conditioned, compacted and meets material specifications discussed previously. The material can be obtained from excavations as part of grading operations for the mine facilities.

All surface water and water from roofs should be diverted around the perimeter of the buildings and discharged downslope away from any planned structures. Footing drains consisting of 4 inch diameter slotted pipe should surround the building perimeter. The drain pipe should be surrounded by a granular material which has less than 5 percent passing the pipe slot width and less than 5 percent passing the #200 sieve. The granular materials should be enveloped in a non-woven geotextile such as Trevira 1114 or equivalent. The drain pipe should be bedded by 2 to 4 inches of granular material and covered by a minimum of 1 foot of granular material. In addition, the drain pipes should slope at a minimum of 0.5 percent and be daylighted to suitable surface drainage areas or channels.

5.5 RETAINING WALLS

For lateral loads on foundations and retaining walls, we recommend a design passive pressure of 190 pcf x H ft (where H is the depth below ground surface). When computing passive pressures, the top 2 feet of material should be omitted unless it is confined by a floor slab or pavement. For a design active earth pressure, we recommend using an active pressure of 38 pcf x H ft (where H is the depth below the ground surface). These recommendations assume a free draining granular backfill placed behind the wall. In addition, these recommended values do not account for the buildup of hydrostatic pressures.

Compaction of backfill placed behind any walls should be limited to 90 percent of the fills maximum dry density determined by modified Proctor (ASTM D1557). Within 3 feet of the wall, compaction of the backfill should be limited to light compaction with hand operated equipment.

6.0 USE OF REPORT

This report has been prepared exclusively for the use of Cyprus Plateau Mining Company on the Willow Creek Project. If there are any changes in the nature, design, or location of the facilities, we should be notified so that we may review our conclusions and recommendations in light of the proposed changes and provide written modifications consistent with the changes.

Localized variations in subsurface conditions may occur and conditions may change over time; hence, a contingency for unanticipated conditions should be included in the budget and schedule. Observation and testing by a qualified geotechnical engineer should be included during construction to allow for site-specific evaluation and corrective recommendations consistent with the actual site conditions revealed during the work.

APPENDIX A

DRILLING LOGS

APPENDIX B

LABORATORY TEST RESULTS

Table 1

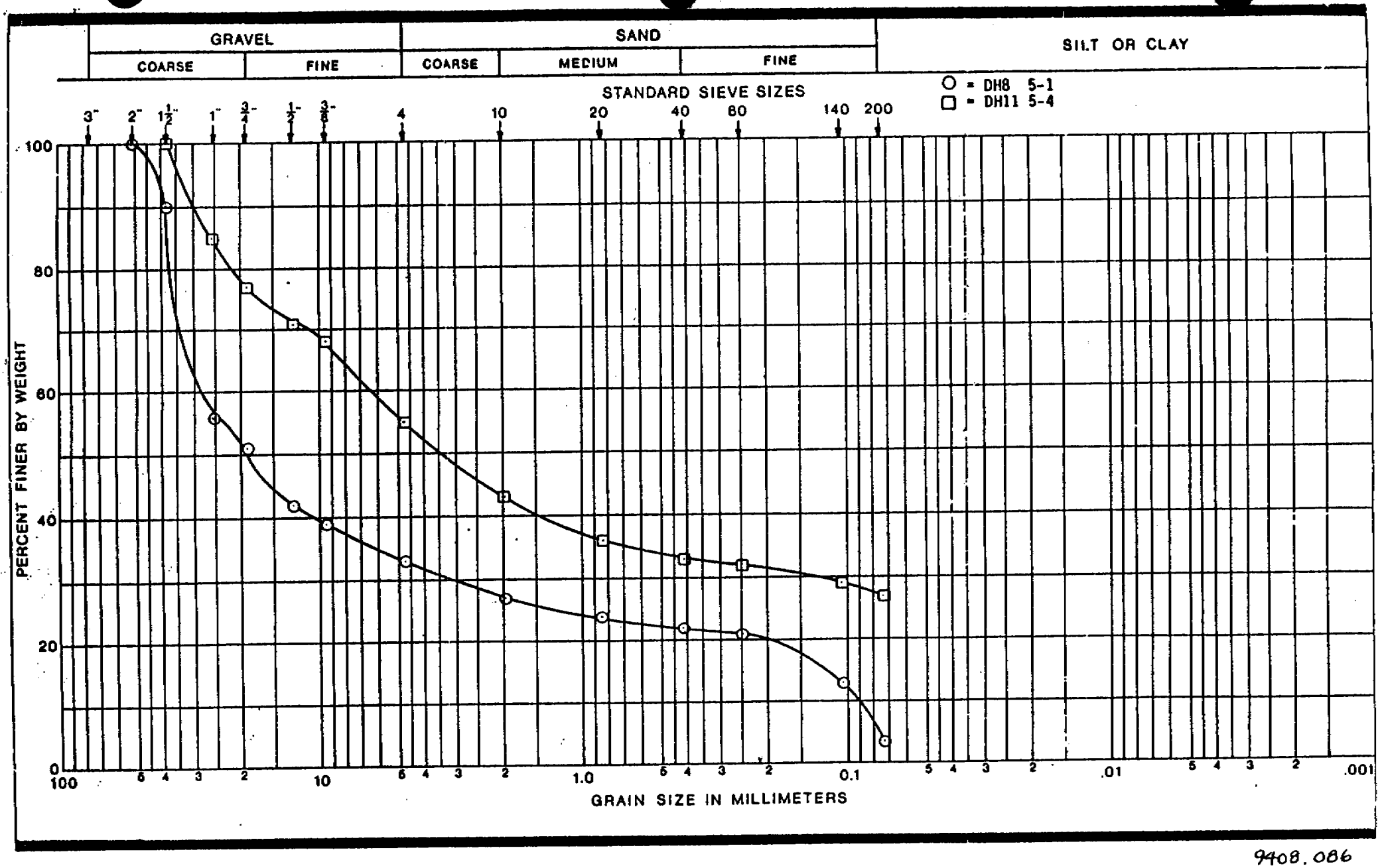
SUMMARY OF TEST DATA

PROJECT Terramatrix, Inc., Willow Creek Project

LOCATION near Helper, Utah FEATURE Foundations

DRILL HOLE NO.	SAMPLE NO.	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
5	5			9.8					18	48	34	
6	2			2.1					29	46	25	
6	9			14.5		33	22	9	0	43	57	
8	1			2.6				NP	67	30	3	GW (ML?)
11	4			10.4		27	18	9	45	28	27	GM (ML?)
12	3			6.8					42	40	18	GM (GW?)

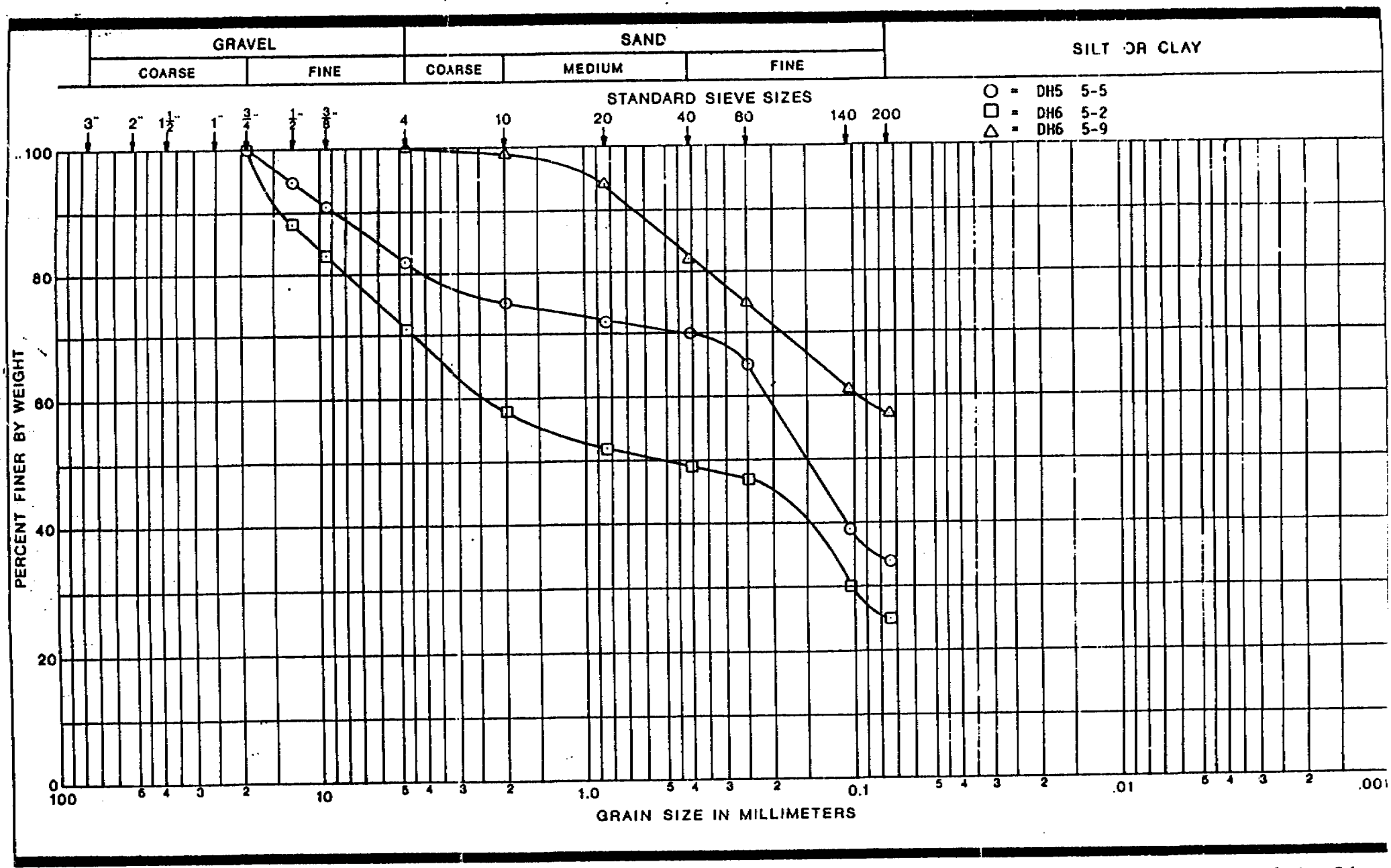
NP = Nonplastic



9408.086

RB&G ENGINEERING INC.
Provo, Utah

Figure GRAIN SIZE DISTRIBUTION
Terramatrix, Inc. , Willow Creek Project
near Helper, Utah



9408.086

RB&G ENGINEERING INC.
Provo, Utah

Figure **GRAIN SIZE DISTRIBUTION**
Terramatrix, Inc., Willow Creek Project
near Helper, Utah

Table 1

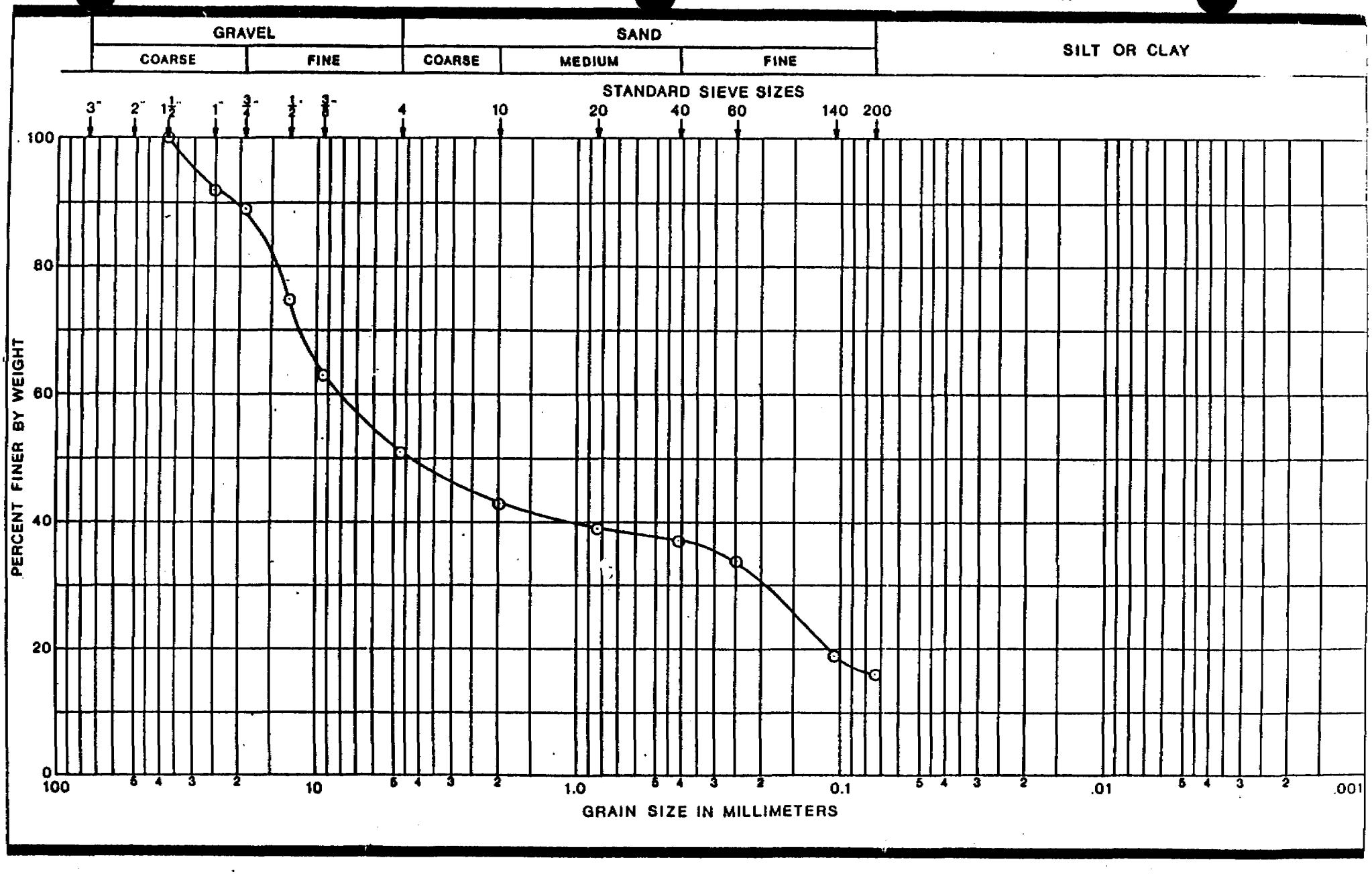
SUMMARY OF TEST DATA

PROJECT Terramatrix, Inc.

LOCATION Willow Creek FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
TH2	10-11.1			10.2				NP	49	35	16	

NP = Nonplastic



RB&G ENGINEERING INC.
Provo, Utah

Figure

WILLOW CREEK-TERAMATRIX
#2 TH-02, DEPTH 10.0-11.1

PROJECT #
9408.086

REPORT #
412072

TerraMatrix
Engineering & Environmental Services
1475 Pine Grove Road, P.O. Box 774018
Steamboat Springs, Colorado 80477

Project Name: Willow Creek / Cyprus
Project Number: 866-5000 Sheet: 1 Of 3
Prepared By: J. Pellicori Date: 1/17/95
Checked By: DLC Date: 1/26/95

FILE

OBJECTIVE : Determine maximum slopes angles for cut and fill slopes.

KNOWNS : Soils in the area are predominantly silty sands. This is based on borehole logs.

Minimum depth to groundwater is 38ft. Groundwater is deeper in most cases.

Granular soils will fail in an infinite slope manner.

ASSUME : Frictional shear strength of in-situ and fill soil : $\phi = 31°$ see attached pg. 2 of 3.

Minimum safety factor : 1.5

METHOD: Infinite Slope $\frac{\tan\phi}{\tan\beta} = SF$

$$1.5 = \frac{\tan 31}{\tan\beta}$$

$$\tan\beta = \frac{\tan 31}{1.5}$$

$$\tan\beta = 0.4006$$

$$\beta = 21.8° \Rightarrow 2.5H:1V$$

Note: DLC
Assumes material compacted to min. of 90% of ASTM D1557.

866-5000
1/17/95 JAP 2/3

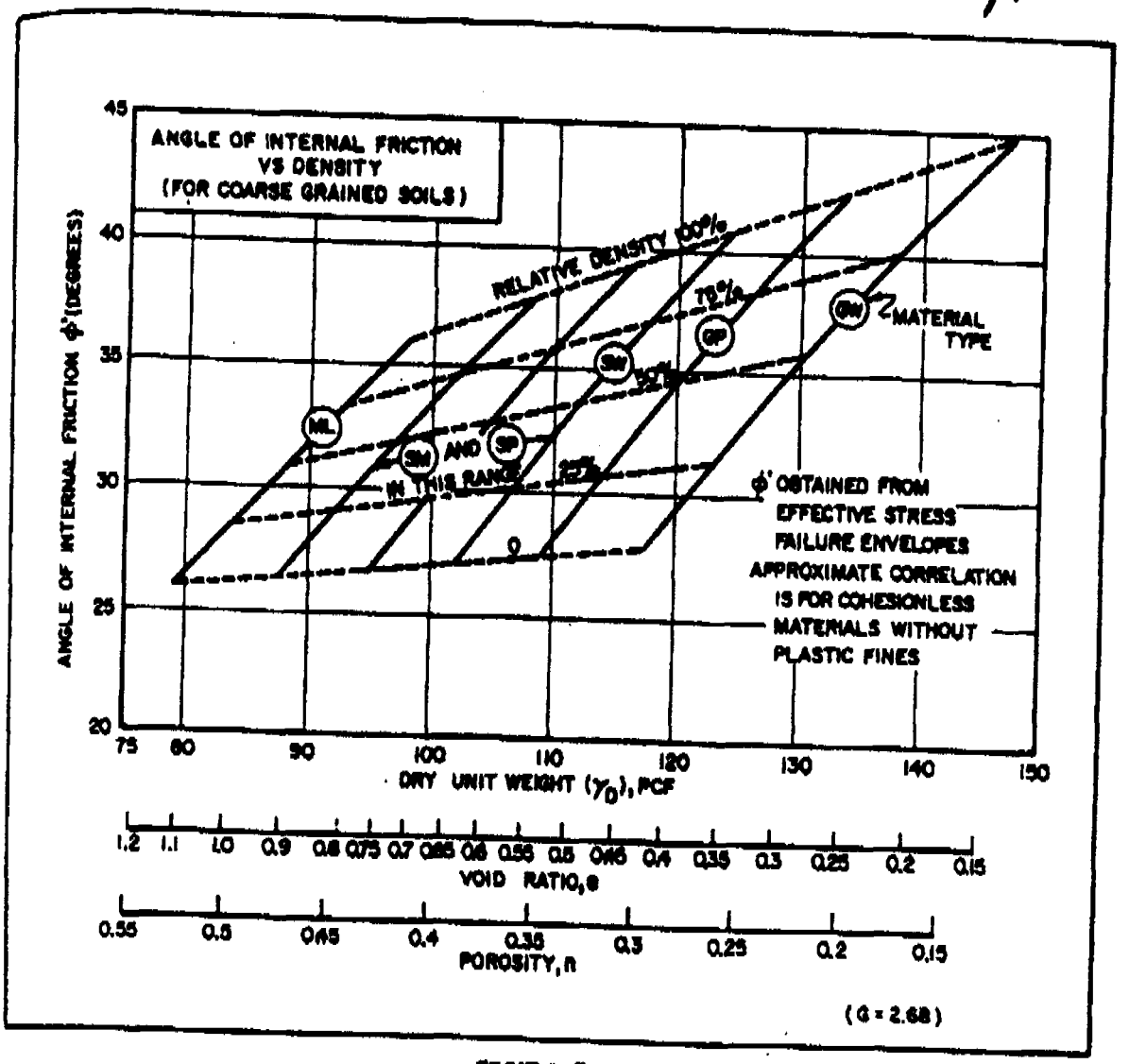


FIGURE 7
Correlations of Strength Characteristics for Granular Soils

866-5100 3/3
1/17/95

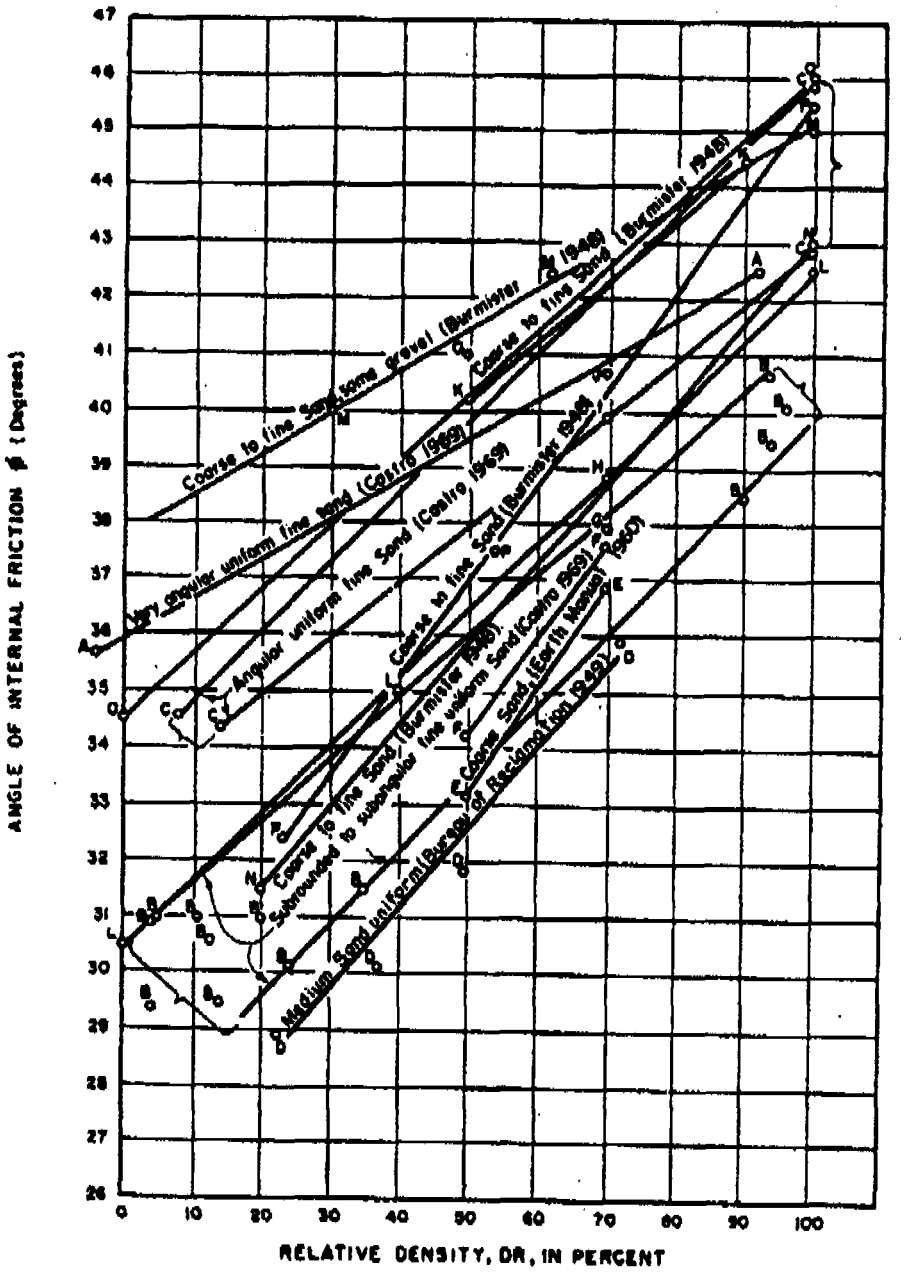


Fig. 8.28 Relative density vs. friction angle for cohesionless soils.

affected by specimen shape or size under plane strain conditions. For very dense sand, ϕ was 7° greater for plane strain shear than for triaxial shear. This reduced to about 3° for loose sand specimens and indicated that at $D_r = 0$ there would be no difference in ϕ.

These authors made tests of large rockfill specimens (36-in diameter), intermediate-sized rockfill specimens (12-in diameter), and small specimens (2.8-in diameter), all with parallel grain size curves and the same material (same shape of grains). Their results indicated that the angle of internal friction of the smallest particles (2.8-in diameter specimen) was 3 to 4 degrees higher than that of the large-sized particles (up to 6 in) in the 36-in diameter specimen, regardless of confining pressure or material type. (Three quite different types of materials were tested.) The intermediate-sized material (12-in diameter specimen) had angles of internal friction 1 to 1½ degrees lower than the smallest material.

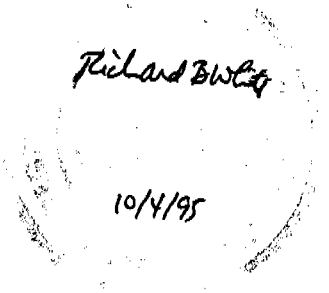
Pertinent data from the large rockfill tests including tests reported by Marsal (1965, 1967a, b) are compiled in Table 8.4. The table lists values of angle of internal friction, axial strain at failure, and volumetric strain at failure for those tests conducted at a confining pressure of 350 psi for which information was available. It may be observed that for the dredger tailings, which contain rounded particles, the values of axial and volumetric strains at failure are 6.5 and 1.5 percent, respectively, while for all of the angular materials these values are greater than 13 and 5.5 percent, respectively. The values of the volumetric strain at failure for all of the angular materials for which data were available ranged between 5.5 and 13 percent. Among these materials, granitic gneiss and shale showed the

APPENDIX 12-5-2
CUT AND FILL CALCULATION SUMMARY

Site Volume Table: Unadjusted

Cut yards	Fill yards	Net yards	Method
Site: Willow Creek Mine			
Stratum: preamlfa vs. reclaim			
239630	235807	3823 (C)	Grid

APPENDIX 12-5-3
RECLAMATION COST ESTIMATE



Willow Creek Refuse Removal
Summary of Bond Estimate

Demolition Costs

Activity	Cost
Demolition	15771
Total Rough Grading	1414748
Survey	8400
Drainage Controls	5421
Total Topsoil	157388
Revegetation	47465
Reseeding and Replanting (25%)	11866
Total Direct Costs	$1,661,059

Indirect Costs	
Startup Cost @ 5% (mob/demob, permits, bond)	$83,053
Contingency @ 10%	$166,106
Engineering Fee @ 5%	$83,053
Contract Management @ 5%	$83,053
Monitoring & Maintenance @ 10%	$166,106
Total Indirect Costs	$581,371
Total Reclamation Costs	$2,242,430
Escalation to Jan 2000 dollars	$317,029
Bond Amount	$2,559,459
Rounded to nearest $1,000	$2,559,000

MAP REF.	DESCRIPTION	MATERIALS	UNIT COST	INFL-ATION RATE	# YR	ADJUST COST	UNIT	LENGHT	WIDTH	HEIGHT	TIME	PERIM.	DIA.	AREA	VOLUM	WEIGHT	#	UNIT	SWELL FACTOR	QUANTITY	UNIT	COST
	Culvert																					
	Removal	60" diameter	$30.65			$30.65	/LF	115									1	FT		115	LF	$3,525
	Structure's Transport Cost	Dump 12 ton	$5.73			$5.73	/TON				2					3		TON-		6	TON-	$34
	Structure's Disposal Cost	Bld. Construct	$35.00			$35.00	/CY													6	CY	$0
	Subtotal																					$3,559
	Equipment's Demolition Cost																					
	Equipment's Dismatle Cost																					
	Equipment's Transport Cost																					
	Equipment's Disposal Cost																					
	Subtotal																					
	Floor's Demolition Cost	Rod Reinforce	$83.40			$83.40	/CY	32	52	0.08								FT		0	CF	
	Floor's Site Factor																					
	Floor's Rein. Factor																					
	Floor's Volume (Dimolished)																	CF	1.3	0	CY	
	Floor's Transport Cost																					
	Floor's Disposal Fee	For disposalo	$6.40			$6.40	/CY													0	CY	
	Subtotal																					$0
	Footer's Demolition Cost																			0	CF	$0
	Footer's Site Factor																					
	Footer's Rein. Factor																					
	Footer's Volume (Dimolished)																		1.3	0	CY	
	Footer's Transport Cost																					
	Footer's Disposal Fee																			0	CY	$0
	Subtotal																					$0
	Foundation's Demolition Cost	Reinforced	$292.00			$292.00	/CY	32	58	0.33					770			CY			CF	
	Foundation's Site Factor																					
	Foundation's Rein. Factor																					
	Foundation's Volume (Dimolished)																		1.3	0	CY	
	Foundation's Transport Cost																					
	Foundation's Disposal Cost	For disposalo	$6.40			$6.40	/CY													0	CY	$0
	Subtotal																					$0

MAP REF.	DESCRIPTION	MATERIALS	UNIT COST	INFL-ATION RATE	# YR	ADJUSTED COST	UNIT	LENGHT	WIDTH	HEIGHT	THICK-NESS	PERIM.	DIA.	AREA	VOLUM	WEIGHT	#	UNIT	SWELL FACTOR	QUANTITY	UNIT	COST
	Office																					12212
	Culvert																					3559
	Total																					$16,271

Reclamation Cost Esimate
Willow Creek Refuse Removal

		Hours in	Hourly	Hourly	Equip.	Operator	Number	Total Hourly	Base	Material			Number of	Escalated				Application/		
	Equipment	Eq. Rental	Equipment	Operating	& Mat.	Hourly	of Men	Equip & Labor	Material	Costs		Escalation	Years	Equip & Labor		Material		Production		
	Costs	Period	Costs	Costs	Overhead	Rate	or Equip.	Costs	Cost	Incl. O&P	Units	Rate	Escalated	Costs	Units	Quantity	Units	Rates	Units	Cost
Rough Grading																				
D8N U Blade	14790	176	84.03	38.6	0.1	38.7	1.00	$174.69				2.01%	0	$174.69	HR			360	HR	$104,639
Multi-Shank Ripper 360-519	2625	176	14.91	4.45	0.1		1	$21.30						$21.30				360	HR	$12,758
Common Building Laborers						30.95	0.50	$15.48				2.01%	0	$15.48	HR			360	HR	$9,273
Subtotal																				$126,671
D7H Series II U Blade	9430	176	53.58	21.9	0.1	38.7	3.00	$365.18				2.01%	0	$365.18	HR			360	HR	$218,743
Common Building Laborers						30.95	1.50	$46.43				2.01%	0	$46.43	HR			360	HR	$27,812
Subtotal																				$246,555
823C	1210	176	6.88	30.45	0.1	38.7	2.00	$159.53				2.01%	0	$159.53	HR			360	HR	$95,558
Common Building Laborers						30.95	1.00	$30.95				2.01%	0	$30.95	HR			360	HR	$18,539
Subtotal																				$114,097
Cat 229 (1991)	8260	176	46.93	20.75	0.1	38.7	4.00	$432.59				2.01%	0	$432.59	HR			360	HR	$271,101
Common Building Laborers						30.95	2.00	$61.90				2.01%	0	$61.90	HR			360	HR	$37,078
Subtotal																				$308,179
926E (1993)	2615	176	15.99	9.1	0.1	38.7	2.00	$132.60				2.01%	0	$132.60	HR			360	HR	$79,427
Common Building Laborers						30.95	1.00	$30.95				2.01%	0	$30.95	HR			360	HR	$18,539
Subtotal																				$97,966
Pump Manual 3" 20,000 gph	450	176	2.56	1.75	0.1		1.00	$4.74				2.01%	0	$4.74	HR			360	HR	$2,839
Common Building Laborers						30.95	0.00	$0.00				2.01%	0	$0.00	HR			360	HR	$0
Subtotal																				$2,839
4X4 12-16 CY	3745	176	21.28	17.9	0.1	31.5	8.00	$596.78				2.01%	0	$596.78	HR			360	HR	$357,471
Common Building Laborers						30.95	0.00	$0.00				2.01%	0	$0.00	HR			360	HR	$0
Subtotal																				$357,471
14G	7230	176	41.08	19.4	0.1	38.7	1.00	$105.23				2.01%	0	$105.23	HR			360	HR	$63,033
Common Building Laborers						30.95	0.50	$15.48				2.01%	0	$15.48	HR			360	HR	$9,273
Subtotal																				$72,306
Crew 4X4 1 ton	735	176	4.29	6.75	0.1		5.00	$60.72				2.01%	0	$60.72	HR			360	HR	$36,371
Foreman Average, Outside						43.65	2.00	$87.30				2.01%	0	$87.30	HR			360	HR	$52,293
Subtotal																				$88,664
Total Rough Grading																				1414748

MAP REF.	DESCRIPTION	MATERIALS	UNIT COST	INFL-ATION RATE	# YR	ADJUST COST	UNIT	LENGHT	WIDTH	HEIGHT	TIME	PERIM.	DIA.	AREA	VOLUM	WEIGHT	#	UNIT	SWELL FACTOR	QUANTITY	UNIT	COST
	Survey																					
	Surey Grades	Crew for line a	$560.00			$560.00	/Day				15							Day		15	Day	$8,400
	Subtotal																					$8,400
	Drainage Controls																					
	Filter Material	Fabric, in tren	$1.42			$1.42	/SY							650				SY		650	SY	$923
	Riprap Placement	Rip Rap Dump	$12.85			$12.85	/TON									350		TON		350	TON	$4,498
	Subtotal																					$5,421
	Floor's Demolition Cost																					
	Floor's Site Factor																					
	Floor's Rein. Factor																					
	Floor's Volume (Dimolished)																					
	Floor's Transport Cost																					
	Floor's Disposal Fee																					
	Subtotal																					
	Footer's Demolition Cost																					
	Footer's Site Factor																					
	Footer's Rein. Factor																					
	Footer's Volume (Dimolished)																					
	Footer's Transport Cost																					
	Footer's Disposal Fee																					
	Subtotal																					
	Foundation's Demolition Cost																					
	Foundation's Site Factor																					
	Foundation's Rein. Factor																					
	Foundation's Volume (Dimolished)																					
	Foundation's Transport Cost																					
	Foundation's Disposal Cost																					
	Subtotal																					
	Total																					$13,821

Reclamation Cost Estimate

Willow Creek Refuse Removal

	Equipment Costs	Hours in Eq. Rental Period	Hourly Equipment Costs	Hourly Operating Costs	Equip. & Mat. Overhead	Operator Hourly Rate	Number of Men or Equip.	Total Hourly Equip & Labor Costs	Base Material Cost	Material Costs Incl. O&P	Units	Escalation Rate	Number of Years Escalated	Escalated Equip & Labor Costs	Units	Material Quantity	Units	Application/ Production Rates	Units	Cost
Topsoil																				
936E (1992)	3170	176	18.01	9.9	0.1	36.7	1.00	$66.29				2.01%	0	$66.29	HR			280	HR	- $18,015
Common Building Laborers						30.95	0.50	$15.48				2.01%	0	$15.48	HR			280	HR	$4,025
Subtotal																				$22,040
6X4 10-12 CY	2390	176	13.58	13.1	0.1	31.5	2.00	$121.70				2.01%	0	$121.70	HR			280	HR	$31,642
Common Building Laborers						30.95	0.00	$0.00				2.01%	0	$0.00	HR			280	HR	$0
Subtotal																				$31,642
D7H Series II U Blade	9430	176	53.58	21.9	0.1	36.7	1.00	$121.73				2.01%	0	$121.73	HR			280	HR	$31,650
Common Building Laborers						30.95	0.50	$15.48				2.01%	0	$15.48	HR			280	HR	$4,025
Subtotal																				$35,675
D4C SERIES III	2830	176	16.11	9.95	0.1	36.7	1.00	$66.27				2.01%	0	$66.27	HR			30	HR	$1,988
Common Building Laborers						30.95	0.30	$15.48				2.01%	0	$15.48	HR			30	HR	$464
Subtotal																				$2,452
8,000 gal water truck	12050	176	68.47	52.05	0.1	31.5	1.00	$164.07				2.01%	0	$164.07	HR			280	HR	$42,658
Common Building Laborers						30.95	0.50	$15.48				2.01%	0	$15.48	HR			280	HR	$4,025
Subtotal																				$46,683
Pump Manual 3" 20,000 gph	450	176	2.56	1.75	0.1		1.00	$4.74				2.01%	0	$4.74	HR			280	HR	$1,232
Common Building Laborers						30.95	0.00	$0.00				2.01%	0	$0.00	HR			280	HR	$0
Subtotal																				$1,232
Crew 4X4 1 ton	735	176	4.29	8.75	0.1		2.00	$24.29				2.01%	0	$24.29	HR			280	HR	$6,315
Foreman Average, Outside						43.65	1.00	$43.65				2.01%	0	$43.65	HR			280	HR	$11,349
Subtotal																				$17,664
Total Topsoil																				157389

MAP REF.	DESCRIPTION	MATERIALS	UNIT COST	INFL-ATION RATE	# YR	ADJUST COST	UNIT	LENGHT	WIDTH	HEIGHT	TIME	PERIM.	DIA.	AREA	VOLUM	WEIGHT	#	UNIT	SWELL FACTOR	QUANTITY	UNIT	COST
	Revegetation																					
	Hydroseed (1 ton per acre																					
	+ 80 lbs tacifier)		$800.00			$800.00	/AC							27.5				AC		27.5	AC	$22,000
	Seed Mix		$350.00			$350.00	/AC							27.5				AC		27.5	AC	$9,625
	Alfalfa - 2 tons/ac		$420.00			$420.00	/AC							27.5				AC		27.5	AC	$11,550
	Fertilizer - 205 lbs/ac		$156.00			$156.00	/AC							27.5				AC		27.5	AC	$4,290
	Subtotal																					$47,465
	Reseeding and Replanting (25%)																					
	Subtotal																					$11,866
	Floor's Demolition Cost																					
	Floor's Site Factor																					
	Floor's Rein. Factor																					
	Floor's Volume (Dimolished)																					
	Floor's Transport Cost																					
	Floor's Disposal Fee																					
	Subtotal																					
	Footer's Demolition Cost																					
	Footer's Site Factor																					
	Footer's Rein. Factor																					
	Footer's Volume (Dimolished)																					
	Footer's Transport Cost																					
	Footer's Disposal Fee																					
	Subtotal																					
	Foundation's Demolition Cost																					
	Foundation's Site Factor																					
	Foundation's Rein. Factor																					
	Foundation's Volume (Dimolished)																					
	Foundation's Transport Cost																					
	Foundation's Disposal Cost																					
	Subtotal																					
	Total																					$59,331

MAP REF.	DESCRIPTION	MATERIALS	UNIT COST	INFL-ATION RATE	# YR	ADJUSTED COST	UNIT	LENGHT	WIDTH	HEIGHT	THICK-NESS	PERIM.	DIA.	AREA	VOLUM	WEIGHT	#	UNIT	SWELL FACTOR	QUANTITY	UNIT	COST
	Survey																					13821
	Revegetation																					53398
	Total																					967,219