Section 10

FISH AND WILDLIFE RESOURCES

10.1 Scope

This report summarizes fish and wildlife studies conducted for Beaver Creek Coal Company (by Western Resource Development Corporation) at the Huntington Canyon No. 4 Mine, Emery County, Utah. The purposes of the investigations were to comply with requirements for fish and wildlife studies of mining affected areas for the Utah Division of Oil, Gas, and Mining (DOGM) and to provide Beaver Creek Coal Company with data useful in planning future mining activities and long-term reclamation programs.

In meeting these basic objectives, the fish and wildlife studies were designed to supply the following types of information: (1) species composition and diversity of the various habitat types; (2) seasonal patterns of distribution and relative abundance; (3) habitats or areas of special value to wildlife, such as big game winter range or movement corridors and raptor nest sites; and (4) the actual or potential status of species listed as threatened, endangered, rare, or of particular interest by the Utah Division of Wildlife Resources (DWR) or the U.S. Fish and Wildlife Service (FWS).

Data were obtained during field trips to the study area in early September, early October, and middle November 1980, and late February, late April, late May, late June/early July, and middle August 1981.

10.1.2 Location and Ecological Setting

The Huntington Canyon No. 4 Mine study area is located along the eastern edge of the Wasatch Plateau in Emery County, Utah. (See Figure 1-2 near the front of the permit application.) Topographically, the study area consists of steep slopes on the face of the plateau and along major drainages, flat surfaces on terraces or floodplains in the valley bottoms, and relatively gentle terrain on top of the plateau (Figure 10-1). The area is underlain by nearly flat-lying sedimentary rocks of the Tertio-Cretaceous North Horn formation and the Lower Tertiary Flagstaff Formation, with Cretaceous Mancos Shale in the lowest portions of the property along the Mill Fork, Little Bear, and Crandall Creek drainages.

The study area has a highly continental climate, with large daily and seasonal variations in temperature. The lower elevations of the permit area are quite dry, with average annual precipitation of 14 inches or less, mostly falling as spring and late summer rain showers. Higher elevations receive more precipitation, much of it as snow which persists through the winter.

The vegetation of the study area is highly variable, due to differences in elevation and exposure. Major habitats include Mountain Shrub, Mixed Riparian, Aspen, Pinyon/Juniper, Middle Elevation Conifer, and High Elevation Conifer associations. Most of the major habitats are represented by phases with different plant dominants; detailed descriptions of major and minor habitats are presented in Section 10.3.1, below.

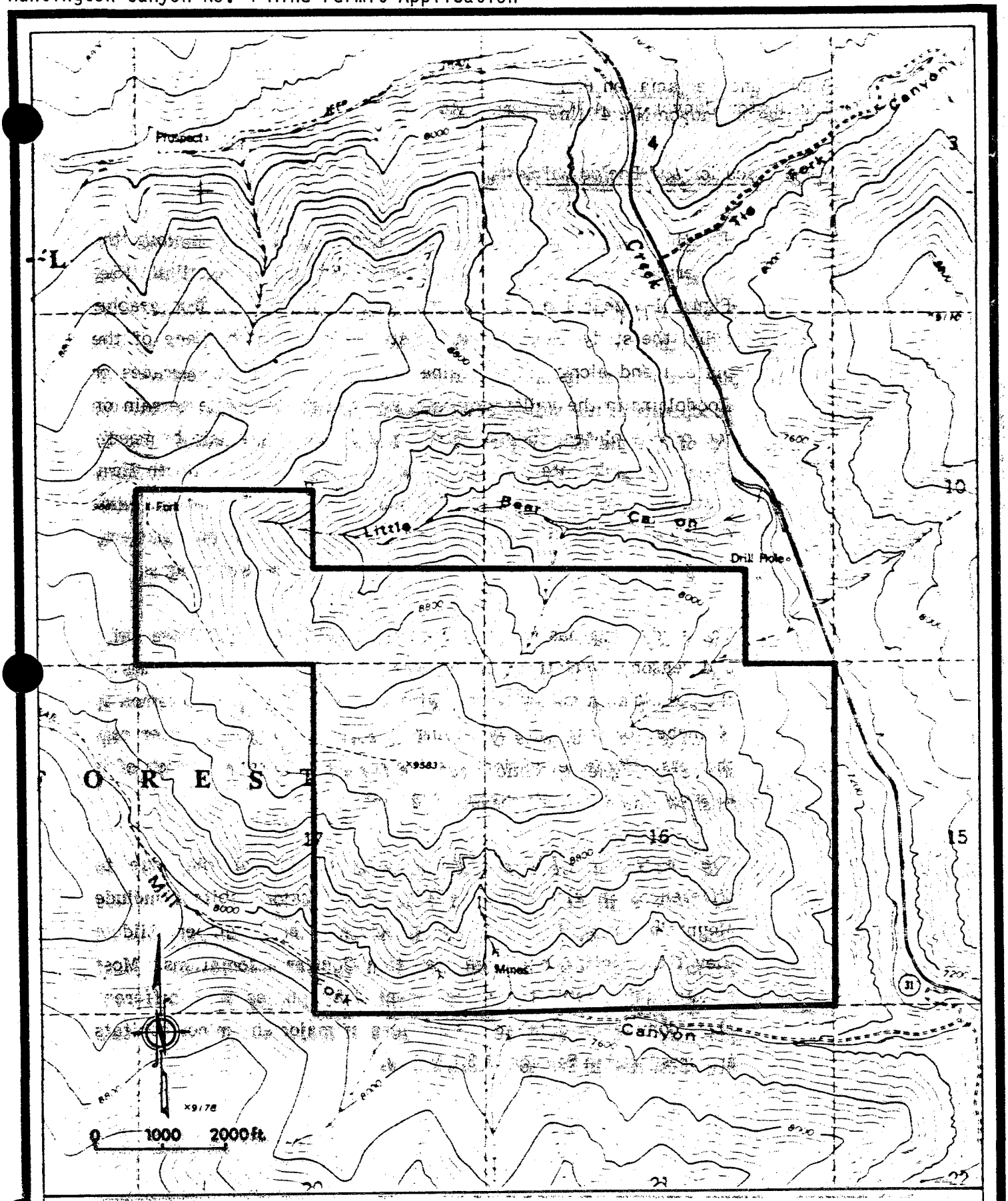


Figure 10-1. The general study area for the Huntington Canyon No. 4 Mine, Emery County, Utah. (Source: USGS 7.5' topographic guadrangle map, Rilda Canyon, Utah)

10.2 Methodology

10.2.1 Literature Review

One of the initial steps in the fish and wildlife studies was to review open-file data and range maps available from the DWR Regional Office in Price, Utah. The purpose of this effort was two-fold: first, it provided a regional backdrop of wildlife information; second, it was helpful in identifying areas of concern to DWR and thus ensuring that their needs and preferences were addressed.

The other major purpose of the literature review was to obtain pertinent publications on the distribution and status of vertebrates in the study region (i.e., the Wasatch Plateau). These books, articles, and monographs provided information on species likely to occur in the area and served as a basis for evaluating the representativeness of the Huntington Canyon No. 4 Mine site.

In March 1981, DWR provided detailed wildlife information for the Huntington Canyon No. 4 site, as requested by Beaver Creek Coal Company, pursuant to UMC 783.20. DWR also prepared a wildlife plan representing their recommendations for mitigation and impact avoidance procedures, pursuant to UMC 784.21. The information compiled by DWR in preparing their response to Beaver Creek Coal Company's request comprises a substantial portion of this report, as does DWR's 1978 publication on vertebrate species of southeastern Utah. Specific elements from these DWR documents are cited throughout this report as DWR (1981a), DWR (1981b), and DWR (1978).

10.2.2 Terrestrial Studies

The methods used during field work were designed to provide descriptive and quantitative data for terrestrial wildlife in the mine plan area. Wildlife data collection for the Huntington Canyon No. 4 Mine studies followed a stratified approach based on habitat types. In many instances, wildlife habitats did not strictly coincide with plant communities, being based on topographic as well as vegetational factors. Therefore, some plant community units were combined or split to best reflect wildlife utilization. The correlations between the two are summarized in the description of each habitat type (Section 10.3.1 below).

The methods employed in addressing the various groups of terrestrial vertebrates were discussed informally with Larry Dalton of DWR in Price, Utah, in September 1980, prior to initiating field studies. These methods are summarized in the following sections.

10.2.2.1 Mammals

For the purpose of field study, this diverse group of organisms was divided into large mammals, medium-sized mammals, and small mammals.

Large mammals consist of large herbivores and large carnivores. For the Huntington Canyon No. 4 Mine studies, these species were studied through a combination of systematic transects and opportunistic sightings. Driven surveys along the Huntington Canyon No. 4 Mine access road were used during each field session to obtain data on abundance, distribution, and habitat use; these data were augmented with walked transects across each habitat type. Walked transects afforded an opportunity to evaluate differential habitat uses from indices such as pellet-group densities and percent browse

10.2.2.1 Mammals (continued)

utilization. Opportunistic sightings during other wildlife efforts were particularly useful for species either too uncommon or furtive to be regularly encountered during systematic surveys or restricted to limited habitats. Aerial surveys were initially proposed but were dropped at the request of DWR.

Medium-sized mammals, such as predators, lagomorphs (rabbits and hares), and large rodents were also surveyed by a combination of systematic and opportunistic techniques. Road transects at dawn and dusk were important for predators and lagomorphs, most of which are most active at these times (i.e., "crepuscular"). Data on sign of the crepuscular species and on actual observation of diurnal species were recorded in conjunction with various daytime field efforts.

Small mammals, which may be used as indicators of ecosystem quality and reclamation success, were to have been surveyed using Sherman live-traps set in lines through each habitat type. As with aerial surveys, DWR specified that this technique not be used. Therefore, small mammal information presented in this report is drawn almost exclusively from DWR (1978) and Durrant (1952).

10.2.2.2 Birds

The most efficient grouping of birds for field studies and baseline reports is raptors, upland fowl, waterbirds, and small birds or songbirds.

Raptors were observed and recorded opportunistically throughout the field program. Daytime surveys were best for hawks and eagles, while dawn/dusk surveys resulted in most sightings of owls.

10.2.2.2 Birds (continued)

In addition, areas of potential importance — e.g., cliffs, riparian areas, and abandoned buildings — were specifically searched in an attempt to locate nest sites. Raptor surveys followed the standard survey techniques described by Call (1978).

Upland gamebird surveys were conducted in conjunction with other field programs and relied primarily on chance encounters of the birds or their sign. Special effort was placed on determining if upland fowl breed in the study area or are present in sufficient numbers to offer recreational value.

Waterbirds (waterfowl, shorebirds, wading birds) were in a similar approach as other large birds — i.e., opportunistically during all field programs plus specific visits to suitable habitats, such as ponds and slow-moving streams. As with upland gamebirds, emphasis was placed on determining the extent to which the study area provided breeding sites and the importance of these species as a recreational resource.

"Small birds" are a heterogeneous group. For the Huntington Canyon No. 4 Mine wildlife studies, this group included perching birds, woodpeckers, hummingbirds, swifts, and frogmouths. In late summer, fall, and winter surveys, the presence, distribution, and abundance of small birds was determined along walked transects in each habitat type and by opportunistic sightings during the initial site reconnaissance. During the breeding season (spring and early summer), quantitative data were obtained by counting the number of breeding pairs (territorial males) of each species within numerous plots located systematically along transect routes through each habitat type. Audial identification was emphasized during this census to avoid problems of differential detectability of species (as

10.2.2.2 Birds (continued)

a function of conspicuousness and activity patterns) and visual penetrability of habitats (e.g., a dense willow thicket versus an open stand of mountain brush).

The small bird transects are not permanently established routes, because the emphasis was on obtaining data from a large number of plots throughout each habitat type, rather than on repeated surveys of a small number of plots. The reasons for selecting this technique are that (a) habitats in the study area are heterogeneous and a larger sample size is necessary to adequately describe the avifauna of each, and (b) year-to-year variability within the complex habitats probably would mask any long-term trends in density, diversity, and composition.

It also should be noted that the small bird survey does not employ the widely used "Emlen transect" method. The major disadvantage of the Emlen method is that results are subject to error due to differential detectability of species, differential visual and audial penetrability of habitats and difficulty in determining how far each bird is from the observer. Moreover, the technique is particularly ill-suited in areas of steep topography and tall, woody vegetation, such the Huntington Canyon No. 4 Mine property.

Spring and summer studies of small birds specifically addressed species listed by FWS and DWR as being of "high federal interest" that potentially are present in the study area. This list includes species that are in regional decline or jeopardy, subject to long-term impact, of high public value or national importance, or federally classified as threatened or endangered. Because most of the species listed as likely to occur are either migratory or nomadic, emphasis was placed on determining if they breed on or near the site.

10.2.2.3 Reptiles and Amphibians

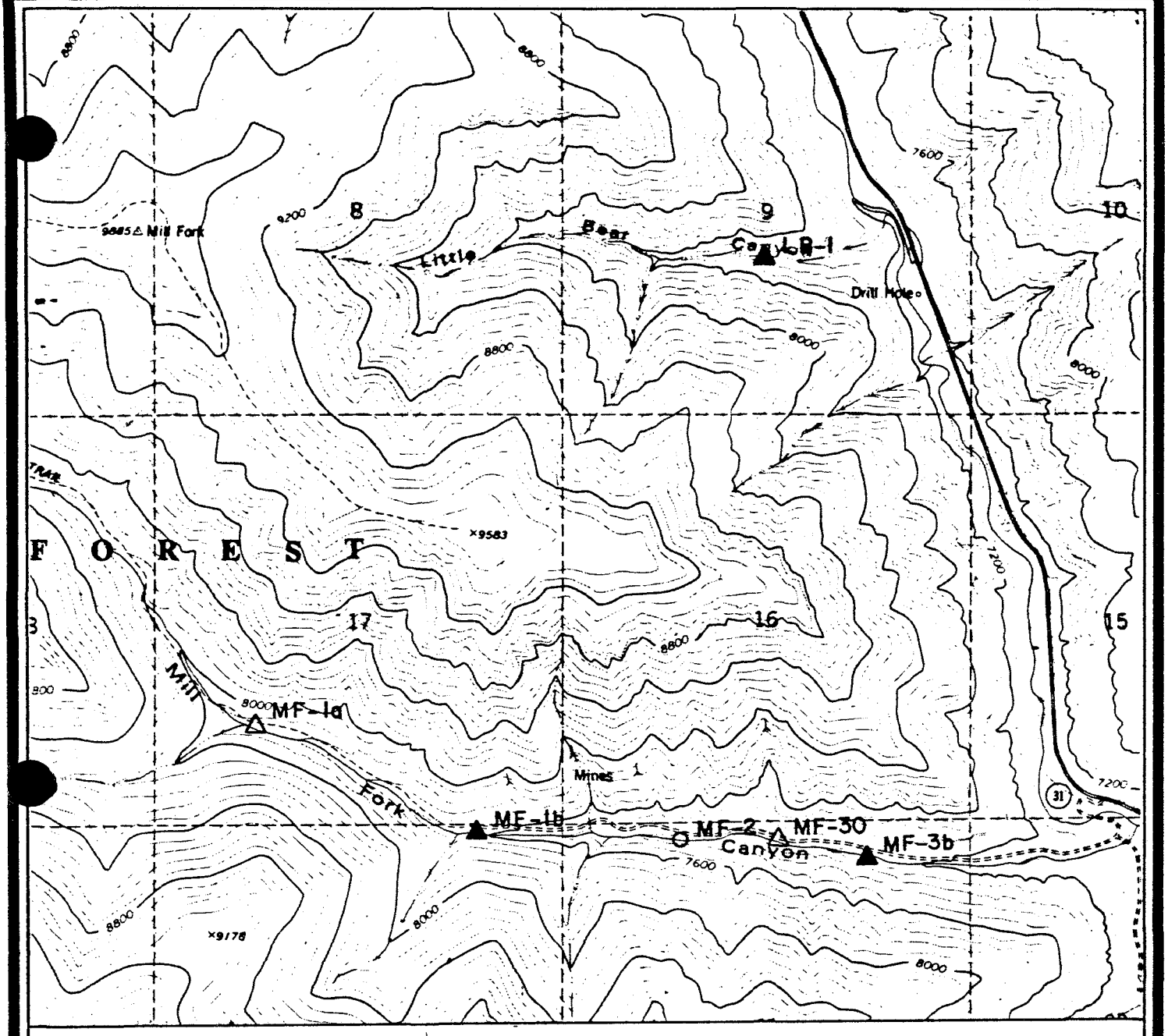
These species can be adequately surveyed in combination with other field efforts. For most species, opportunistic sightings are expected to provide sufficient detail on abundance and distribution. Amphibians, however, will be surveyed by visiting potential breeding sites, such as ponds or marshy areas, during the spring breeding period, when they may be identified by their vocalizations.

10.2.3 Aquatic Studies

Field and lab methods used in the Huntington Canyon No. 4 Mine aquatic studies were selected to assist Beaver Creek Coal Company environmental staff in describing the biotic and abiotic components of study area streams, discerning possible impacts of the existing mining operation, and recommending future mitigation and monitoring programs. Biotic components specifically included sampling for macroinvertebrates and evaluating the fisheries potential. Abiotic components included field techniques for testing water quality, as well as descriptions of substrate and channel morphology. Studies were conducted in November 1980 and April 1981.

Three sample sites were selected in November 1980 to provide data on Mill Fork above, opposite, and below the mining affected area. Refer to Figure 10-1A. In the autumn survey, site selection was limited primarily by ice cover. During the spring survey, waterflow was more intermittent, and the original upper and lower sites were dry, thus necessitating their relocation.

The sample site on Little Bear Creek was located in a representative stretch about 300 m above its confluence with Huntington Creek.



EXPLANATION

- ▲ Aquatic Sampling Sites (April 1981)
- △ Aquatic Sampling Sites (November 1980)
- ○ Aquatic Sampling Sites (April 1981 and November 1980)

ANACONDA Minerals Company
Division of Atlantic Richfield Company

FIGURE 10-1A

STUDY AREA

HUNTINGTON CANYON NO. 4 MINING PROJECT

Emery County, Utah

0 1 2

SCALE IN MILES

10.2.3.2 Habitat Quality

Basic physicochemical characteristics of surface water related to aquatic ecosystem quality were evaluated using standard field equipment during both the fall and spring surveys. In November 1980, temperature and conductivity were measured with a Yellow Springs Model 33 S-C-T meter, hydrogen ion concentration was calculated with an Ace mini-pH meter, and dissolved oxygen was measured by the modified Winkler method. In April 1981, chemical characteristics were determined with a Hach Fish Culturist water chemistry kit, while temperature was measured with a mercury thermometer submersed for at least 5 minutes.

10.2.3.3 Aquatic Invertebrates

Biological community surveys involved use of a 0.5 mm mesh Surber sampler to collect aquatic invertebrates. At each sample site, the substrate was agitated with a 1 ft^2 area to dislodge invertebrates, which were swept by the stream current into a trailing net. Surber samples were collected from at least one pool and one riffle at each site. The combined pool/riffle samples were fixed in the field and returned to the lab for enumeration and identification to the lowest practicable taxonomic level (usually genus). Identification was based on standard reference works for the region (e.g., Baumann et al. 1977, Merritt and Cummins 1978, Pennak 1978).

Nongame fish were to be sampled with a dipnet to determine species composition and relative abundance, but none was observed during either survey.

10.3 Existing Fish and Wildlife Resources

10.3.1 Wildlife Habitats in the Mine Plan Area

Wildlife habitat types were identified and described during the initial field visits to the Huntington Canyon No. 4 Mine site. As described in Section 10.2.2 above, wildlife habitats do not strictly correspond to vegetation community types. In most studies, more wildlife habitats are recognized than are plant communities, because (1) wildlife values generally can be differentiated at the phase (subcommunity) level and (2) some habitats, such as rock outcrops, cliffs, and scree slopes, are not plant-related at all.

Habitats distinguishable at the Huntington Canyon No. 4 Mine Site are described below.

10.3.1.1 Pinyon/Juniper Woodlands

"PJ" habitats, prevalent on south-facing slopes with rocky substrates of blocky sandstone, were extensive in the study area (see the Vegetation Map, Plate 9-1). Most Pinyon/Juniper areas were dominated by open stands of Pinyon Pine Pinus edulis, Rocky Mountain Juniper Juniperus scopulorum, and Utah Juniper Juniperus osteosperma, with large Curl-leaf Mountain Mahogany Cercocarpus ledifolius (Figure 10-2). In a few places, the conifers were essentially lacking, resulting in a Mountain Mahogany "woodland." Many of the Mountain Mahogany more closely resembled small trees than shrubs being over 3 m high and having a single large trunk near the ground. Scattered Ponderosa Pine Pinus ponderosa and Douglas-fir Pseudotsuga menziesii were conspicuous in more mesic sites, especially valley bottoms, and Serviceberry Amelanchier sp. was occasionally present in significant numbers.

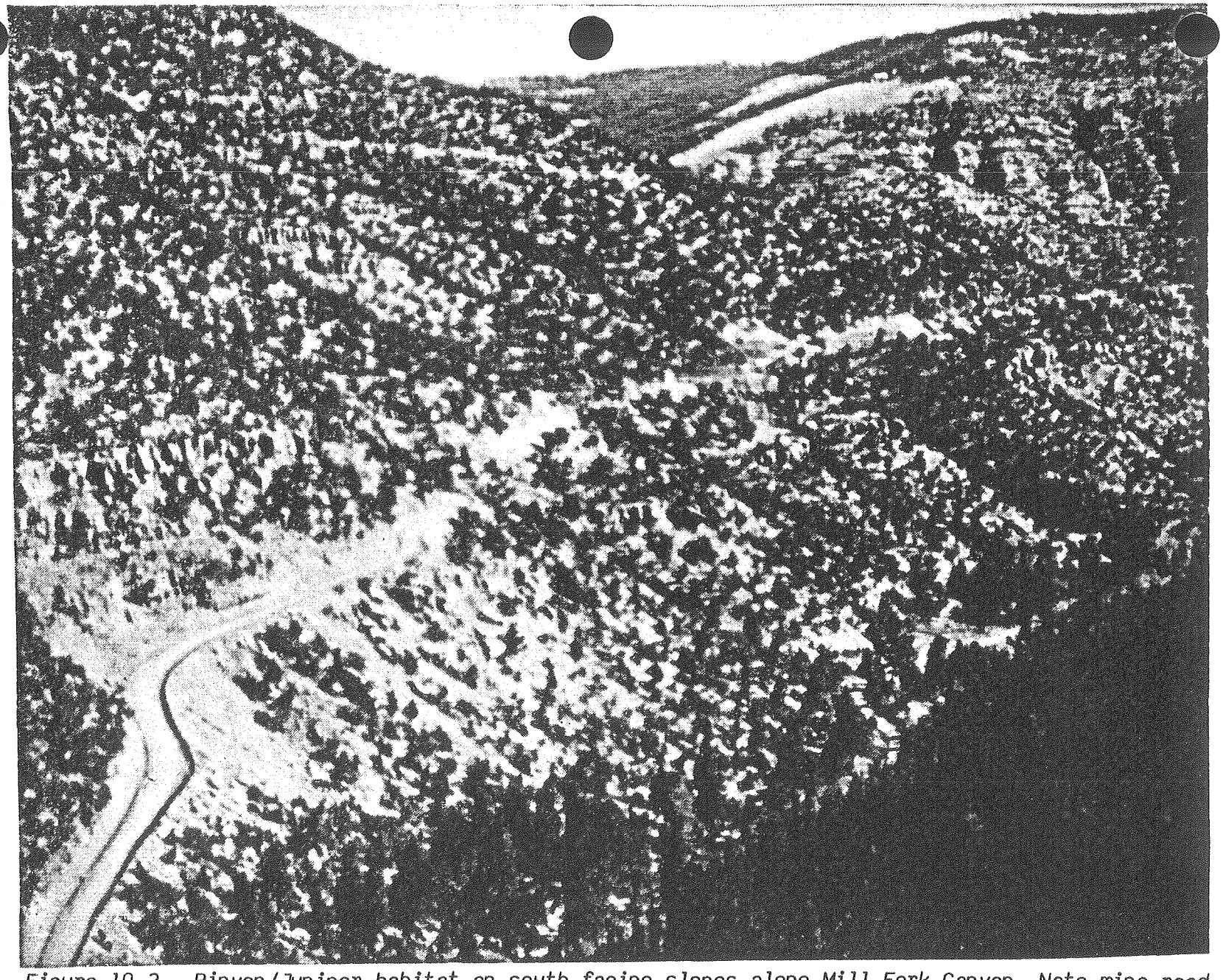


Figure 10-2. Pinyon/Juniper habitat on south-facing slopes along Mill Fork Canyon. Note mine road running diagonally from lower left corner, dense Middle Elevation Conifers in lower right, and Mixed Riparian zone along valley floor.

10.3.1.1 Pinyon/Juniper Woodlands (continued)

Prominent PJ understory species included Big Sagebrush Artemisia tridentata, Fringed Sage Artemisia frigida, Broom Snakeweed Xanthocephalum sarothrae, Salina Wildrye Elymus salinus, Indian Ricegrass Oryzopsis hymenoides, Scarlet Globemallow Sphaeralcea coccinea, Scarlet Gilia Ipomopsis aggregata, and Gumweed Tansy-aster Machaeranthera grindelioides.

Mountain Shrub

No areas of mountain shrub within the Huntington No. 4 permit area were delineated by Western Resources in their field trips. However, small areas of practically pure stands of green manzanita Arctostaphyllos patula were mapped by Stoecker-Keammerer in 1982 as manzanita shrubland. Refer to the Vegetation Exhibit, Plate 9-1.

WRD described green manzanita at other Beaver Creek Mine sites as being a component of the xeric phase of the mountain shrub community type. Within these study sites, at higher elevations, some south-facing slopes were strongly dominated by this evergreen shrub of particular value to wildlife.

As described in the 1982 report on vegetation types mapped, the manzanita shrubland type is limited in extent and occurs on an

east facing slope on the ridge between Crandall and Little Bear Canyons. The type is characterized by the dominance of manzanita (Arctostaphylos patula). Mountain-lover grows in the understory of the manzanita. The dense stands of manzanita tend to limit the growth of herbaceous species.

10.3.1.2 Middle Elevation Conifer Forests

North-facing slopes, such as south of Mill Fork across from the mine site (Figure 10-3), were cloaked in a dense coniferous forest consisting of both low- and high-elevation components. White Fir Abies concolor, Douglas-fir, and Engelmann Spruce Picea engelmannii were codominants of this unit, although it is referred to only as "Douglas-fir" on the Vegetation Map (Plate 9-1). The understory included a variety of shrubs, such as Snowberry Symphoricarpos sp., Currant Ribes sp., Mountain-lover Pachystima myrsinites, Woods Rose Rosa woodsii. and Oregon Holly-grape Mahonia repens.

Common Juniper Juniperus communis was particularly well developed as a shrub stratum in some sites, especially in exposed areas where the conifer understory was more open. Limber Pine Pinus flexilis and Bristlecone Pine Pinus aristata were also present, generally as scattered individuals along forest edges. These two species occasionally formed a wind-related ecotone between south-facing conifer stands and subalpine dry meadows near steep ridgetops (Figure 10-4).

10.3.1.3 Mixed Riparian Forests

Streamside communities in the permit area generally were characterized by typical riparian vegetation (Figure 10-3, Plate 9-1). Prominent tree species were Narrowleaf Cottonwood Populus angustifolia, Quaking Aspen Populus tremuloides, Douglas-fir, White Fir, Engelmann Spruce, and Blue Spruce Picea pungens. Large deciduous shrubs included Thinleaf Alder Alnus tenuifolia, Western River Birch Betula occidentalis, Mountain Maple Acer glabrum, Redtwig Dogwood Swida sericea (Cornus stolonifera), Elderberry Sambucus cf. coerulea, Chokecherry Prunus virginiana var. melanocarpa, and a number of Willow Salix species.

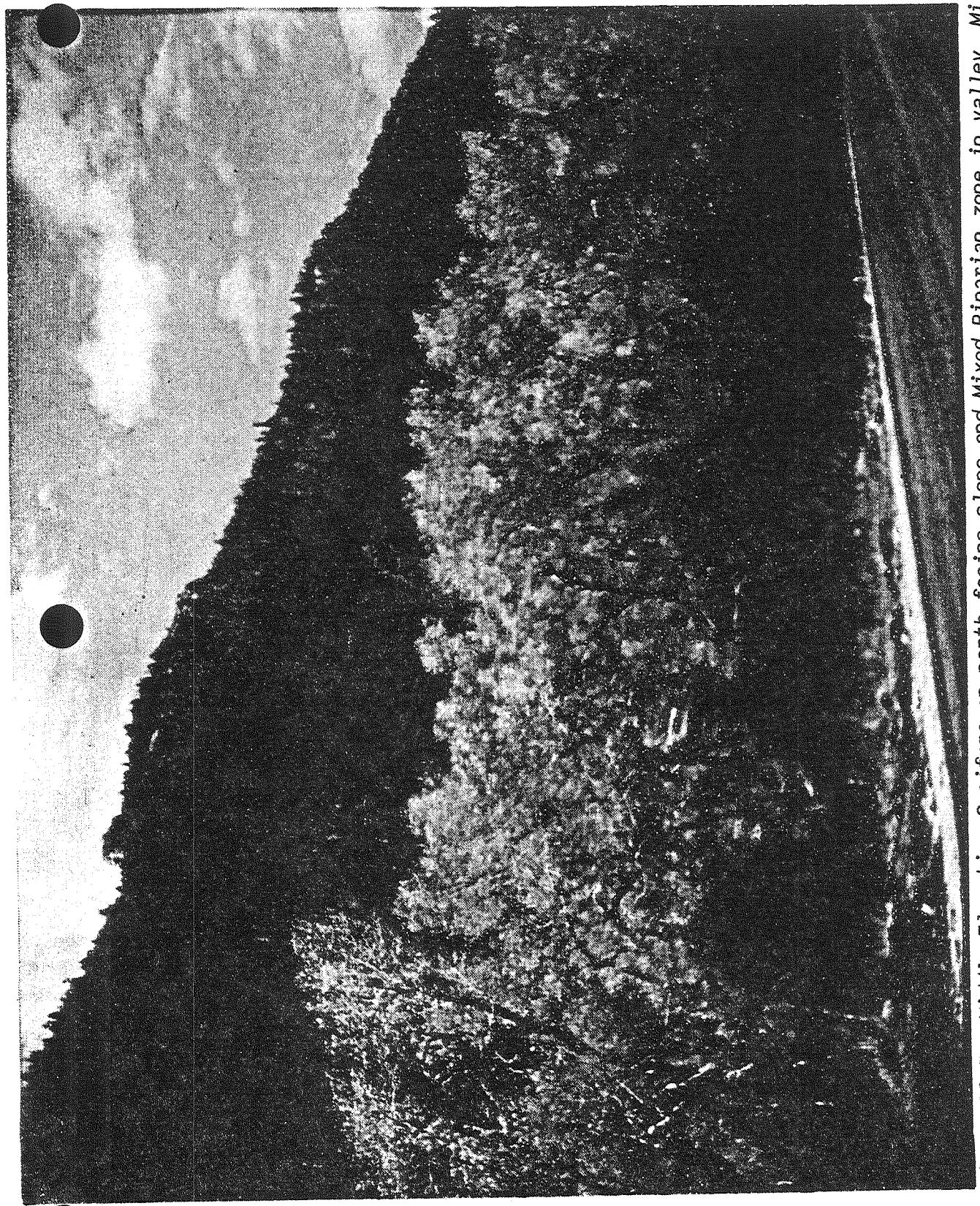


Figure 10-3. Middle Elevation Conifers on north-facing slope and Mixed Riparian zone in valley, Mill Fork Canyon. Conifers are Douglas-fir and White Fir, deciduous trees are Narrowleaf Cottonwood.

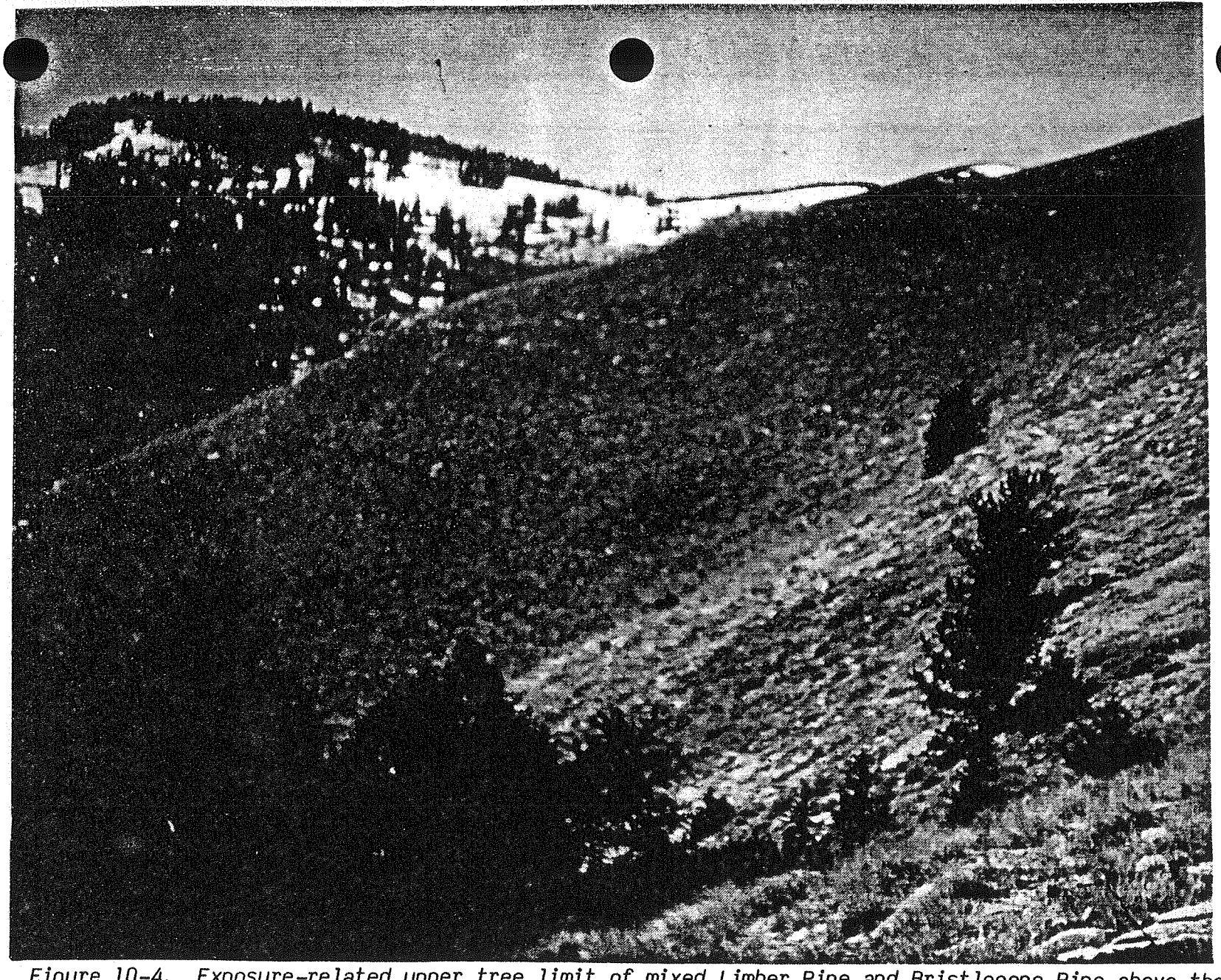


Figure 10-4. Exposure-related upper tree limit of mixed Limber Pine and Bristlecone Pine above the mine site (note absence of snow). Treeless areas are weedy dry meadows and dense sagebrush-snowberry shrub stands, heavily grazed by domestic sheep. Left background is High Elevation Conifer Forest.

10.3.1.4 Aspen Forests

Quaking Aspen formed rather extensive stands on top of the plateau west of the permit boundary (i.e., Mill Fork Mountain), especially along drainages and on the north-facing slopes of Crandall Canyon. Typical aspen understories included Arnica, Aster, Castilleja, Erigeron, Fragaria, Frasera, Geranium, Heliomeris, Lathyrus, Ligusticum, Lupinus, Osmorhiza, Smilacina, Thalictrum, and Vicia. In a few sites, however, grazing by sheep had apparently been so intense historically that weedy or nonpalatable plants dominated, e.g., Achillea, Cynoglossum, Delphinium, Dugaldia, Hackelia, Helianthus, Lappula, Phacelia, Taraxacum, Tragopogon, and Valeriana. Although shrubs were nearly absent in some places, Snowberry, Oregon Holly-Grape, Woods Rose, and a variety of other woody species were typical of most aspen stands. Prominent grasses were Mountain Brome Bromus marginatus, Nodding Brome Bromus anomalus, Smooth Brome Bromus inermis, Slender Wheatgrass Agropyron trachycaulum, Blue Wildrye Elymus glaucus, Orchardgrass Dactylis glomerata, and Western Needlegrass Stipa occidentalis.

10.3.1.5 High Elevation Conifer Forests

The gentle terrain on top of the plateau supported dense stands of Engelmann Spruce, Subalpine Fir Abies lasiocarpa, and Douglas-fir, with a well developed understory of shrubs and forbs similar to the Middle Elevation Conifer type described above. Small drainages provided suitable sites for additional subalpine forbs, such as Aconitum, Cardamine, Mertensia, Mimulus, and Polemonium. As indicated on the Vegetation Map (Plate 9-1), upper slopes in the Little Bear Canyon area had burned in the past, resulting in open slopes with the charred remains of mature conifers still standing (Figure 10-5).

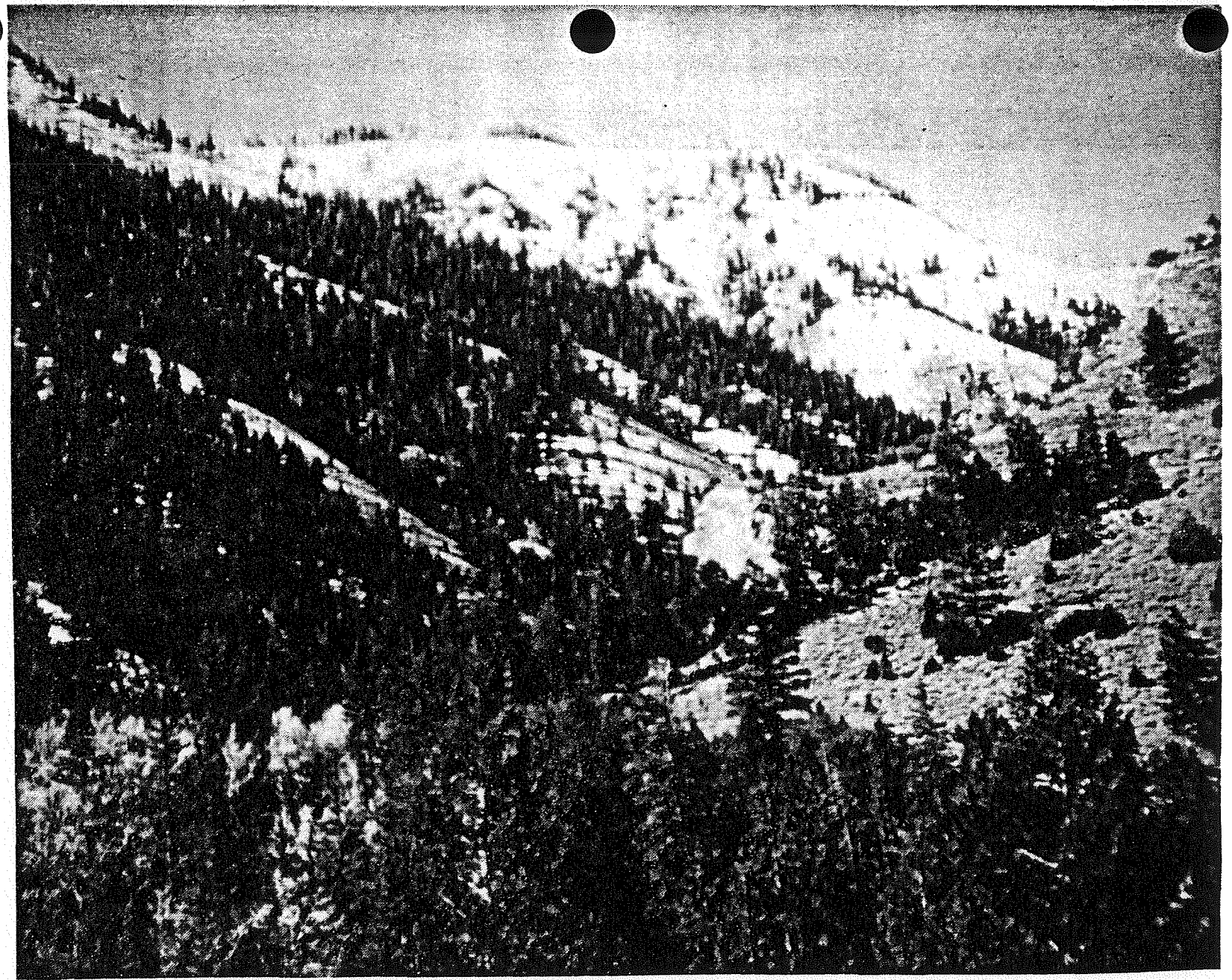


Figure 10-5. Little Bear Canyon in the northeastern portion of the study area, viewed from Huntington Canyon. Note dense Middle Elevation Conifers to the left, open Pinyon/Juniper with scattered Douglas-firs to the right, and Mixed Riparian zone in the foreground. Bare area on ridgeline is a burned conifer stand.

10.3.1.6 Subalpine Dry Meadows and Sagebrush

Plateau habitats in the permit area included open areas dominated by native and introduced rangeland grasses, weedy forbs (listed under the Aspen habitat description), and in some areas, dense sagebrush and snowberry shrublands. This unit is shown as Sagebrush Grassland on the Vegetation Map (Plate 9-1). The distribution of the dry meadows and sagebrush appeared to be controlled in part by exposure, such as on knolls and steep south-facing slopes (Figure 10-4). Most such areas showed evidence of extreme overgrazing by sheep. In a few exposed sites, Common Junipers formed dense, low clumps reminiscent of krummholz at higher elevation tree limits.

10.3.1.7 Aquatic Ecosystems

Major aquatic habitats within the study area are Mill Fork, Little Bear Creek, and Crandall Canyon.

Mill Fork originates on the eastern slope of East Mountain and flows eastward for about 5 mi before joining Huntington Creek. From its point of origin at about 10,120 ft to its terminus at about 7,040 ft, Mill Fork has a mean gradient of approximately 600 ft/mi (11.4 percent). Like most small drainages in mountainous terain, it is concave in longitudinal profile, being much steeper near its head than its mouth. The stream is nearly straight, with a meander factor estimated at less than 5 percent.

Although indicated as a perennial stream on the USGS topographic quadrangle map for the area, Mill Fork actually is intermittent overall. In November 1980, the creek had flowing water in only about one-half of its length through the study area (i.e., between its first tributary and its mouth) and was frozen throughout its lowest mile. Where flowing, discharge appeared not to exceed

10.3.1.7 Aquatic Ecosystems (continued)

about 0.007 m^3/sec. In April 1981, discharge was even more restricted, with actual flow essentially limited to the stretch between the upper and lower sample sites, a length of about 300 m.

Little Bear Creek is fed primarily by a spring at about 9,000 ft, although snowmelt and precipitation runoff (enhanced by a burn in dense spruce/fir stands near the top of Little Bear Canyon) contribute to peak flows. Throughout its 1.5 mi length, Little Bear Creek is fairly steep, with an average gradient of about 1,200 ft/mi. The essentially permanent flow and greater discharge of Little Bear Creek (about 0.085 m^3/sec) compared to Mill Fork probably are related primarily to the presence of the spring, although slope, aspect, plant cover, and substrate may also contribute to the difference.

Crandall Creek is perennial in some reaches, but is dry in other areas during periods of base flow. Discharge during water year 1979 averaged 0.062 m^3/second. Annual discharge per unit area was 280 acre-feet/$mi.^2$. Approximately 80% of the streamflow in water year 1979 occurred between April and July resulting from snowmelt (Danielson, et al, 1981).

10.3.2 Wildlife

10.3.2.1 Aquatic Wildlife and Habitat Value Determination

Major studies were initiated in 1980 and completed in 1981 on Mill Fork and Little Bear Creek.

10.3.2.1 Aquatic Wildlife and Habitat Value Determination (continued)

Based on benthic macroinvertebrate and aquatic habitat surveys, and on data provided by DWR (1981a), Mill Fork supports neither game nor nongame (forage) fish and lacks sufficient flow in most years to provide spawning sites. However, the stream probably does contribute some invertebrate food items and a small amount of surface flow to Huntington Creek, an important fishery in the region.

The same is true of Little Bear Creek, which enters Huntington Canyon upstream of Mill Fork.

No fish were seen or collected in either Mill Fork or Little Bear Creek during field studies, nor is a permanent fishery reported by DWR (1981a). The primary reason for the absence of fish from Mill Fork probably is the very low flows observed during both sampling sessions. Although the low flows may have been partly attributable to low precipitation in the region during the 1980-81 study period, examination of the creek channel indicates that the stream seldom carries substantially greater discharge. If fish do occasionally move into lower portions during periods of peak flow, their survival in the creek would be minimal, with movement back into Huntington Creek a more likely scenario.

Little Bear Creek had more flow than Mill Fork (see Section 10.3.1.7), but regular use of the stream by fish probably is precluded by a combination of (1) very steep lower stretches, resulting in a partial barrier to migration from Huntington Creek, and (2) withdrawal of water at the source-spring throughout the summer by the town of Huntington, resulting in very low late summer flows.

10.3.2.1 Aquatic Wildlife and Habitat Value Determination (continued)

Based on benthic macroinvertebrate and aquatic habitat surveys, and on data provided by DWR (1981a), both Mill Fork and Little Bear Creek continues some invertebrate food items and a small amount of surface flow to Huntington Creek, an important fisheries in the region. Although the present study did not permit a quantitative estimate of the percentage of prey-base and water added to Huntington Creek by the two study area streams, the amounts appear to be small. Therefore, the greatest value of the Mill Fork and Little Bear Creek aquatic habitats is the water, cover, and food they provide to a variety of terrestrial vertebrates (see the following section).

10.3.2.2 Terrestrial Wildlife and Habitat Value Determinations

As used in this report, "value" incorporates both ecological and economic criteria. Examples of criteria used in value determination include considerations such as whether a species is an indicator of environmental stress, critical to the food web as a prey or predator, important for monitoring programs (see Section 10.7 below), or represents a significant hunting or trapping resource. High value habitats are those which support especially high diversities or densities of wildlife, attract species not otherwise found in the area, or are important to high value wildlife species (as defined above).

Both site-specific field studies conducted for Beaver Creek Coal Company and information provided by DWR (1981a) indicate that the most important habitat type in the study area is the Mixed Riparian zone along major drainage ways. The reasons for classifying Mixed Riparian as the highest priority wildlife habitat are the availability of water and the structural and compositional diversity

10.3.2.2 Terrestrial Wildlife and Habitat Value Determinations (continued)

of the plant community. The second point directly or indirectly affects a number of factors, such as feeding sites, nesting sites, resting or roosting sites, and quantity and quality of food items (such as herbage, seeds, fruit, invertebrates, and small vertebrates). Other high priority habitats listed by DWR (1981a) are seeps or springs which provide water, and cliffs which afford nesting sites for many species of raptorial birds.

Important and other prevalent wildlife species are discussed in the following sections, which are organized by taxonomic group.

10.3.2.3 Mammals

According to DWR (1978), 84 species of mammals are known to occur in the Wasatch Plateau region, of which 64 are expected to inhabit the study area. Twenty-five mammal species are considered by DWR (1981a) to be of high interest to the State of Utah. These species, and other species prominent in the study area, are described below.

Two bat species of special interest to Utah are the Red Bat Lasiurus borealis, which roosts in wooded areas, and the Western Big-eared Bat Plecotus townsendii, which roosts in caves, rock overhangs, tunnels, or abandoned buildings. See Appendix Table 10-8 for a complete listing of bat species potentially present in the study area.

High interest (small game) lagomorphs observed in the study area are the Mountain Cottontail Sylvilagus nuttallii and Snowshoe Hare Lepus americanus. Based on DWR information (1981a), study area provides "substantial" habitat for the cottontail, while the mosaic

10.3.2.3 Mammals (continued)

of Spruce/Fir, Aspen, and Riparian zones at the highest elevations provides "high priority" breeding habitat to the hare. Lowest elevation Pinyon/Juniper habitats may support a few Desert Cottontail Sylvilagus audubonii, which DWR reports to occur below 7,000 ft in most areas (1981a).

One sciurid of high interest to Utah is the Northern Flying Squirrel Glaucomys sabrinus, for which both the Middle Elevation and High Elevation conifer stand-types potentially provide substantial habitat in the study area. Other prominent sciurids observed during field studies, but not classified as being of special concern to Utah, are the Red Squirrel Tamiasciurus hudsonicus, which was common in Mixed Conifer; the Rock Squirrel Spermophilus variegatus (often mistaken for a tree squirrel) in Pinyon/Juniper; the Uintah Ground Squirrel S. armatus in Dry Meadows; the Golden-mantled Ground Squirrel S. lateralis and Uintah Chipmunk Eutamias umbrinus in Pinyon/Juniper and most higher elevation habitats; and the Least Chipmunk E. minimus in virtually every habitat. Sign (burrows) probably belonging to another species — Northern Pocket Gopher Thomomys talpoides — were observed in dry meadow and forest clearings above the Huntington Canyon No. 4 Mine study area.

One of the most important groups of terrestrial vertebrates are the small rodents, such as the cricetine and microtine mice, jumping mice, and pocket mice. These species are a vital link in the food web, particularly since they provide the vast bulk of prey for virtually all mammalian and avian predators. Small mammals were not addressed in this study, however, because DWR would not permit a live-trapping sampling program. However, Appendix

10.3.2.3 Mammals (continued)

Table 10-8 provides a list of species expected to occur in the study area, based on known geographic ranges and ecological preferences.

The Beaver Castor canadensis is a resident of the Wasatch Plateau region, although none was observed in the study area during site-specific field investigations. The apparent absence of Beaver presumably is due to the paucity of flowing streams being too small and intermittent to offer suitable habitat. Muskrat Ondatra zibethicus also inhabit aquatic habitats in the vicinity of the study area, but, like the Beaver, none was observed during field studies, again owing to the scarcity of surface water.

Small carnivores of high interest (as furbearers) to Utah include a number of mustelids: Badger Taxidea taxus, Marten Martes caurina, Mink Mustela vison, Long-tailed Weasel M. frenata, Short-tailed Weasel M. erminea, Striped Skunk Mephitis mephitis, and Spotted Skunk Spilogale putorius. This group also includes two procyonids, the Raccoon Procyon lotor and the Ringtail Bassariscus astutus.

Based on habitats within the study area, all of these species may occur, although the Raccoon and Mink show a fairly high affinity to surface water and thus are less likely to occur than the other species. Appendix Table 10-8 summarizes the habitat preferences of the small carnivores reported by DWR (1978) as potentially present.

Larger carnivores reportedly present in the region (DWR 1978) are the Black Bear Ursus americanus, Mountain Lion Felis concolor, Bobcat Lynx rufus, Canada Lynx Lynx canadensis, Coyote Canis

10.3.2.3 Mammals (continued)

latrans, Red Fox Vulpus vulpus, and Gray Fox Urocyon cinereoargenteus. Black Bear are known to occur, based on reports by mine personnel and diagnostic sign, and appear to be especially common in wooded valley bottoms. Mountain Lions are likely to occur, with rugged areas along deeper valleys providing the most suitable habitat for denning.

Both the Coyote and Bobcat are known to occur, based on diagnostic sign and direct observation. These species inhabit a broad range of habitats and hence should be considered ubiquitous. Red Fox and Canada Lynx also occupy a variety of habitats, with the fox generally below and the lynx generally above middle elevations in the region. Neither of these species has been observed, nor has the Gray Fox, which tends to occur in low numbers within its range. Other species which theoretically are potentially present in the region are the Gray Wolf Canis lupus and the Wolverine Gulo luscus (DWR 1981a). However, these species are so rare — if extant at all — that they are of interest as oddities rather than as critical components of the ecosystem.

Of the large predators discussed above, all but the Coyote and Gray Fox are classified as high interest species, based primarily on their value as game species (Black Bear and Mountain Lion), their regional decline (Canada Lynx), or their value in the commercial fur trade.

Large ungulates present on or near the mine permit site are Mule Deer Odocoileus hemionus, American Elk Cervus elaphus, and Moose Alces alces. Deer and elk are common in the region, and overall populations are reported by DWR (1981a) to be increasing for both species. Pre-hunting season aerial trend counts of mule deer in Herd Unit 34 (Table 10-1) indicate an approximate two-fold

Table 10-1 Aerial trend counts and herd classification of Mule Deer in Herd Unit 34, (Huntington), Utah, 1973-1980

Year	1973	1974	1975	1976	1977	1978	1979	1980
Aerial Trend Count								
Pre-season	103	213	199	243	318	207	202	235
Post-season	000	000	208	203	273	262	200	227
Herd Classification (post-season)								
Fawns/100 does	000	000	122	108	105	66	78	71
Bucks/100 does	000	000	27	23	19	13	10	4

Table 10-2 Aerial trend counts and herd classification of American Elk in Herd Unit 12, (Mantis), Utah, 1971-1980

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Aerial Trend Count										
Pre-season	550	775	623	906	1269	1283	1278	1291	1106	1459
Herd classification (pre-season)										
Calves/100 cows	54	60	57	55	50	60	55	52	51	56
Bulls/100 cows	24	21	18	12	14	25	20	18	14	12

10.3.2.3 Mammals (continued)

increase in the deer population from 1973 to 1980 (DWR 1980a). Aerial trend counts of elk in Herd Unit 12 (Table 10-2) indicate a similar increase in populations of that species from 1971 to 1980 (DWR 1980a). It should be emphasized that these numbers represent only trends in population size and are not estimates of population numbers.

Although Mule Deer age ratios (fawns/100 does) indicate a possible steady decline in herd productivity from 1975-1980, age ratios do not necessarily reflect true reproduction and are subject to misinterpretation without additional information, such as rates of increase or annual recruitment of females to the population (Caughley 1974). In general, however, there appears to have been a decrease in deer productivity (fawns/doe) during the past 6 years. The elk herd in Unit 12 shows an upward trend in population and relatively stable production, indicating the presence of a viable herd.

Habitats in the vicinity of the Huntington Canyon No. 4 Mine are mapped by DWR (1981a) as including high priority summer range and crucial-critical winter range for both deer and elk. Summer range for these species is the mosaic of conifers, aspen, and meadows atop the plateau. Although some summer range does occur at higher elevations within the permit area, it is more prevalent on East Mountain to the west and southwest, and Gentry Mountain to the east of Huntington Canyon.

Both the DWR (1980a) and Beaver Creek Coal Company Wildlife consultants have found summer range to be in generally fair to good condition, except for areas of overgrazing by domestic sheep. Within the study, dry meadows have received particularly heavy grazing pressure (see Section 10.3.1.6 above).

10.3.2.3 Mammals (continued)

Summer ranges generally are occupied by deer and elk from middle May through late October, although the exact timing may vary from year to year depending on temperature, snowfall, and range condition. While not a limiting factor to ungulate populations, summer range is important in providing energy reserves to meet deficiencies in winter energy supplies (Klein 1968, Baker and Hobbs 1981).

Winter range for deer and elk includes a variety of slope and vegetation types. Lower slopes throughout much of the study area are mapped by DWR (1981a) as crucial-critical elk winter range (Figure 10-6), based on vegetation types. Most elk winter range in the region occurs farther to the south, primarily in snow-free open areas, such as meadows and wind-swept ridgetops, interspersed with conifers and aspen for cover.

For deer, south- and east-facing slopes along portions of Mill Fork, Little Bear Creek, and Crandall Canyons provide relatively warm and snow-free sites, which are especially important during severe winters (Figure 10-7). Xeric slopes within the study area generally support an open conifer woodland with an understory of shrubs and bunchgrasses. On predominantly south-facing sites along Mill Fork Canyon, the conifers are dominated by Pinyon Pine, Rocky Mountain Juniper, and Utah Juniper, with scattered Ponderosa Pine and Douglas-fir (Figure 10-2). On east-facing sites along the west side of Huntington Canyon and lower Little Bear Canyon, the conifer stratum includes a more significant Douglas-fir component (Figure 10-5), probably due to aspect and a somewhat higher mean elevation.

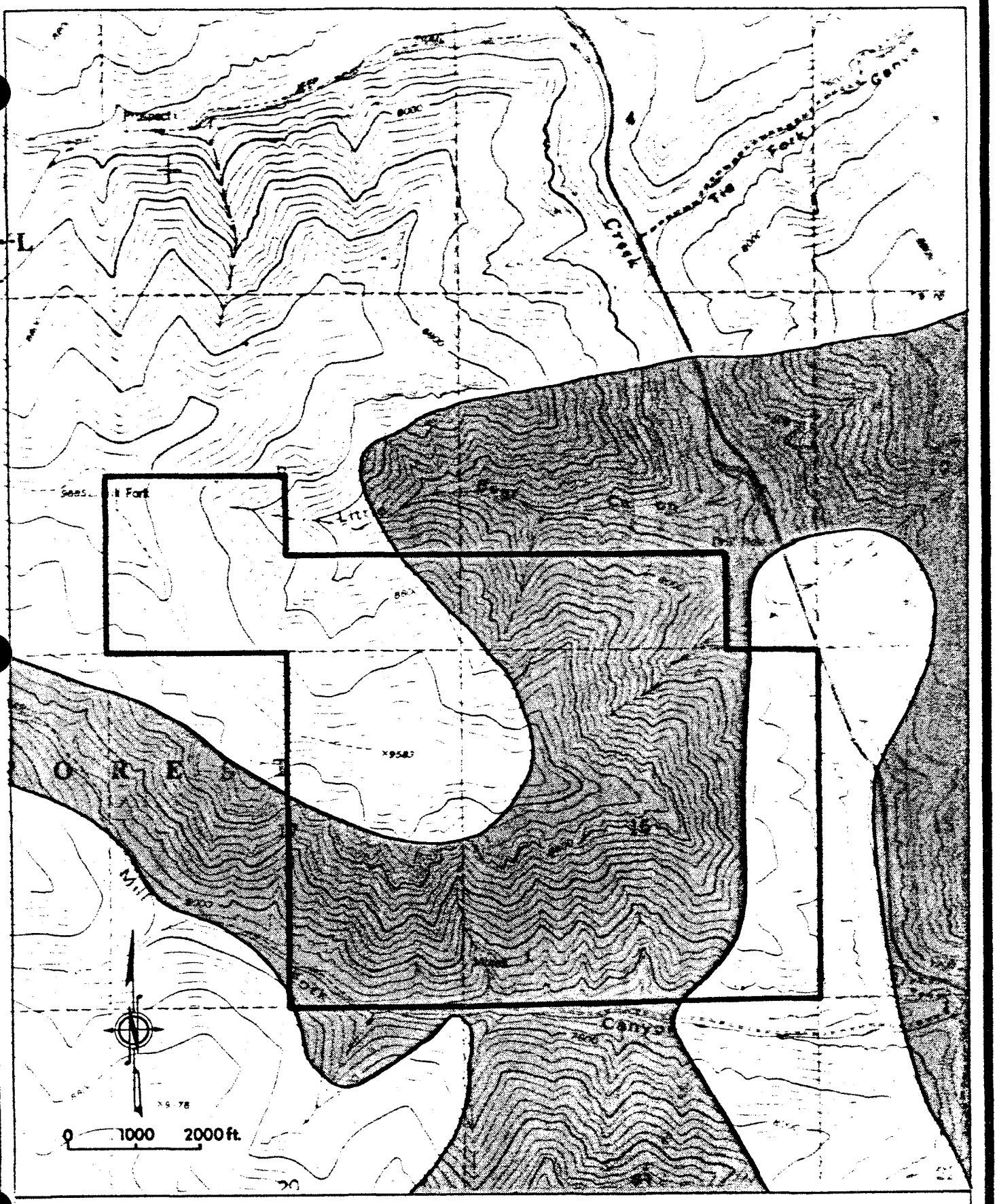
10.3.2.3 Mammals (continued)

Other important elements in winter range are Riparian zones, which provide water, cover, and an abundance of browse, and north-facing slopes, which provide both hiding and thermal cover (Thomas 1979, Carpenter and Regelin 1981). Winter use by deer and elk of north-slope Middle Elevation conifers probably varies, depending on temperature and snow accumulation under the trees.

Deer pellet-group counts were conducted in the three major winter range habitat types to obtain an index of habitat preference (Robel et al. 1970). Habitat preference indices were calculated by dividing the percent frequency of sample plots containing deer pellet groups by the percentage of area covered by each habitat within the permit area (Table 10-3). The Mixed Riparian habitat type appeared to be highly preferred over both the Middle Elevation Conifer and Pinyon/Juniper habitat types. The close juxtaposition of the riparian and coniferous forest types makes these areas particularly attractive, due to the availability of both browse and thermal cover. The relatively high preference index for the Middle Elevation Conifer type probably is a proximity effect created by the adjacent Riparian zone. Although field data suggested that Pinyon/Juniper was the least preferred, its importance as part of the total winter range should not be underestimated. As previously stated, south-facing slopes may be important when deer and elk are forced to seek open feeding areas during severe winters. (Note: The 1980-1981 winter during which field studies were conducted was unusually mild and snow-free, thus probably skewing survey results toward areas of thermal cover compared to more typical years.)

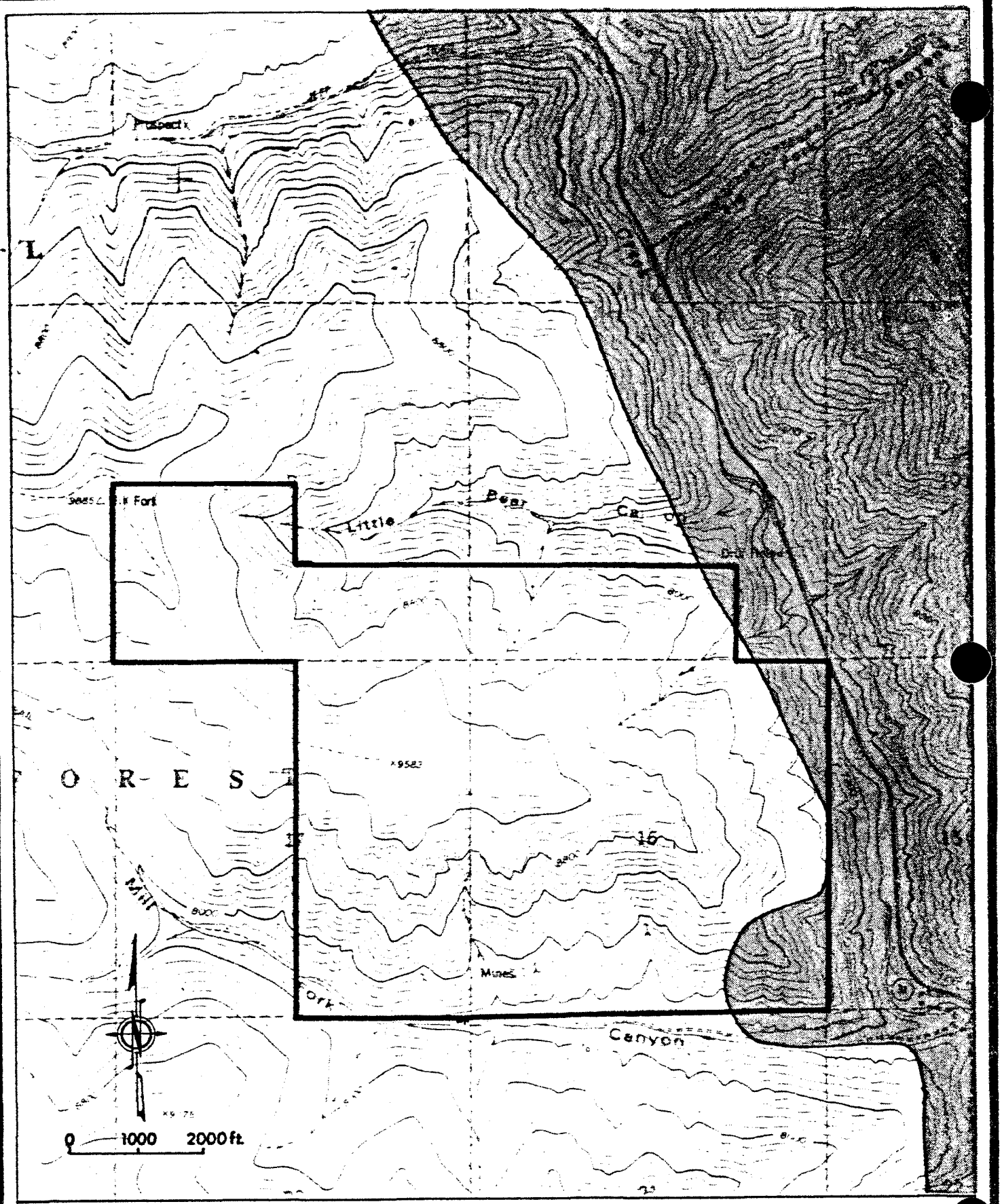
Elk calving and deer fawning occurs in the Wasatch Plateau region in late May and June. Although no specific sites have been identified in the study area by DWR (1980a, 1981a) or Beaver Creek

FIGURE 10-6



Crucial-critical winter range for American Elk in the study area (DWR 1981a).

Figure 10-7



Crucial-critical winter range for Mule Deer in the study area (DWR 1981a).

Table 10-3 Big game winter range habitat preference indices for the Huntington Canyon No. 4 Mine, Emery County, Utah (1980-1981).

Habitat	Percent Habitat*	Percent of Plots With Sign	Habitat Preference Index
Pinyon/Juniper	80	50	0.67
Middle Elevation Conifer	15	70	4.7
Mixed Riparian	5	60	12.0

*Estimated winter range for permit area.

10.3.2.3 Mammals (continued)

Coal Company wildlife consultants, all riparian zones and other mesic habitat types are considered potential calving and fawning grounds. However, the large riparian belt along Huntington Creek probably is not utilized, owing to the proximity of State Highway 31. Similarly, the riparian area along Mill Fork opposite the Huntington Canyon No. 4 Mine probably receives little use during the critical parturition period because of mining activities and traffic on the access/coal haulage road. Upper reaches of Mill Fork Canyon, aspen-conifer-meadow mosaics on top of the plateau, and Little Bear Canyon are likely fawning and calving areas, based on habitat characteristics and the proximity of both winter and summer range.

Moose occur in the Wasatch Plateau, as a result of six transplants -- totaling 43 animals — during the winters of 1973, 1974, and 1978. Ten sightings were reported by DWR (1980a) between May 1973 and February 1978; the observations closest to the study area were in Crandall Canyon 4 km to the north and on Gentry Mountain 4 km to the east. DWR (1981a) reports that a portion of the study area provides Moose winter range, but field studies indicate that preferred habitat is quite limited. The Riparian zones are the most likely sites for Moose within the study area.

Because of DWR's unwillingness to permit aerial surveys, the topographic reliefs of the site, and poor access to most of the area by roads, it was not possible to estimate the populations of big game during the 1980-1981 field study. Even where populations estimates are possible, however, they are of limited value, for two major reasons. First, the animals have such large daily and seasonal ranges that periodic censuses do not accurately indicate the number of animals using a given area — either on any one day

10.3.2.3 Mammals (continued)

or throughout the year. Second, the variable affecting population size and distribution are so numerous that estimating the herd size tells little about the influence of a single factor (such as the operation of a coal mine).

10.3.2.4 Birds

Approximately 140 species of birds are potentially present in the study area during at least part of the year (Appendix Table 10-9), of which 29 are listed by DWR (1981a) as being of high state interest. These species, which include game-birds and raptors, are discussed below, as are prominent small birds observed or expected in the study area.

Gamebirds include waterfowl, upland fowl (gallinaceous birds), and doves. Waterfowl do not provide a significant recreational resource in the study area because of the limited surface water. However, small wetgrass areas atop the plateau west of the property may receive occasional seasonal use by puddle ducks, such as Green-winged Teal Anas crecca and Mallard A. platyrhynchos.

Upland fowl potentially provide a more important recreation resource, with DWR (1981) reporting both the Blue Grouse Dendragapus obscurus and Ruffed Grouse Bonasa umbellus as yearlong inhabitants of the study area. Blue Grouse concentrate in open stands of spruce and fir during the winter, where they feed on needles and buds. Thus, both Middle and High Elevation Conifer forests provide potential "crucial-critical" winter range (DWR 1981a). Other habitat types occupied by this species include Low Elevation Pinyon/Juniper and Mountain Shrubland in the spring and High Elevation Conifer-Aspen-Meadow mosaic in summer and fall.

10.3.2.4 Birds (continued)

Blue Grouse were not observed during field studies in the study area, but booming males were heard along slopes adjacent to Mill Fork west of the site in spring 1981.

Ruffed Grouse occupy a fairly broad range of habitats, especially Aspen and Mountain Shrubland, although conifers often are used during the winter. DWR (1981a) reports that deciduous zones within 0.25 mi of a stream provide "high priority" habitat for Ruffed Grouse overall, while Aspen forests afford "crucial-critical" habitat during the mid-winter period (the birds apparently rely on aspen staminate buds as a winter food source). Ruffed Grouse were not observed during site-specific field studies.

Other gamebirds in the region are the Band-tailed Pigeon Columba fasciata and Mourning Dove Zenaida macroura. The pigeon is uncommon in the Wasatch Plateau, usually occurring as isolated stragglers or small flocks at irregular intervals in spruce/fir habitats (DWR 1981a). The dove is a much more likely inhabitant of the region, with Pinyon/Juniper and Riparian habitats potentially providing high priority nesting habitat. It should be noted, however, that site-specific field studies indicate a fairly low abundance of Mourning Doves in the study area, perhaps partially due to the scarcity of reliable surface water. From this standpoint, seeps and springs on the south-facing pinyon/juniper slope above the Huntington Canyon No. 4 Mine may be particularly important to doves — but not in large numbers.

Raptors observed by wildlife consultants are the Golden Eagle Aquila chrysaetos, Red-tailed Hawk Buteo jamaicensis, Goshawk Accipiter gentilis, Sharp-shinned Hawk A. striatus, American Kestrel Falco sparverius, and Great Horned Owl Bubo virginiana.

10.3.2.4 Birds (continued)

In addition, mine personnel reported seeing Screech Owl Otus asio along the Mill Fork Mixed Riparian zone. All of these species are likely to breed in or near the permit area, based on habitats available and observations during the nesting season. Redtails frequently were seen soaring along the ridge above the mine, probably hunting in the open PJ and Sagebrush Grassland habitat types. No nest was located, but aggressive behavior by an adult Redtail in late June 1981 indicated a probable nest site in dense conifers across Mill Fork Canyon from the mine.

Adult Sharpshinned Hawks were routinely encountered in the Riparian zone and adjacent north-facing conifers in lower Mill Fork Canyon. Adult Kestrels (one male, one female) were generally seen in the same area, except across the stream in more open south-facing habitats. Typical nesting habitat for the Sharpshinned consists of deciduous or coniferous trees and brush, while Kestrels more often prefer cliff sites. Both of these habitats occur along Mill Fork Canyon, and it therefore seems likely that these two species breed in the study area.

Great Horned Owls probably are fairly common, but owls are easily overlooked, and only one bird was actually observed. Its presence in appropriate habitats (riparian forest) in the breeding season (late April) suggests that the Great Horned Owl is a breeding resident.

Goshawks were observed only in higher elevation Conifer-Meadow mosaics west of the permit area. Only one Golden Eagle was seen — an adult gliding from west to east along the ridgetops above the mine in late April. Goshawks generally nest in large aspen or conifers, while Golden Eagles prefer cliff sites, such as available along Huntington Canyon.

10.3.2.4 Birds (continued)

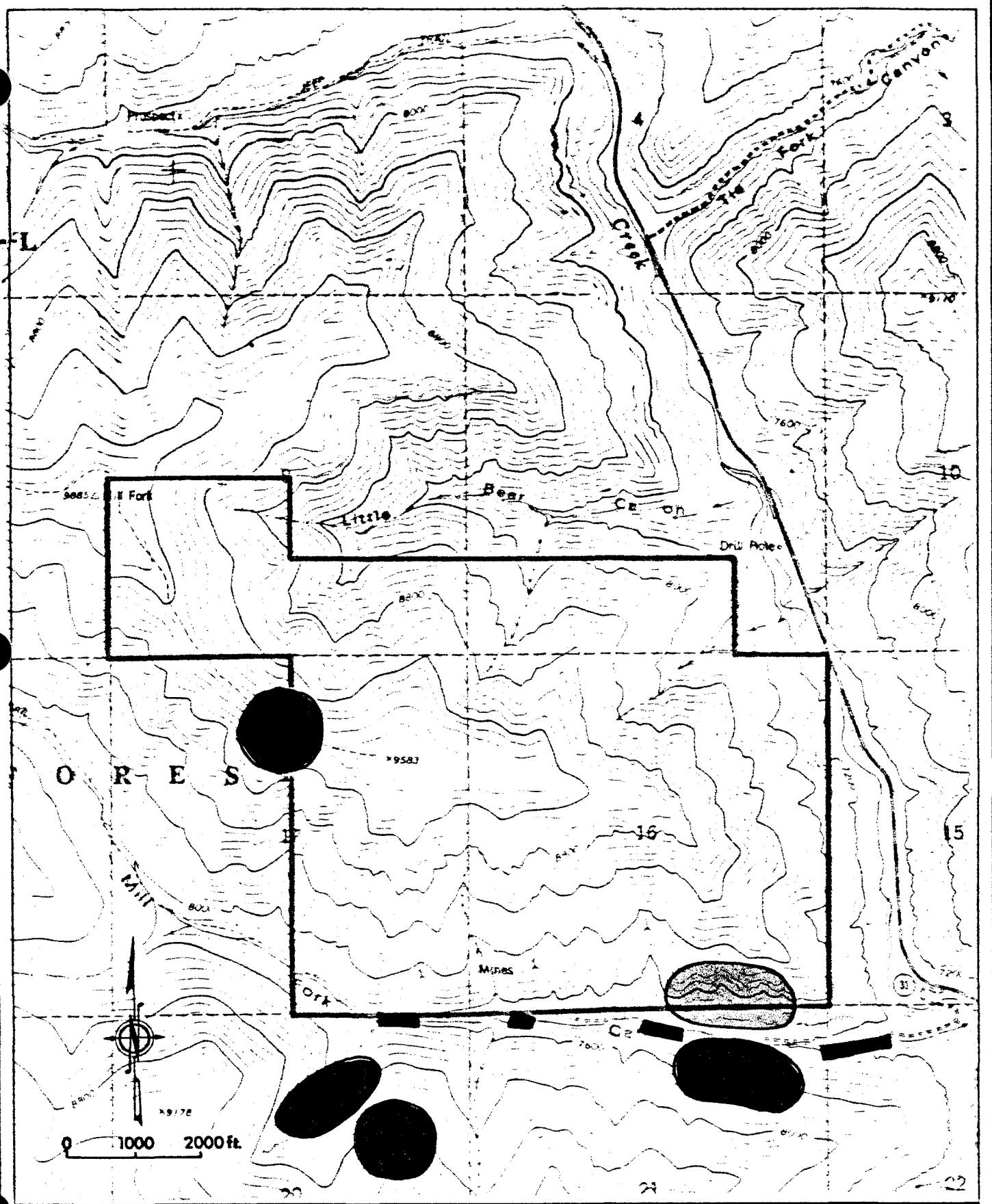
Figure 10-8 shows areas of heaviest raptor use, including probable nesting areas.

During a separate raptor survey conducted for Beaver Creek Coal Company in the nesting season (Springer and Truettt 1980), six inactive stick nests were found in the study area. Of these, four were dilapidated, one appeared to have been used in 1979, and one had been improved in 1980 but was not used. All of the nests were on cliffs on the north side of Mill Fork Canyon. Based on the size of ther nests, Springer and Truett (1980) judged that they were too small for Golden Eagles and instead had been used by Red-tailed Hawks, Great Horned Owls, and/or Common Ravens Corvus corax.

DWR (1981a) classifies the study area as "substantial" habitat for these species, as well as for others potentially present but not observed (Appendix Table 10-9). U.S. Fish and Wildlife Service raptor specialists Ron Joseph and Bruce Waddell visited the study area in August 1981, during which they confirmed that, while the cliffs along Mill Fork provide suitable nest sites, the general area lacks sufficient hunting habitat for intensive use by eagles, large falcons, and most buteos. The six inactive stick nests located in 1980 were not revisited in 1981. The 1981 survey was treated as a separate survey from the 1980 work and was based on efforts to locate active nesting sites.

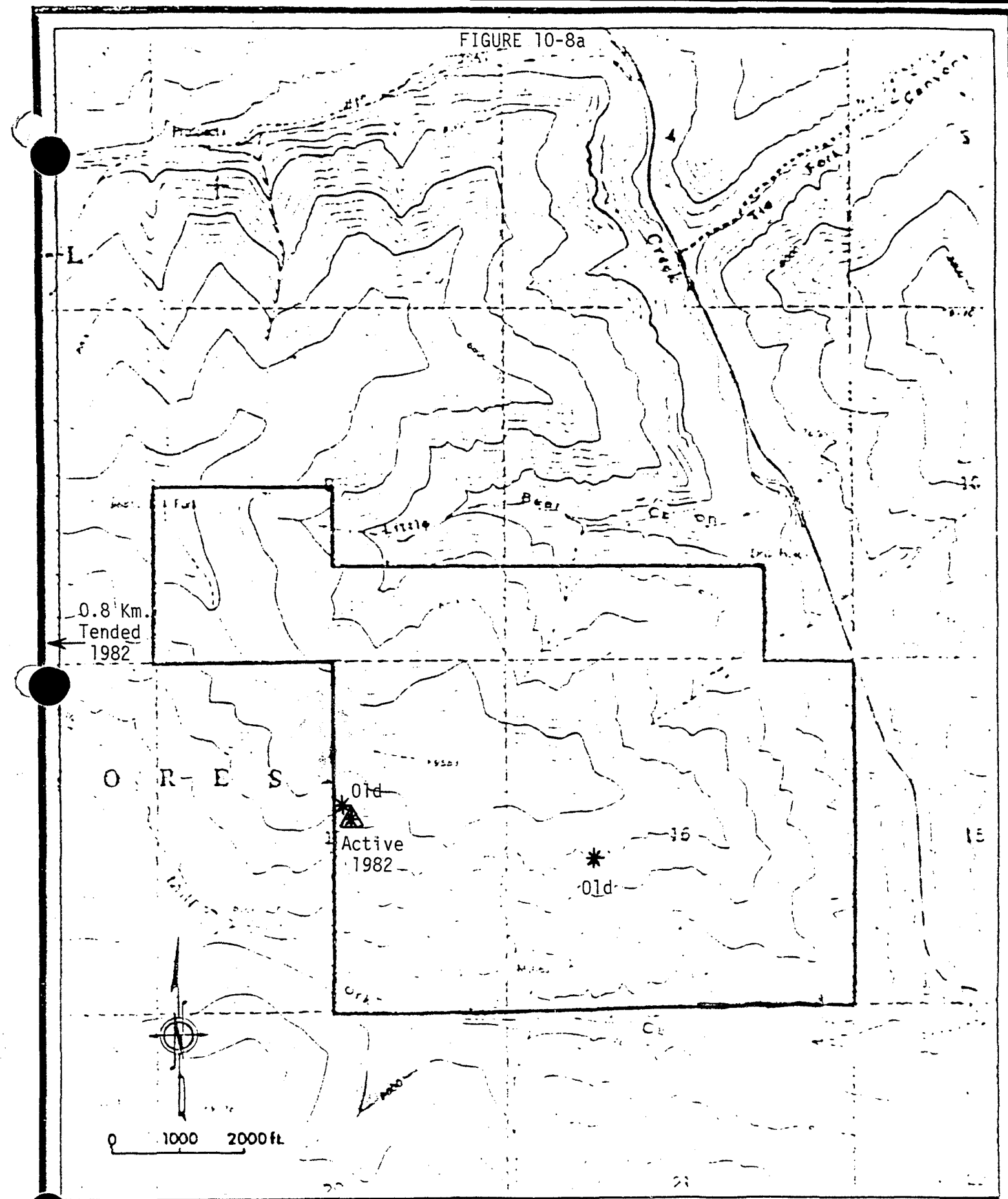
Raptors are of particular concern to DWR for three principal reasons. First, they are predators on small mammals and hence important in maintaining ecosystem balance.

Figure 10-8



Areas of frequent occurrence, and hence possible breeding, by Red-tailed Hawks (red), Sharp-shinned Hawks (green), American Kestrels (blue), and Great Horned Owls (yellow) in the study area, 1981. Red strips along the Mill Fork road represent areas of frequent deer crossings.

FIGURE 10-8a



GOLDEN EAGLE NEST LOCATIONS

U.S. FISH AND WILDLIFE SURVEY - 1982

10.3.2.4 Birds (continued)

Second, because they are high-order predators and have large home ranges, they are valuable indicators of environmental stress, sensitive to disturbance from rather far-removed activities, and consequently logical keystone species in ongoing monitoring programs. Third, the public at large is interested in raptors and therefore exerts considerable pressure for their protection.

Although public and regulatory concern is focused on gamebirds and raptors, small birds comprise the vast majority of species and avian biomass present in virtually any ecosystem. Approximately 125 species of small birds are potentially present in the study area (Appendix Table 10-9), including cuckoos, frogmouths, swifts, hummingbirds, flycatchers, and songbirds.

Aspen Forests provide habitat for the largest number of small birds, particularly hole-nesting species for which aspen are especially attractive owing to their soft wood. Typical breeding species include the Common Flicker Colaptes auratus, Hairy Woodpecker Picoides villosus, Downy Woodpecker P. pubescens, Yellow-bellied (Red-naped) Sapsucker Sphyrapicus varius nuchalis, Western Wood Pewee Contopus sordidulus, Western Flycatcher Empidonax difficilis, Dusky Flycatcher E. oberholseri, Violet-green Swallow Tachycineta thalassina, Tree Swallow Iridoprocne bicolor, Black-capped Chickadee Parus atricapillus, Mountain Chickadee P. gambeli, White-breasted Nuthatch Sitta carolinensis, House Wren Troglodytes aedon, American Robin Turdus migratorius, Mountain Bluebird Sialia currucoides, Townsend's Solitaire Myadestes townsendii, Warbling Vireo Vireo gilvus, Yellow-rumped Warbler Dendroica cornoata, and Gray-headed Junco Junco caniceps. Coniferous Forest habitats supported almost as many small bird species, with regular breeding inhabitants including the Hairy

10.3.2.4 Birds (continued)

Woodpecker, Olive-sided Flycatcher Nuttallornis borealis, Hammond's Flycatcher Empidonax hammondii, Steller's Jay Cyanocitta stelleri, Clark's Nutcracker Nucifraga columbiana (at higher elevations Mountain Chickadee, Red-breasted Nuthatch Sitta canadensis, Pygmy Nuthatch S. pygmaea (at lower elevations), Ruby-crowned Kinglet Regulus calendula, Solitary Vireo Vireo solitarius (at lower elevations), Yellow-rumped Warbler, Western Tanager Piranga ludoviciana, Gray-headed Junco, Chipping Sparrow Spizella passerina, Red Crossbill Loxia curvirostra, and Pine Siskin Carduelis pinus.

Mixed Riparian zones included many elements of both the aspen and conifer stands described above, plus a number of species endemic to the tall mesic shrubs or the mixture of tall shrubs, conifers, and deciduous trees. Essentially endemic species were the Willow Flycatcher Empidonax traillii, Gray Catbird Dumetella carolinensis, Swainson's Thrush Catharus ustulatus, Orange crowned Warbler Vermivora celata, Yellow Warbler Dendroica petechia, MacGillivray's Warbler Oporornis tolmiei, Wilson's Warbler Wilsonia pusilla, Black-headed Grosbeak Pheucticus melanocephalus, Rufous-sided Towhee Pipilo erythrophthalmus, and Song Sparrow Melospiza melodia. Especially common birds from the aspen and conifer habitats included the Downy Woodpecker, Yellow-bellied Sapsucker, Western Flycatcher, American Robin, Townsend's Solitaire, Mountain and Black-capped Chickadees, House Wren, Warbling Vireo, Yellow-rumped Warbler, and Western Tanager.

Pinyon/Juniper stands, which form the vegetational cover throughout most of the mine affected area, had a relatively depauperate avifauna compared to the more mesic types —but typical of PJ stands in the region. Endemic species in this habitat type were the

10.3.2.4 Birds (continued)

Pinyon Jay Gymnorhinus cyanocephalus, Plain Titmouse Parus inornatus, Rock Wren Salpinctes obsoletus, Blue-gray Gnatcatcher Polioptilacaerulea, Black-throated Gray Warbler Dendroica nigrescens, and Green-tailed Towhee Pipilo chlorura.

Tables 10-4 and 10-5 summarize plot surveys during the peak of the small bird breeding season in May 1981. Quantitative data were collected only for the Pinyon/Juniper and Mixed Riparian habitat types because other units are poorly represented in or adjacent to the affected area and the amount of data would therefore be too limited for reliability.

Although densities are reported as number of territorial males per hectare, plots censused actually were smaller. For the linear riparian zone plots were 100 m by 30 m (0.3 ha); for the steep PJ habitats, plots were 50 m by 100 m (0.5 ha). Additional data reported in the tables are frequency (the percentage of total plots in which each species occurred) and relative abundance (the percentage of total bird observations which each species comprises).

As can be seen from the two tables, the Mixed Riparian habitat type had both a high total density (21.0/ha), attributable to the diversity of nesting and foraging sites, and a large number of species (21). By contrast, the Pinyon/Juniper type, which comprises by far the greatest portion of the affected area, supported only fifteen species and 4.6 breeding pairs per hectare within the sample plots.

Table 10-4 Small bird breeding data, Mixed Riparian habitat type, Huntington Canyon No. 4 Mine, Emery County, Utah, May 1981.

Species	Density[1]	Frequency[2]	Relative[3] Abundance
Warbing Vireo	2.9	86	13.8
Yellow-rumped Warbler	2.4	50	11.4
Western Tanager	2.4	50	11.4
Hermit Thrush	1.4	42	6.7
Ruby-crowned Kinglet	1.4	42	6.7
House Wren	1.2	36	5.7
Hammond's Flycatcher	1.0	36	5.7
Western Flycatcher	1.0	28	4.8
Steller's Jay	1.0	28	4.8
Brown Creeper	0.7	21	3.3
Townsend's Solitaire	0.7	21	3.3
Orange-crowned Warbler	0.7	21	3.3
Wilson's Warbler	0.7	21	3.3
Chipping Sparrow	0.7	21	3.3
Willow Flycatcher	0.5	14	2.4
Mountain Chickadee	0.5	14	2.4
Black-capped Chickadee	0.5	14	2.4
Gray Catbird	0.5	14	2.4
American Robin	0.2	7	1.0
MacGillivray's Warbler	0.2	7	1.0
Pine Siskin	0.2	7	1.0
Total	21.0		100.0

[1]Number of breeding pairs (inferred from singing males) per hectare, n=14. Plot size = 100 m by 30 m.

[2]Percent of total plots in which each species occurred.

[3]Percent of total bird observations comprised by each species.

Table 10-5 Small bird breeding data, Pinyon/Juniper habitat type, Huntington Canyon No. 4 Mine, Emery County, Utah May, 1981.

Species	Density[1]	Frequency[2]	Relative[3] Abundance
Solitary Vireo	0.6	30	13.0
Green-tailed Towhee	0.6	30	13.0
Dusky Flycatcher	0.5	25	10.9
Mountain Chickadee	0.5	25	10.9
Western Tanager	0.4	20	8.7
Yellow-rumped Warbler	0.4	20	8.7
American Robin	0.3	15	6.5
Ash-throated Flycatcher	0.2	10	4.3
Blue-gray Gnatcatcher	0.2	10	4.3
Rock Wren	0.2	10	4.3
Black-throated Gray Warbler	0.2	10	4.3
Chipping Sparrow	0.2	10	4.3
Plain Titmouse	0.1	5	2.2
Canyon Wren	0.1	5	2.2
Mountain Bluebird	0.1	5	2.2
Total	4.6		99.8

[1]Number of breeding pairs (inferred from singing males) per hectare, n = 20. Plot size = 100 m by 50 m.

[2]Percent of total plots in which each species occurred.

[3]Percent of total bird observations comprised by each species.

10.3.2.4 Birds (continued)

Winter residents included many of the breeding species listed above, plus large influxes of White-crowned Sparrows Zonotrichia leucophrys and Dark-eyed Juncos Junco hyemalis in virtually every habitat type. Appendix Table 10-9 provides additional information on species actually or potentially occurring in the study area.

10.3.2.5 Reptiles and Amphibians

No cold-blooded terrestrial vertebrates were observed during site-specific field studies, but three groups of species are expected in the study area. Xeric Sites, especially at lower elevations, provide habitat for several lizards and snakes, with the Collared Lizard Crotaphytus collaris, Fence Lizard Sceloporus undulatus, Tree Lizard Urosaurus ornatus, Striped Whipsnake Masticophis taeniatus, and Racer Coluber constrictor most likely to be present in significant numbers. Mesic Sites, especially at higher elevations, probably are inhabited by a few snakes, most notably the Bullsnake Pituophis melanoleucus and Western Terrestrial Garter Snake Thamnophis elegans. Aquatic Sites, including ponds and wet meadows, could be utilized for breeding by amphibians such as the Tiger Salamander Ambystoma tigrinum, Western Toad Bufo boreas, and Western Chorus Frog Pseudacris triseriata. As noted in other sections of this report, however, surface water is limited in the study area, and habitat for amphibians is marginal at best.

Appendix Table 10-10 provides a complete list of herptiles in the Wasatch Plateau region and potentially present in the study area.

10.3.2.6 Aquatic Organisms

No fish were seen or collected in the major drainges and it is doubtful that fish could survive in these small streams, although individuals may move a short distance into them during periods of peak runoff. However, this occurrence would be transitory because the fish would migrate back to Huntington Creek as water levels receded.

The benthic macroinvertebrate community of Mill Fork was surveyed in November 1980 and April 1981 at stations above (MF-1), opposite (MF-2), and below (MF-3) the existing Huntington Canyon No. 4 Mine. The results of these surveys, and coincident water quality and habitat quality evaluations, are summarized in the following subsections.

Site MF-1 was located during the fall survey at the confluence of Mill Fork and an unnamed tributary about 460 m upstream of the western permit area boundary. This stretch of the stream consisted of several small pools connected by riffles. Mean pool depth was 18 cm, mean riffle depth was 4 cm and stream width was 1.5 m, or less. Rubble and gravel were the primary substrate components of riffles, while pools contained a mixture of rubble, gravel, sand, and silt as well as deciduous leaf packs were in the pools. Mean water velocity of the riffles was about 15 cm/sec. Spruce and fir along the creek provided a dense canopy and the stream banks were retained by grasses.

Eighteen aquatic invertebrate taxa were captured in two Surber samples. The midge Chironomidae was the abundant organism (50 percent) but oligochaetes, young stonefly instars, the stonflies Malenka and Pteronarcella badia, the caddisfly Hesperophylax, and the flies Atherix variegata and Simuliidae were moderately com-

10.3.2.6 Aquatic Organisms (continued)

mon (Table 10-6). The water was moderately alkaline, and dissolved oxygen was 10.1 mg/l. Water temperature was 1.0 C (Table 10-7).

Lack of surface flows at Site MF-1 during the following spring survey necessitated relocating the site about 0.9 km downstream. In this area the stream consisted of one pool (about 3 m by 5 m by 30 cm deep) and a shallow riffle-run (about 5 cm deep) below the pool. The small rubble and sand substrate of the creek was overlain with fine sediments, most likely dust and eroded soils from the adjacent access road. Several culverts directed run-off from the road to the stream. Riparian vegetation provided a fairly dense canopy over the creek, and the stream contained leaf litter and small limbs.

The Surber samples taken from the pool and riffle-run contained fourteen taxa. The midge Chironomidae was the most common aquatic invertebrate (73.4 percent). The planarian Polycelis coronata, the mayflies Ameletus and Cinygmula, the caddisfly Hesperophylax, and the cranefly Ormosia were moderately abundant (Table 10-6). Alkalinity was rather high (428 mg/l), but other parameters were not unusual (Table 10-7).

Site MF-2 was located in 1980 opposite the active mine area and about 30 m upstream of a small settling pond. This stretch consisted of pools connected by riffles. Gravel was the primary substrate component of the riffles, while the substrate of the pools was mainly sand with a silt overburden. Riffles and pools were about 1.2 m wide and had mean depths of 4.5 cm and 13.5 cm, respectively. Water velocity of the riffles was about 7-8 cm/sec.

Table 10-6 Aquatic invertebrates collected from Mill Fork Creek, 18 November 1980 and 26-27 April 1981, and Little Bear Creek, 27 April 1981, Emery County, Utah.

Organism	Site[1] MF-1(80) #	%	MF-1(81) #	%	MF-2(80) #	%	MF-2(81) #	%	MF-3(80) #	%	MF-3(81) #	%	LB-1 (81) #	%
Turbellaria					4	2.8								
Tricladia														
Planariidae														
Polycelis coronata			59	6.6			1	4.2						
Nematoda					1	0.7								
Oligochaete	52	10.6	2	0.2	30	21.3	2	8.3	2	1.5			18	6.5
Ostracoda	3	0.6	52	5.8					1	0.8				
Copepoda			1	0.1										
Hydracarina									1	0.8				
Insecta														
Plecoptera														
Young instars	47	9.6			15	10.6								
Nemouridae											24	32.9		
Malenka sp.	18	3.7							10	7.6				
Perlodidae														
Isoperla sp.									18	13.6	1	1.4	1	0.9

[1]The sites are those above, opposite, and below the Huntington Canyon No. 4 Mine on Mill Fork (MF-1, MF-2, and MF-3, respectively) in both 1980 and 1981, and on Little Bear Creek (LB-1) in 1981. Values reported are total numbers per taxon per site (#) and percent relative abundance (%).

Table 10-6 (continued)

Organism	Sites MF-1(80) #	%	MF-1(81) #	%	MF-2(80) #	%	MF-2(81) #	%	MF-3(80) #	%	MF-3(81) #	%	LB-1 (81) #	%
Pteronarcidae														
Pteronarcella badia	47	9.6	1	0.1	15	10.6								
Ephemeroptera														
Baetidae														
Baetis sp.	8	1.6					2	8.3	46	34.8	3	4.1	49	45.0
Siphlonuridae														
Ameletus sp.	3	0.6	31	3.4	17	12.1	3	12.5	10	7.6	1	1.4		
Ephemerellidae														
Ephemerella sp.			6	0.7	1	0.7					1	1.4		
Ephemerella grandis	1	0.2							1	0.8				
Ephemella doddsi					1	0.7								
Heptageniidae														
Heptagenia sp.	3	0.6			19	13.5			8	6.1				
Epeorus sp.							1	4.2			4	5.5	1	0.9
Cinygmula sp.			23	2.6			6	25.0					5	4.6
Hemiptera														
Hebridae														
Hebrus sp.	1	0.2												
Trichoptera														
Polycentropodidae							1	4.2						
Limnephilidae														
Hesperophylax sp.	22	4.5	33	3.7	15	10.6	3	12.5	11	8.3	2	2.7	4	3.7
Rhyacophilidae														
Rhyacophila sp.			1	0.1					1	0.8			2	1.8
Hydropsychidae														
Hydropsyche sp.									1	0.8				

Table 10-6 (continued)

Organism	Sites MF-1(80) #	%	MF-1(81) #	%	MF-2(80) #	%	MF-2(81) #	%	MF-3(80) #	%	MF-3(81) #	%	LB-1 (81) #	%
Diptera														
Empididae							1	4.2	1	0.8				
Chironomidae	247	50.3	660	73.4	15	10.6	3	12.5	5	3.8	30	41.1	17	15.6
Ceratopogonidae			6	0.7	3	2.1					1	1.4	1	0.9
Tipulidae														
Tipula sp.	3	0.6			1	0.7			3	2.3				
Helius sp. or Ormosia sp.					1	0.7								
Ormosia sp.			22	2.4										
Dicranota sp.			2	0.2							4	5.5	4	3.7
Hexatoma sp.									2	1.5	2	2.7	5	4.6
Dixidae														
Dixa sp.	1	0.2							1	0.8				
Athericidae														
Atherix variegata	16	3.3			1	0.7			10	7.6				
Anthiomyidae														
Limnophora aequifrons	2	0.4			1	0.7								
Simuliidae	15	3.1			1	0.7								
Gastropoda														
Planorbidae (old shells)	2	0.4												
Gyraulus sp.							1	4.2						
Pelecypoda														
Sphaeriidae														
Total Number Taxa	**18**		**14**		**17**		**11**		**18**		**11**		**12**	
Total Number Organisms	**491**		**899**		**141**		**24**		**132**		**73**		**109**	

Table 10-7 Physicochemical water characteristics of sampling sites on Mill Fork, 17 November 1980, and 26-27 April 1981, and Little Bear Creek, 27 April 1981, Emery County, Utah.

Parameter	Sites[1] MF-1(80)	MF-1(81)	MF-2(80)	MF-2(81)	MF-3(80)	MF-3(81)	LB-1 (81)
Dissolved Oxygen (mg/l)	10.1	6.8	5.8	8.0	10.2	7.3	7.6
Alkalinity (mg/l)	----	----	----	291.0	----	308.2	256.8
Hardness (mg/l)	----	428.0	----	359.5	----	513.6	393.8
pH	8.4	7.8	7.3	8.5	7.4	8.5	8.6
Conductivity (micromhos/cm)	310	----	415	----	310	----	----
Temperature (C)	1.0	4.0	4.0	3.5	0.9	5.5	5.0

[1]The sites are those above, opposite, and below the Huntington Creek No. 4 Mine on Mill Fork (MF-1, MF-2, and MF-3, respectively) in both 1980 and 1981, and on Little Bear Creek (LB-1) in 1981.

10.3.2.6 Aquatic Organisms (continued)

Oligochaetes were the most numerous (21.3 percent) of the seventeen aquatic intertebrate taxa collected at MF-2. Young stonefly instars, the stonefly Pteronarcella badia, the mayflies Ameletus and Cinygmula, the caddisfly Hesperophylax, and the midge Chironomidae each had at least fifteen representatives (Table 10-6). The water was warmer at MF-2 than MF-1 in 1980. Dissolved oxygen was significantly lower than at MF-1 and the pH was slightly higher (Table 10-7).

In 1981 this site was located at approximately the same point as it was in 1980. In 1981, the flow pattern was primarily riffle-run and no true pools were noted. The substrate was mainly hard-packed clay with rubble evenly distributed over the clay, a fine layer of silt covered the substrate. In this stretch the stream occupied a narrow channel (about 0.4 m) and flowed through a deeply cut ravine (about 2 m to 3 m). Cottonwood and aspen provided a moderately complete canopy and cottonwood leaf packs were lodged among the rubble.

The two aquatic invertebrate samples yielded only 24 specimens of eleven taxa. Cinygmula sp. was the most common organism (25.0 percent). All other taxa were represented by three or fewer individuals (Table 10-6).

Dissolved oxygen was higher (8.0 mg/l) than at MF-1 and alkalinity was lower (359.5 mg/l). Other physicochemical parameters were not unusual (Table 10-7).

Site MF-3 was located about 1.8 km above the confluence of Mill Fork and Huntington Creek in November 1980. Pool habitat was slightly more prevalent than riffle. Pools averaged about 1.2 m

10.3.2.6 Aquatic Organisms (continued)

wide and 16.8 cm deep; riffles varied from about 0.5 m to 1.5 m wide and were about 4.8 cm deep. Riffle substrate was mainly gravel with some rubble. The pools had a sand-gravel substrate overlaid with silt and abundant leaf litter. Water velocity in the riffles was about 15 cm/sec. The riparian vegetation provided a rather dense canopy. The site the creek was covered with ice from about 100 m below MF-3 to its juncture with Huntington Creek.

The mayfly Baetis was the most abundant of the eighteen taxa collected in two Surber samples at MF-3 in 1980. Six other taxa (Malenka sp., Isoperla sp., Ameltus sp., Heptagenia sp., Hesperophylax sp., and Atherix variegata) were moderately common (Table 10-6). Water temperature, dissovled oxygen, and conductivity at MF-3 were more similar to readings obtained at MF-1 than MF-2 in 1980, while the pH of MF-3 was more similar to MF-2 than MF-1 (Table 10-7).

Because of changes in discharge, MF-3 was moved about 0.6 km farther downstream in April 1981. Water flowed only a short distance (less than 0.3 km) in the vicinity of MF-3 and disappeared about 15 m below the site. The substrate in this stretch was primarily sand and small gravel and silt covered all substrate components. Riffle-run was the main flow pattern, but several small (about 0.5 m by 0.5 m) plunge basins had been formed by debris dams. Water velocity did not exceed 15 cm/sec in the riffles. Organic debris in the area was less than at the more upstream sites during the spring survey, and riparian vegetation provided an incomplete canopy.

10.3.2.6 Aquatic Organisms (continued)

Eleven aquatic invertebrate taxa were collected in four samples at MF-3 in 1981. The stonefly Neumouridae and the stonefly Nemouridae and the midge Chiromidae were the most common organisms (32.9 and 41.1 percent, respectively). All other forms were present in low numbers (Table 10-6).

LB-1, the sample station for Little Bear Creek in 1981, was located about 300 m upstream from the confluence with Huntington Creek. Note: Water is removed from the headwater spring and diverted into a 12 in. pipe by the town of Huntington. Construction of the pipeline did not appear to have caused introduction of disturbed soil into the creek when the stream was visited. However, the diversion of water from the spring results in lower flows than would occur naturally. Nonetheless, surface flows in Little Bear Creek were greater than in Mill Fork in April 1981. The stream alternated between a single channel and a braided network. The substrate was primarily bedrock with some gravel. For much of its course the stream was heavily shaded by conifers and deciduous shrubs.

Twelve aquatic invertebrate taxa were obtained in two Surber samples. Baetis sp. was the most common organism (45.0 percent), while Oligochaetes and chironomids were moderatley abundant (16.5 and 15.6 percent, respectively) (Table 10-6). The rather low pH at LB-1 reflected the moderately high hardness (393.8 mg/l) of the water. The high hardness was also evidenced by a calcareous coating on twigs and exposed roots submersed below the waterline. Dissolved oxygen and water temperature readings were not unusual (Table 10-7).

10.3.2.6 Aquatic Organisms (continued)

Overall, the aquatic macroinvertebrate community of Mill Fork in the study area was more diverse in fall 1980 than in spring 1981. The principal reason for this probably is that surface flows were greatly reduced in April, and Mill Fork therefore provided less total available habitat. The somewhat greater permanence of running water in the upper portions of Mill Fork are reflected in higher numbers in aquatic organisms (Table 10-6).

Aside from the low numbers related to persistence of flow, the benthic macroinvertebrate community of both Mill Fork and Little Bear Creek were typical of small mountain streams in the region. The major taxa are adapted to low flows, and the few permanent pools provide a source for active or inactive re-population of sections subject to seasonal desiccation.

10.3.3 Species of Special Significance

In addition to the prevalent terrestrial vertebrates described above, including those listed by DWR as being of high priority to Utah, are a number of species which are of special significance for legal reasons. These include species listed by FWS as "threatened" or "endangered" at the national level or as "Migratory Birds of High Federal Interest."

10.3.3.1 Threatened and Endangered Species

Listed threatened and endangered species potentially present in the study are the American Peregrine Falcon Falco peregrinus anatum, which breeds in Utah; Arctic Peregrine Falcon Falco peregrinus tundrius, which migrates through Utah; and Bald Eagle Haliaeetus leucocephalus, which winters in Utah.

10.3.3.1 Threatened and Endangered Species

None of the species is likely to occur, because habitats in the area are marginal. However, areas of potential occurrence include riparian forests along Huntington Canyon for the Bald Eagle, cliff areas in the region for the American Peregrine Falcon, and upland areas for the Arctic Peregrine Falcon.

10.3.3.2 Migratory Birds of High Federal Interest

This group of especially significant species is comprised of 22 bird species identified by FWS as occurring in the Uintah-Southwestern Utah Coal Production Region (see Section 10.2.2.2 above for a summary of criteria used in compiling this list):

1. Bald Eagle
2. Golden Eagle
3. Ferruginous Hawk
4. Cooper's Hawk
5. Peregrine Falcon
6. Prairie Falcon
7. Merlin
8. Osprey
9. Spotted Owl
10. Burrowing Owl
11. Flammulated Owl
12. Sandhill Crane
13. Great Blue Heron
14. Long-billed Curlew
15. Band-tailed Pigeon
16. Pileated Woodpecker
17. Williamson's Sapsucker
18. Lewis' Woodpecker
19. Black Swift
20. Western Bluebird
21. Scott's Oriole
22. Grace's Warbler

Based on information provided by DWR (1978, 1981a) and site-specific field surveys, five of these species are actually or potentially present in the study area, besides the Bald Eagle, Golden Eagle, Peregrine Falcon, and Band-tailed Pigeon previously discussed in this report.

10.3.3.2 Migratory Birds of High Federal Interest (continued)

The most likely raptors are the Cooper's Hawk Accipiter cooperii and Flammulated Owl Otus flammeolus, both of which occur in the Wasatch Plateau and prefer wooded country, such as in the major drainage canyons. DWR (1981a) has reported the study area as providing substantial habitat for Prairie Falcons Falco mexicanus as well. However, the distance from potential nest sites on cliff faces in the area to expansive grassland hunting habitats — and the existing levels of human activity —probably preclude this species from utilizing the site and vicinity.

Williamson's Sapsucker Sphyrapicus thyroideus was determined to breed near the study area during the site-specific field studies. The presence of this species is not surprising, because the open aspen/conifer mosaic provides preferred nesting habitat (Crockett and Hadow 1975, Crockett and Hansley 1978), and it has been reported as breeding in "all the mountainous counties of the state" (Hayward et al. 1976:120). Although no nests were located, the status of Williamson's Sapsucker as a breeder was inferred from observations of courting adults in spring and juveniles (in the same area) in late summer. The area in which the sapsuckers were observed was an open aspen stand between Mill Fork and a PJ slope about 2 km west of the permit boundary in Section 17. The nest, though not located, is believed to have been in or near an aspen stand between the stream channel and the base of a south-facing PJ slope in southwestern Section 17, about one mile from the start of the trail at the mine road switchback.

The Black Swift Cypseloides niger also breeds in the Wasatch Plateau (DWR 1978), generally on cliff sites near or behind a waterfall. The near absence of mesic cliff sites in the study area greatly reduces the likelihood that the Black Swift is present as a

10.3.3.2 Migratory Birds of High Federal Interest (continued)

breeder. However, it would not be surprising for Black Swifts to use the area for hunting, because they are wide-ranging in their search for insect prey. White-throated Swifts Aeronautes saxatalis were common along cliffs in the study area, but this species is of no special status in Utah.

The Western Bluebird Sialia mexicana is the other listed species which would not be particularly surprising in the study area, based on known occurrence elsewhere in the Wasatch Plateau and habitat preference (i.e., open conifers, from pinyon/juniper to spruce/fir). This species most likely would occur as isolated pairs in the breeding season or as small flocks at lower elevations in the winter; none was observed during field studies. As noted previously, the closely related Mountain Bluebird is an uncommon resident in the study area, utilizing aspen cavities for breeding and open pinyon/juniper for winter foraging.

10.4 Potential Impacts on Fish and Wildlife

Wildlife impacts typically can be categorized into three groups: loss or modification of habitat, disturbance, and mortality.

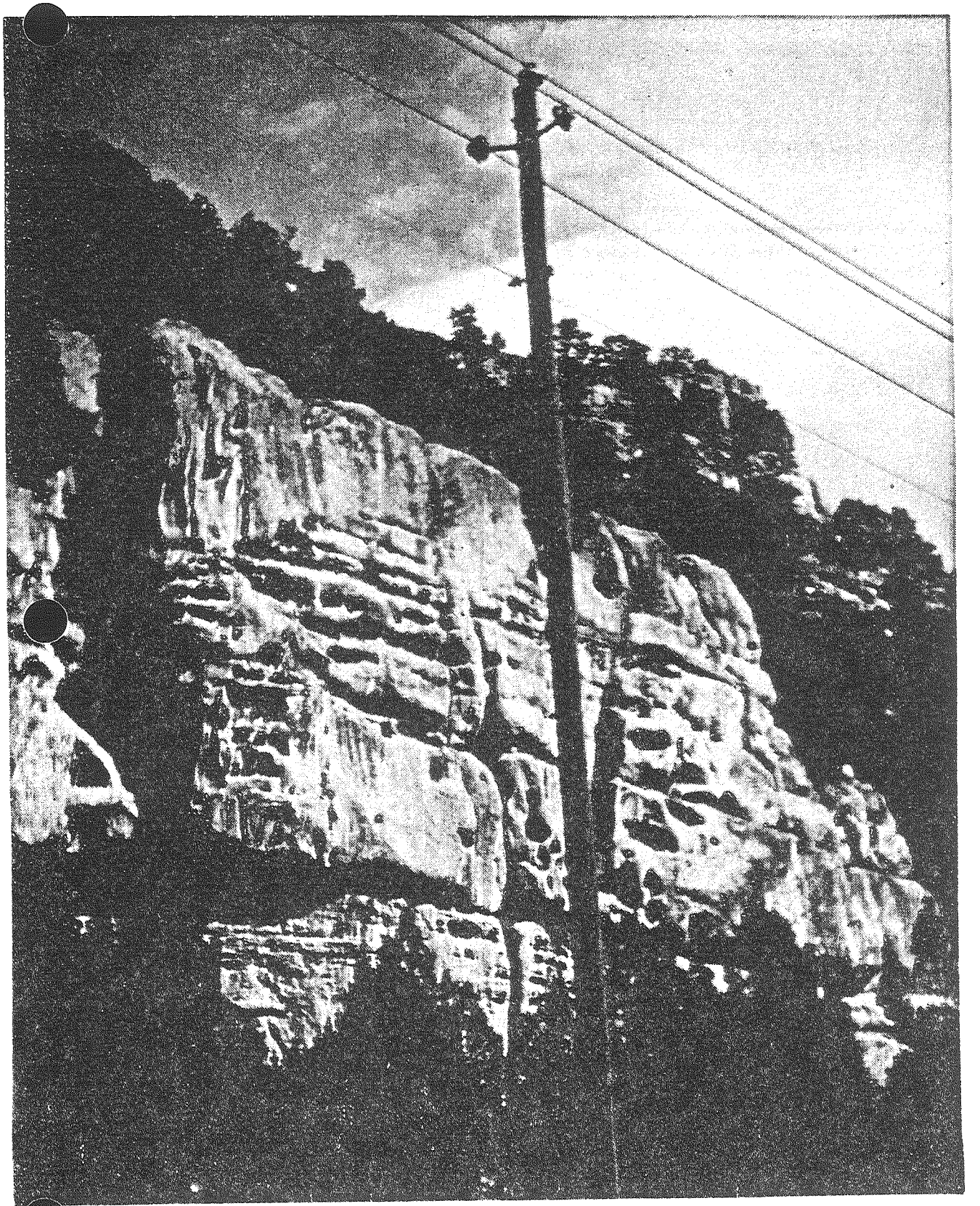
The limited amount of surface distrubance associated with the Huntington Canyon No. 4 Mine will result in a total habitat loss of about 78 acres during the life of the mine. With the mine in existence, this loss of habitat has already occurred. Virtually all of the mine activity is confined to the Pinyon/Juniper/Mountain Mahogany habitat type, and it does not appear that this loss of habitat has had a significant impact on wildlife in the permit area.

10.4 Potential Impacts on Fish and Wildlife (continued)

Disturbance of furtive species results from the levels of noise and activity associated with an operational mine. Thus, most larger species of birds and mammals (including, for example, deer, carnivores, and raptors) tend to avoid the mine site, at least during working hours. Most of these species are likely to move freely around the mine site on weekends and to quickly re-inhabit the area after decommissioning.

Two types of mortality potentially are associated with operation of the Huntington Canyon No. 4 Mine: raptor electrocutions on unsafe power poles and mammal roadkills. A raptor hazard survey was conducted for Beaver Creek Coal Company in conjunction with baseline field studies. The results of this survey indicate that the raptor hazard is slight, because (1) most poles utilize a relatively safe armless configuration, (2) the positioning of the poles relative to adjacent topography would tend to limit use, (3) most of the raptors commonly present in the area are not frequent users of powerline perches, and (4) the least safe pole designs are near the active mine, where raptor use probably is minimal. Figure 10-9 shows the most common pole configuration on the distribution line along Mill Fork Canyon.

Mule Deer roadkills along the Mill Fork access and haulage road have been monitored by Beaver Creek Coal Company; to date, no roadkills have been reported. This is not surprising, because a steep cliff face along most of its length serves as an effective barrier to deer movement (Figure 10-9). Road crossing surveys were conducted during the winter of 1980-81 to investigate the potential problem of deer-vehicle collisions along the Mill Fork access and haulage road by identifying preferred deer crossing sites. The major deer crossing, accounting for 13 of the 23 sets of



gure 10-9. The most common powerpole configuration on the distribution line along Mill Fork Canyon. The cliff face in the background is an effective barrier to deer movement between Mill Fork and south-facing slopes along most of its length.

10.4 Potential Impacts on Fish and Wildlife (continued)

tracks observed, was near the confluence of Mill Fork and Huntington Canyon in the extreme northwestern part of Section 22 (Figure 10-8). A number of other deer crossing sites, generally associated with minor side drainages such as the boundary of Sections 16 and 21, were used less frequently. These crossings accounted for only about 40 percent of the actual tracks recorded. Overall, the roadkill risk is higher in the early morning and late afternoon/early evening, when deer are most active. The greatest hazard is in late winter, when deer are likely to move regularly between south-facing slopes and the riparian zones — and thus across the Mill Fork Canyon access/haul road. Crossing peaks also are expected to coincide with seasonal migrations between summer range and winter range, which tend to be concentrated along topographic funnels such as major drainages. However, this represents a fairly brief period, whereas winter range along Mill Fork is occupied for periods of up to a few months.

Beaver Creek Coal Company also has monitored roadkills along the Huntington Canyon Road, with a total of three deer collisions reported between the access road turnoff and the Huntington Canyon Powerplant between May 1980 and May 1981; two involved Beaver Creek Coal Company employees or coal haulage contractors. All of the collisions occurred in late winter/early spring, coinciding with the season of highest deer concentration at the lower elevations of the study area.

Field investigations indicate that the most severe impact to terrestrial wildlife in the study area has been intensive and apparently prolonged overgrazing by domestic herbivores. The decrease in the total production and quality of forage limits carrying capacity for both large and small mammals, and hence for predators that depend on them for food.

10.4 Potential Impacts on Fish and Wildlife (continued)

Impacts to aquatic ecosystems also have been minor. Moreover, water quality, habitat quality, and macroinvertebrate studies revealed no indications that Mill Fork has sustained any diminution in overall value as a result of the operation of the Huntington Canyon No. 4 Mine. The only apparent effect has been the addition of fine particles wafting or washing into the creek from the adjacent access road. Even this, however, has had far less influence on the Mill Fork ecosystem than the inherently low and variable flows.

Little Bear Creek has been unaffected by mining, but water diversion near its headwaters by the town of Huntington has resulted in lower than natural flows. This small stream is expected to remain unimpacted if underground mining is extended into Little Bear Canyon, unless the channel is disturbed by subsidence.

Crandall Canyon has been unaffected by Beaver Creek Coal Company mining. However, Genwall Coal Company had previously built an entrance road to its lease at the upper reaches of the canyon.

Because Mill Fork, Little Bear Creek, and Crandall Canyon have been essentially unaffected by the mining operation, and should remain so, Huntington Creek is also essentially unaffected. The greatest potential risk is the inflow of sediments following a high intensity precipitation event or unusually high spring runoff. Mitigation measures already incorporated into the operational design of the Huntington Canyon No. 4 Mine have substantially reduced the likelihood of this potential impact (see the following section).

10.5 Mitigation and Management Plans

As noted in the precending sections of this report, the Huntington Canyon No. 4 Mine is an existing operation, for which no major additional surface disturbances presently are planned. Therefore, the mitigation and management plans focus on minimizing impacts related to continued mining activities and facilitating rapid return of the site to suitable habitat after decommissioning.

Many of the mitigation and impact avoidance procedures utilized in the following sections have been drawn from information provided to Beaver Creek Coal company by DWR (1981b). A number of these measures also were proferred by Beaver Creek Coal Company in their interim submittal to DOGM, which was prepared prior to receipt of DWR's document.

DWR (1981b) emphasized three basic aspects to mitigation and impact avoidance for the terrestrial habitats at the Huntington Canyon No. 4 Mine: habitat and wildlife protection, reclamation, and wildlife management.

10.5.1 Terrestrial Habitats and Wildlife

Habitat protection measures center on avoiding especially important or sensitive areas, such as Riparian zones, and not using persistent pesticides, which would diminish the long-term health of an ecosystem.

Reclamation is particularly important as a means of controlling erosion and resotring disturbed areas to productive wildlife habitat. Beaver Creek plans to use one or more of the following procedures in achieving the reclamation goal (1) planting a diverse mixture of native grasses, forbs, and (where appropriate) woody species, (2)

10.5.1 Terrestrial Habitats and Wildlife (continued)

using seedling stock rather than relying solely on seeds for trees or shrubs, (3) actually transplanting stock or turf from new disturbed sites to reclaimed sites, and (4) leaving islands of natural vegetation in new disturbed sites. Appropriate distribution of shrubs (i.e. grouping) will be utilized on a site-specific basis to enhance any benefits to wildlife species on the mine site.

An appropriate combination of the above listed practices shall be employed in the reclamation and revegetation of this mine-site to ensure enhancement of wildlife habitat.

Wildlife management is important for minimizing harmful effects (e.g., fencing animals out of areas containing toxic substances) and preventing damage to newly reclaimed areas (e.g., excluding large herbivores and possibly controlling rodents). Specific types of mitigation, impact avoidance, and wildlife management procedures recommended by DWR (1981b) and Beaver Creek Coal Company consultants include the following.

10.5.1.1 Mammals

For small mammals, most of which are secretive and have small home ranges, mitigation will be almost totally related to habitat protection and reclamation - i.e., ways of minimizing short- and long-term habitat loss. For larger species, such as big game carnivores and ungulates, the problem is complicated by their large home ranges, seasonal movements, and sensitivity to disturbance.

10.5.1.1 Mammals

Disturbance-related impacts will be mitigated to a significant extent by Beaver Creek Coal Company policies against harassing or hunting wildlife in the permit area. These policies will continue throughout the operation of the mine. Further, "employee awareness" programs will specifically inform mine personnel of especially sensitive periods or habitats, such as deer fawning seasons and areas, bear dens, critical winter areas, and so forth. Roadkills will be minimized by an employee awareness program, and reminders at critical seasons (e.g., late winter). In addition, these sensitive aspects of the ecosystem will be avoided during future exploration, operation, and reclamation activities.

Wildlife, such as deer and elk, could potentially be affected by decreased seep and spring flow during the latter summer and fall months if they were the only sources of water. However, within the daily range of movement, alternative watering sources are available. Huntington Creek lies adjacent to the lease on the eastern boundary. To the west, higher elevations exist where perennial pools are more likely to occur. If seeps and springs were adversely affected by mining activities, wildlife, such as deer and elk, may be affected during the latter summer and fall months, but the affect would mainly be a change in movement patterns. Thus, the affects would be more qualitative rather than quantitative. Winter movement patterns should not be affected to as great a degree since snow would be available as an alternative water source.

However, if springs or seeps are adversely impacted by subsidence, an effort will be made to restore or replace the lost water. This will be accomplished by: (1) Attempting to reopen the previous flow area; or (2) by dedicating an appropriate amount of water rights to develop an alternative source.

10.5.1.1 Mammals (continued)

To ensure successful permanent revegetation, fences will be erected around permanent reseeded areas to exclude domestic grazing. To prevent entanglement of wildlife, three-strand, 40-inch, barbed wire fences will be constructed. Strand spacing will be 14 inches, 27 inches and 40 inches above the ground. This form of fence will allow for the passage of wildlife without entanglement or disturbance to migratory patterns.

10.5.1.2 Birds

Like small mammals, songbirds and other small species are most sensitive to habitat loss, an mitigation will therefore focus of habitat protection and reclamation. In addition, active nests or nest trees will not be disturbed.

For raptors and gamebirds, which like large mammals are more wide-ranging and susceptible to disturbance, an employee awareness program will ensure that active nests or other "crucial-critical" use ares are avoided during the sensitive season and that the birds are not harassed or killed. The potential raptor electrocution hazard posed by some powerline pole configurations has been determined by U.S. Fish and Wildlife Service raptor biologist Ron Joseph to not require corrective modification as long as raptor mortality continues not to occur (see Section 10.4 above).

Cliffs within the permit area will be protected from subsidence based on the following criteria:

(1) Lower cliffs along the Mill Fork Canyon are within the Star Point Sandstone, which is below and outside of the area to be mined; and

10.5.1.2 Birds (continued)

(2) The upper, or higher cliffs within the permit area are within the Castlegate Sandstone Unit which is typically 800' - 1200' above the upper seam in the area. Outcrops of this unit are very limited within th permit area, and although subsidence is possible here, it is very unlikely due to the massive overburden and the limited exposure on the property (see Sec. 3.4.8.2 for further discussion on subsidence).

(3) No further mining is anticipated directly below any of the identified golden eagle nesting sites, and no further surface disturbance is anticipated for this operation; therefore, no mitigation plans are proposed for these sites at this time.

In the event that nests are impacted or lost due to subsidence, Beaver Creek Coal Company will mitigate the loss through: (1) Replacement of nests; (2) establishment of alternate nest sites; or (3) such other site-specific measures as agreed upon between U.S.F.W.S. and Beaver Creek Coal Company.

10.5.1.3 Reptiles and Amphibians

Besides minimizing habitat loss and restoring native vegetation, the principal mitigation measures for reptiles will be to avoid killing individuals and to not disturb or destroy snake dens, amphibian breeding ponds, and other sensitive use areas.

10.5.2 Aquatic Habitats and Organisms

Habitat loss or deterioration of the Mill Fork aquatic ecosystem has been limited to the stream and constructing sediment ponds to protect the stream from an increased sediment load from the mine affected area. Additional details of these procedures for protecting Mill Fork are provided in Sections 3.2.8, 3.2.9, and 7.2.3 of the mine permit application.

10.5.2 Aquatic Habitats and Organisms (continued)

As stated in Section 10.3.2.6, fish individuals may move into the smaller tributaries of Huntington Creek during periods of peak runoff. Otherwise, it is doubtful those tributaries within the lease would sustain fish populations. A decrease in the flow attributed to seeps and springs would not affect any fish that may have migrated into the tributaries since, at the time of migration, seeps and springs do not contribute a substantial percentage to base flow. The percentage that seeps and springs contribute to base flow increases as the summer season progresses as runoff from snowmelt decreases.

10.6 Stream Buffer Zone Determination

Beaver Creek Coal Company has committed to maintaining a 100 ft buffer zone along Mill Fork. This approach is expected to ensure that the stream channel and adjacent riparian vegetation will remain free of physical disturbance by the continued mining operation.

10.7 Fish and Wildlife Monitoring

Beaver Creek Coal Company will conduct a wildlife monitoring program throughout the operational life of the Huntington Canyon No. 4 Mine. The monitoring program will utilize the services of a full-time environmental specialist and, as necessary, professional consultants to evaluate the ongoing success of operational mitigation measures, ensure that threatened or endangered species and sensitive or critical use areas remain undisturbed by future activities, deal with any unforeseen difficulties which might arise, and participate in reclamation efforts upon completion of the project.

10.7 Fish and Wildlife Monitoring (continued)

One aspect of the monitoring program continues to be performed by Beaver Creek Coal Company: (1) monthly inspections of specific stations along Mill Fork to monitor sediment load. Routine reporting by coal haulage personnel of any roadkills along the access corridor was also a part of the monitoring program when the site was active; however, as of April, 1990, no road kills have been reported, nor were any known to have occurred on the Mill Fork Road since the original permit was issued in 1984. Since coal haulage no longer occurs from this mine, and the road is public (U.S. Forest Service), monitoring and reporting of road kills will no longer be conducted.

Observations of any threatened or endangered species, not previously reported on the permit area, will be reported to the proper regulatory authorities.

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Appendix

Table 10-8

MAMMALS IN THE HUNTINGTON CANYON NO. 4 MINE STUDY AREA

EMERY COUNTY, UTAH (1980-1981)

Species	Status	Relative Abundance*	Habitat Preference*
SORICIDAE			
Northern Water Shrew *Sorex palustris*	potential	uncommon	riparian
Merriam's Shrew *S. merriami*	potential	uncommon	ubiquitous
Vagrant Shrew *S. vagrans*	likely	common	riparian, meadows
Masked Shrew *S. cinereus*	likely	common	moist sites
Dusky Shrew *S. obscurus*	likely	common	conifers, meadows
VESPERTILIONIDAE			
Little Brown Myotis *Myotis lucifugus*	likely	common	caves, riparian
Small-footed Myotis *M. leibii*	likely	uncommon	caves, cliffs
Long-legged Myotis *M. volans*	likely	common	cliffs, trees
Long-eared Myotis *M. evotis*	likely	common	conifers
Fringed Myotis *M. thysanodes*	likely	uncommon	caves, cliffs
Yuma Myotis *M. yumanensis*	likely	uncommon	caves
California Myotis *M. californicus*	likely	common	caves, cliffs
Silver-haired Bat *Lasionycteris noctivagans*	likely	common	conifers
Western Pipistrelle *Pipistrellus hesperus*	likely	common	caves, cliffs
Big Brown Bat *Eptesicus fuscus*	likely	common	caves, cliffs

*Includes onsite observation and DWR regional information.

Table 10-8 (continued)

Species	Status	Relative Abundance	Habitat Preference
VESPERTILIONIDAE (continued)			
Red Bat *Lasiurus borealis*	likely	uncommon	conifers, riparian
Hoary Bat *L. cinereus*	likely	uncommon	conifers, riparian
Western Big-eared Bat *Plecotus townsendii*	likely	common	caves, cliffs
LEPORIDAE			
White-tailed Hare *Lepus townsendii*	potential	common	sagebrush, grassland
Snowshoe Hare *L. americanus*	likely	common	conifers, aspen
Black-tailed Hare *L. californicus*	potential	common	sagebrush, grassland
Mountain Cottontail *Sylvilagus nuttallii*	observed	common	conifers, pinyon/juniper
Desert Cottontail *S. audubonii*	potential	common	sagebrush, pinyon/juniper
SCIURIDAE			
Red Squirrel *Tamiasciurus hudsonicus*	observed	common	conifers
Rock Squirrel *Spermophilus variegatus*	observed	common	ubiquitous
Uintah Ground Squirrel *S. armatus*	observed	common	dry meadows
Golden-mantled Ground Squirrel *S. lateralis*	observed	common	ubiquitous
Northern Flying Squirrel *Glaucomys sabrinus*	potential	common	conifers
Yellow-bellied Marmot *Marmota flaviventris*	likely	common	rocky areas
Least Chipmunk *Eutamius minimus*	observed	common	ubiquitous
Uintah Chipmunk *E. umbrinus*	observed	common	ubiquitous
Cliff Chipmunk *E. dorsalis*	likely	common	pinyon/juniper

Table 10-8 (continued)

Species	Status	Relative Abundance	Habitat Preference
GEOMYIDAE			
Northern Pocket Gopher *Thomomys talpoides*	present	common	meadows
Valley Pocket Gopher *T. bottae*	potential	common	meadows
HETEROMYIDAE			
Great Basin Pocket Mouse *Perognatuus parvus*	potential	common	pinyon/juniper
Ord's Kangaroo Rat *Dipodomys ordii*	potential	common	pinyon/juniper
CASTORIDAE			
Beaver *Castor canadensis*	potential	common	aquatic
CRICETIDAE			
Western Harvest Mouse *Reithrodontomys megalotis*	potential	common	sagebrush, grassland
Deer Mouse *Peromyscus maniculatus*	likely	abundant	ubiquitous
Canyon Mouse *P. crinitus*	likely	common	rocky areas
Brush Mouse *P. boylii*	likely	common	brushlands
Pinyon Mouse *P. truei*	likely	common	pinyon/juniper
Bushy-tailed Woodrat *Neotoma cinerea*	likely	common	ubiquitous
Muskrat *Ondatra zibethicus*	likely	common	aquatic
Meadow Vole *Microtus pennsylvanicus*	likely	common	meadows
Mountain Vole *M. montanus*	likely	common	meadows
Richardson's Vole	likely	common	meadows

Table 10-8 (continued)

Species	Status	Relative Abundance	Habitat Preference
CRICETIDAE (continued)			
Long-tailed Vole *M. longicaudus*	likely	common	meadows, brushland
MURIDAE			
Norway Rat *Rattus norvegicus*	potential	common	mine areas
House Mouse *Mus musculus*	potential	common	mine areas
ZAPODIDAE			
Western Jumping Mouse *Zapus princeps*	likely	common	riparian, meadows
ERETHIZONTIDAE			
Porcupine *Erethizon dorsatum*	observed	common	wooded areas
CANIDAE			
Coyote *Canis latrans*	present	common	ubiquitous
Red Fox *Vulpes vulpes*	likely	common	ubiquitous
Gray Fox *Urocyon cinereoargenteus*	likely	common	riparian, conifers
URSIDAE			
Black Bear *Ursus americanus*	present	common	ubiquitous
PROCYONIDAE			
Ring-tailed Cat *Bassariscus astutus*	likely	common	riparian, brushland
Raccoon *Procyon lotor*	potential	irregular	riparian

Table 10-8 (continued)

Species	Status	Relative Abundance	Habitat Preference
MUSTELIDAE			
Short-tailed Weasel *Mustela erminea*	potential	uncommon	ubiquitous
Long-tailed Weasel *M. frenata*	likely	common	ubiquitous
Mink *M. vison*	potential	uncommon	meadows, riparian
Marten *Martes caurina*	likely	uncommon	conifers
Wolverine *Gulo luscus*	potential	rare	conifers, aspen
Badger *Taxidea taxus*	potential	common	sagebrush, grasslands
Spotted Skunk *Spilogale putorius*	likely	common	riparian, brushlands
Striped Skunk *Mephitis mephitis*	likely	common	ubiquitous
FELIDAE			
Bobcat *Lynx rufus*	present	common	ubiquitous
FELIDAE (continued)			
Canada Lynx *L. canadensis*	potential	rare	conifers, aspen
Cougar *Felis concolor*	likely	uncommon	ubiquitous
CERVIDAE			
Mule Deer *Odocoileus hemionus*	observed	common	ubiquitous
Moose *Alces alces*	potential	uncommon	meadows, aquatic
American Elk *Cervus elaphus*	observed	common	ubiquitous

Appendix

Table 10-9

BIRDS IN THE HUNTINGTON CANYON NO. 4 MINE STUDY AREA

EMERY COUNTY, UTAH (L980-L98L)

Species	Status	Relative Abundance	Habitat Preference
PODICIPEDIDAE			
Pied-billed Grebe *Podilymbus podiceps*	potential, summer	uncommon	wet areas
ANATIDAE			
Mallard *Anas platyrhynchos*	potential, summer	uncommon	wet areas
Green-winged Teal *A. crecca*	potential, summer	uncommon	wet areas
Blue-winged Teal *A. discors*	potential, summer	uncommon	wet areas
CATHARTIDAE			
Turkey Vulture *Cathartes aura*	observed, summer	uncommon	ubiquitous
ACCIPITRIDAE			
Goshawk *Accipiter gentilis*	observed, resident	uncommon	conifers, aspen
Sharp-shinned Hawk *A. striatus*	observed, resident	common	wooded areas
Cooper's Hawk *A. cooperii*	potential, resident	uncommon	wooded areas

*Includes onsite observation and DWR regional information.

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
ACCIPITRIDAE (continued)			
Red-tailed Hawk *Buteo jamaicensis*	observed, resident	common	ubiquitous
Swainson's Hawk *B. swainsoni*	likely, summer	uncommon	ubiquitous
Rough-legged Hawk *B. lagopus*	likely, winter	uncommon	ubiquitous
Golden Eagle *Aquila chrysaetos*	observed, resident	uncommon	ubiquitous
Bald Eagle *Haliaeetus leucocephalus*	potential, winter	irregular	ubiquitous
Marsh Hawk *Circus cyaneus*	likely, resident	uncommon	open areas
FALCONIDAE			
Prairie Falcon *Falco mexicanus*	potential, resident	uncommon	open areas
Peregrine Falcon *F. peregrinus*	potential, migrant	irregular	open areas
Merlin *F. columbarius*	potential, winter	uncommon	open areas
American Kestrel *F. sparverius*	observed resident	uncommon	open areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
TETRAONIDAE			
Blue Grouse *Dendragapus obscurus*	likely, resident	common	conifers, aspen
Ruffed Grouse *Bonasa umbellus*	potential, resident	common	aspen, brushlands
Sage Grouse *Centrocercus urophasianus*	potential, resident	uncommon	sagebrush
PHASIANIDAE			
California Quail *Lophortyx californicus*	potential, resident	common	brushlands
Chukar Partridge *Alectoris chukar*	potential, resident	common	rocky areas
Ring-necked Pheasant *Phasianus colchicus*	potential, resident	common	agricultural
ARDEIDAE			
Great Blue Heron *Ardea herodias*	potential, summer	uncommon	wet areas
Snowy Egret *Egretta thula*	potential, summer	irregular	wet areas
Black-crowned Night Heron *Nycticorax nycticorax*	potential, summer	irregular	wet areas
GRUIDAE			
Sandhill Crane *Grus canadensis*	potential, migrant	irregular	meadows

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
RALLIDAE			
Sora Rail *Porzana carolina*	potential, resident	uncommon	meadows
American Coot *Fulica americana*	potential, summer	uncommon	wet areas
SCOLOPACIDAE			
Common Snipe *Capella gallinago*	potential, resident	uncommon	meadows
Spotted Sandpiper *Actitis maculata*	potential, resident	uncommon	wet areas
PHALAROPODIDAE			
Wilson's Phalarope *Steganopus tricolor*	potential, migrant	uncommon	wet areas
Northern Phalarope *Lobipes lobatus*	potential, migrant	uncommon	wet areas
COLUMBIDAE			
Band-tailed Pigeon *Columba fasciata*	potential, summer	irregular	brushland
Mourning Dove *Zenaida macroura*	observed, migrant	irregular	ubiquitous
CUCULIDAE			
Yellow-billed Cuckoo *Coccyzus americanus*	potential, summer	irregular	riparian

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
STRIGIDAE			
Screech Owl *Otus asio*	present, resident	uncommon	riparian
Flammulated Owl *Otus flammeolus*	potential, resident	irregular	conifers
Great Horned Owl *Bubo virginianus*	observed, resident	common	ubiquitous
Pygmy Owl *Glaucidium gnoma*	potential, resident	irregular	wooded areas
Long-eared Owl *Asio otus*	likely resident	common	wooded areas
Short-eared Owl *A. flammeus*	potential, resident	uncommon	open areas
Saw-whet Owl *Aegolius acadicus*	potential, resident	irregular	conifers
CAPRIMULGIDAE			
Poor-will *Phalaenoptilus nuttalli*	potential, resident	uncommon	wooded areas
Common Nighthawk *Chordeiles minor*	observed, summer	uncommon	ubiquitous
APODIDAE			
Black Swift *Cypseloides niger*	potential, summer	uncommon	rocky areas
White-throated Swift *Aeronautes saxatalis*	observed, summer	common	rocky areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
TROCHILIDAE			
Black-chinned Hummingbird *Archilochus alexandri*	observed, summer	uncommon	brushlands
Broad-tailed Hummingbird *Selasphorus platycercus*	observed, summer	common	ubiquitous
Rufous Hummingbird *Selasphorus rufus*	likely summer	common	ubiquitous
Calliope Hummingbird *Stellula calliope*	likely, summer	common	conifers, aspen
ALCEDINIDAE			
Belted Kingfisher *Megaceryle alcyon*	potential resident	uncommon	aquatic
PICIDAE			
Common Flicker *Colaptes auratus*	observed, resident	common	wooded areas
Yellow-bellied Sapsucker *Sphyrapicus varius*	observed, resident	common	riparian, aspen
Wiliamson's Sapsucker *S. thyroideus*	observed, summer	uncommon	aspen, conifers
Hairy Woodpecker *Picoides villosus*	observed, resident	common	conifers, aspen
Downy Woodpecker *P. pubescens*	obseved, resident	common	riparian, aspen
Northern Three-toed Woodpecker *P. tridactylus*	likely, resident	uncommon	conifers

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
TYRANNIDAE			
Eastern Kingbird *Tyrannus tyrannus*	potential, summer	common	agricultural
Western Kingbird *T. verticalis*	likely, summer	common	pinyon/juniper
Cassin's Kingbird *T. vociferans*	potential, summer	uncommon	pinyon/juniper
Ash-throated Flycatcher *Myiarchus cinerascens*	observed, summer	uncommon	pinyon/juniper, riparian
Willow Flycatcher *Empidonax traillii*	observed, summer	uncommon	riparian
Hammond's Flycatcher *E. hammondii*	observed, summer	common	conifers
Dusky Flycatcher *E. obserholseri*	observed, summer	common	aspen, brushlands
Gray Flycatcher *E. wrightii*	potential, summer	irregular	dry wooded areas
Western Flycatcher *E. difficilis*	observed, summer	common	moist wooded areas
Olive-sided Flycatcher *Nuttallornis borealis*	observed, summer	uncommon	conifers
Western Wood Pewee *Contopus sordidulus*	observed, summer	common	aspen
Say's Phoebe *Sayornis saya*	likely, resident	uncommon	open areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
ALAUDIDAE			
Horned Lark *Eremophila alpestris*	potential, resident	uncommon	open areas
HIRUNDINIDAE			
Violet-green Swallow *Tachycineta thalassina*	observed, summer	common	wooded areas
Tree Swallow *Iridoprocne bicolor*	observed, summer	common	wooded areas
Rough-winged Swallow *Stelgidopteryx ruficollis*	potential, summer	common	wet areas
Barn Swallow *Hirundo rustica*	potential, summer	common	ubiquitous
Cliff Swallow *Petrochelidon pyrrhonota*	observed, summer	common	rocky areas
Purple Martin *Progne subis*	potential, summer	uncommon	open forests
CORVIDAE			
Steller's Jay *Cyanocitta stelleri*	observed, resident	common	conifers, aspen
Gray Jay *Perisorius canadensis*	potential, resident	irregular	conifers
Scrub Jay *Aphelocoma coerulescens*	potential, resident	common	pinyon/juniper

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
CORVIDAE (continued)			
Black-billed Magpie *Pica pica*	observed, resident	uncommon	ubiquitous
Common Raven *Corvus corax*	observed, resident	common	ubiquitous
Common Crow *C. brachyrhynchos*	likely	irregular	ubiquitous
Pinyon Jay *Gymnorhinus cyanocephalus*	observed, resident	common	pinyon/juniper
Clark's Nutcracker *Nucifraga columbiana*	observed, resident	common	conifers
PARIDAE			
Black-capped Chickadee *Parus atricapillus*	observed, resident	common	wooded areas
Mountain Chickadee *P. gambeli*	observed, resident	common	conifers, aspen
Plain Titmouse *P. inornatus*	observed, resident	uncommon	pinyon/juniper
Bushtit *Psaltriparus minimus*	likely, resident	common	pinyon/juniper
SITTIDAE			
White-breasted Nuthatch *Sitta carolinensis*	observed, resident	common	wooded areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
SITTIDAE (continued)			
Red-breasted Nuthatch S. canadensis	observed, resident	uncommon	conifers
Pygmy Nuthatch S. pygmaea	observed, resident	uncommon	conifers
CERTHIIDAE			
Brown Creeper Certhia familiaris	observed, resident	common	wooded areas
CINCLIDAE			
Dipper Cinclus mexicanus	potential, resident	uncommon	riparian
TROGLODYTIDAE			
House Wren Troglodytes aedon	observed, summer	common	aspen, conifers
Rock Wren Salpinctes obsoletus	observed, resident	abundant	rocky areas
Canyon Wren Catherpes mexicanus	observed, resident	uncommon	rocky areas
Bewick's Wren Thryomanes bewickii	potential, resident	common	pinyon/juniper
Marsh Wren Cistothorus palustris	potential, migrant	irregular	wet meadows

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
MIMIDAE			
Mockingbird *Mimus polyglottos*	potential, migrant	irregular	brushlands
Gray Catbird *Dumetella carolinensis*	observed, summer	uncommon	riparian
Sage Thrasher *Oreoscoptes montanus*	potential, resident	common	sagebrush
TURDIDAE			
American Robin *Turdus migratorius*	observed, resident	common	ubiquitous
Hermit Thrush *Catharus gattatus*	observed, summer	common	conifers
Swainson's Thrush *C. ustulatus*	observed, summer	uncommon	riparian, aspen
Veery *C. fuscenscens*	likely, summer	uncommon	riparian
Mountain Bluebird *Sialia currucoides*	observed, resident	uncommon	open woodlands
Western Bluebird *S. mexicana*	potential, resident	uncommon	open woodlands
Townsend's Solitaire *Myadestes townsendi*	observed, resident	common	wooded areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
SYLVIIDAE			
Blue-gray Gnatcatcher *Polioptila caerulea*	observed, summer	uncommon	pinyon/juniper
Golden-crowned Kinglet *Regulus satrapa*	likely, resident	uncommon	conifers
Ruby-crowned Kinglet *R. calendula*	observed, resident	common	wooded areas
BOMBYCILLIDAE			
Bohemian Waxwing *Bombycilla garrulus*	likely, winter	uncommon	ubiquitous
Cedar Waxwing *B. cedrorum*	likely, winter	uncommon	ubiquitous
LANIIDAE			
Northern Shrike *Lanius excubitor*	likely, winter	uncommon	open areas
Loggerhead Shrike *L. ludovicianus*	likely, resident	common	open areas
STURNIDAE			
Starling *Sturnus vulgaris*	potential, resident	common	agricultural
VIREONIDAE			
Solitary Vireo *Vireo solitarius*	observed, summer	uncommon	open conifers
Warbling Vireo *V. gilvus*	observed, summer	common	aspen, riparian

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
PARULIDAE			
Orange-crowned Warbler *Vermivora celata*	observed, summer	uncommon	wooded areas
Nashville Warbler *V. ruficapilla*	likely, migrant	uncommon	riparian, brushlands
Virginia's Warbler *V. virginiae*	likely, summer	common	riparian, brushlands
Yellow Warbler *Dendroica petechia*	observed, summer	common	riparian
Yellow-rumped Warbler *D. coronata*	observed, summer	common	conifers, riparian
Black-throated Gray Warbler *D. nigrescens*	observed, summer	uncommon	pinyon/juniper
Townsend's Warbler *D. townsendi*	likely, migrant	uncommon	conifers
MacGillivray's Warbler *Oporornis tolmiei*	observed, summer	uncommon	riparian, brushlands
Common Yellowthroat *Geothylpis trichas*	likely, summer	uncommon	wet areas
Yellow-breasted Chat *Icteria virens*	likely, summer	common	riparian, brushlands
Wilson's Warbler *Wilsonia pusilla*	observed, summer	common	riparian
American Redstart *Setaphaga ruticilla*	likely, migrant	uncommon	riparian

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
PLOCEIDAE			
House Sparrow *Passer domesticus*	potential, resident	common	agricultural
ICTERIDAE			
Western Meadowlark *Sturnella neglecta*	potential, resident	uncommon	open areas
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	potential, migrant	uncommon	wet areas
Red-winged Blackbird *Agelaius phoeniceus*	potential, resident	uncommon	wet areas
Brewer's Blackbird *Euphagus cyanocephalus*	potential, resident	uncommon	agricultural
Common Grackle *Quiscalus quiscula*	potential, migrant	irregular	agricultural
Brown-headed Cowbird *Molothrus ater*	likely, resident	uncommon	wooded areas
Northern Oriole *Icterus galbula*	likely, summer	common	riparian
THRAUPIDAE			
Western Tanager *Piranga ludoviciana*	observed, summer	common	wooded areas

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
FRINGILLIDAE			
Black-headed Grosbeak *Pheucticus melanocephalus*	observed, summer	common	riparian, brushlands
Evening Grosbeak *Hesperiphona vespertina*	likely, resident	uncommon	wooded areas
Lazuli Bunting *Passerina amoena*	likely summer	uncommon	riparian
Indigo Bunting *P. cyanea*	potential summer	irregular	riparian
House Finch *Carpodacus mexicanus*	likely, resident	uncommon	ubiquitous
Cassin's Finch *C. cassinii*	observed, resident	uncommon	conifers
Pine Grosbeak *Pinicola enucleator*	likely, resident	uncommon	conifers
Rosy Finch *Leucosticte arctoa*	likely, winter	irregular	ubiquitous
American Goldfinch *Carduelis tristis*	likely, resident	common	riparian, agricultural
Lesser Goldfinch *C. psaltria*	likely, resident	common	riparian, brushlands
Pine Siskin *C. pinus*	observed resident	common	conifers, riparian
Red Crossbill *Loxia curvirostra*	observed, resident	common	conifers

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
FRINGILLIDAE (continued)			
Rufous-sided Towhee *Pipilo erythrophthalmus*	observed, resident	uncommon	riparian
Green-tailed Towhee *P. chlorura*	observed, summer	common	brushlands
Dark-eyed Junco *Junco hyemalis*	observed, winter	common	ubiquitous
Gray-headed Junco *J. caniceps*	observed, resident	common	conifers, aspen
Savannah Sparrow *Passerculus sandwichensis*	potential, summer	uncommon	wet meadows
Vesper Sparrow *Pooecetes gramineus*	potential, summer	uncommon	open areas
Lark Sparrow *Chondestes grammacus*	potential summer	uncommon	brushlands
Black-throated Sparrow *Amphispiza bilineata*	potential, summer	uncommon	brushlands
Sage Sparrow *A. belli*	potential summer	uncommon	sagebrush
Tree Sparrow *Spizella aborea*	likely, winter	uncommon	brushlands
Chipping Sparrow *S. passerina*	observed, summer	common	conifers
Brewer's Sparrow *S. breweri*	potential summer	irregular	sagebrush

Table 10-9 (continued)

Species	Status	Relative Abundance	Habitat Preference
FRINGILLIDAE (continued)			
Harris' Sparrow *Zonotrichia querula*	potential, winter	irregular	brushland, riparian
White-crowned Sparrow *Z. leucophrys*	observed, resident	common	conifers, riparian
Fox Sparrow *Z. iliaca*	potential, resident	irregular	riparian
Lincoln's Sparrow *Melospiza lincolnii*	likely, resident	uncommon	wet meadows
Song Sparrow *M. melodia*	observed, resident	common	riparian

Appendix

Table 10-10

REPTILES AND AMPHIBIANS IN THE HUNTINGTON CANYON NO. 4 MINE STUDY AREA, EMERY COUNTY, UTAH (L980-8L)

Species	Status*	Relative Abundance*	Habitat Preference
AMBYSTOMATIDAE			
Tiger Salamander *Ambystoma tigrinum*	likely	common	aquatic
PELOBATIDAE			
Great Basin Spadefoot Toad *Saphiopus intermontanus*	likely	common	ubiquitous
BUFONIDAE			
Western Toad *Bufo boreas*	potential	uncommon	ubiquitous
Woodhouse Toad *B. woodhousei*	likely	common	ubiquitous
HYLIDAE			
Western Chorus Frog *Pseudacris triseriata*	likely	common	aquatic, wet meadows
RANIDAE			
Leopard Frog *Rana pipiens*	likely	common	aquatic
IGUANIDAE			
Collared Lizard *Crotaphytus collaris*	likely	common	rocky areas
Leopard Lizard *C. wislizenii*	potential	common	rocky areas
Eastern Fence Lizard *Sceloporus undulatus*	likely	common	rocky areas
Sagebrush Lizard *S. graciosus*	potential	common	brushland
Tree Lizard *Urosaurus ornatus*	likely	common	brushland

*Includes onsite observation and DWR regional information.

Table 10-10 (continued)

Species	Status	Relative Abundance	Habitat Preference
IGUANIDAE (continued)			
Side-blotched Lizard *Uta stansburiana*	potential	common	open areas
Short-horned Lizard *Phryonosoma douglassi*	potential	common	open areas
TEIDAE			
Western Whiptail *Chemidophorus tigris*	likely	common	open areas
BOIDAE			
Rubber Boa *Charina bottae*	likely	common	ubiquitous
COLUBRIDAE			
Striped Whipsnake *Masticophis taeniatus*	likely	common	ubiquitous
Racer *Coluber constrictor*	likely	common	open areas
Ring-necked Snake *Diadophis punctatus*	potential	irregular	moist areas
Bullsnake *Pituophis melanoleucus*	likely	common	ubiquitous
Milk Snake *Lampropeltis triangulatum*	potential	irregular	ubiquitous
Sonora Mountain Kingsnake *L. pyromelana*	potential	irregular	wooded areas
Wandering Garter Snake *Thamnophis elegans*	likely	common	ubiquitous
Common Garter Snake *T. sirtalis*	potential	irregular	moist areas
Night Snake *Hypsiglena torquata*	potential	common	brushlands
CROTALIDAE			
Western Rattlesnake *Crotalus viridis*	likely	common	rocky or open areas

Section 11

CLIMATOLOGY AND AIR QUALITY

11.1 Existing Environment

11.1.1 Climate

The climate of the Price, Utah area is varied and strongly influenced by topography. The climatic can be characterized as acid, specifically dry continental. The prevailing local low-level meteorological influences are mountain-valley breeze systems. The low amount of annual precipitation is a result of the Sierra Nevada and Cascade Ranges which act as natural barriers and prevent moist maritime air from the North Pacific from reaching the interior basins to the east.

On a more local scale the Wasatch Mountains to the west of Castle Valley and the Tavaputs Plateau to the north provide a shelter from storms associated with westerly and northerly winds. Areas on the lee side of the Wasatch Range generally receive less than 10 inches of precipitation annually.

Tables 11-1 and 11-2 contain monthly and annual totals of temperature and precipitation, respectively, for four stations: Hiawatha, Soldier Summit, Emery and Price. Average annual temperature at Emergy and Price are 46.2°F and 49.6°F, respectively. The temperature ranges from a mean minimum monthly value of 24.0°F for Emery and 23.3°F for Price in January and a mean maximum in July of 68.4°F for Price in January and a mean maximum in July of 68.4°F at Emery and 74.3°F at Price. Annual precipitation averages 7.22 inches at Emery and 9.25 inches at Price. At Hiawatha and Soldier Summit January is the coldest month (23.1°F and 17.4°F, respectively) and July the warmest

Table 11-1

MEAN MONTHLY TEMPERATURES (^{o}F) 1931-1955[1]

Location	Elevation (feet)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Hiawatha	7,230	23.1	26.6	33.5	45.7	52.6	61.6	69.4	67.2	60.3	48.6	34.1	26.1	45.7
Soldier Summit	7,477	17.4	20.3	27.6	37.6	46.1	53.3	61.4	59.9	52.3	42.0	28.6	21.0	39.0
Emery	6,200	24.0	28.2	36.3	45.6	53.7	61.3	68.4	66.2	59.3	48.7	35.5	27.0	46.2
Price	5,569	23.3	29.6	39.2	49.5	58.6	66.9	74.3	72.2	64.4	52.1	37.0	27.8	49.6
Castle Dale	5,680	Annual mean temperature = 45.8^{o}F												
Ferron	5,925	Annual mean temperature = 47.7^{o}F												

Table 11-2

MEAN MONTHLY PRECIPITATION (inches) 1931-1955[2]

Location	Elevation (feet)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Hiawatha	7,230	1.00	0.85	1.03	0.83	1.04	1.02	1.27	1.88	0.99	1.27	0.73	1.07	12.98
Soldier Summit	7,477	1.69	1.54	1.47	1.11	1.04	0.97	1.36	1.65	0.98	1.24	1.20	1.67	15.92
Emery	6,200	0.51	0.38	0.47	0.36	0.50	0.55	0.80	1.26	0.73	0.76	0.32	0.58	7.22
Price	5,567	0.74	0.59	0.69	0.61	0.66	0.73	0.95	1.10	0.83	0.91	0.48	0.96	9.25
Castle Dale	5,680													8.39
Ferron	5,925													7.92

11.1.1 Climate (continued)

(69.4°F and 61.4°F, respectively). Annual precipitation is higher at these sites due to their proximity to mountainous terrain (12.98 and 15.92 inches, respectively).

Winters in the area are cold and dry with total snowfall averaging between 10 and 20 inches. The area averages 225 days per year of clear skies, 105 days partly cloudy, and 35 days cloudy. The growing season ranges from 110 to 135 days.[3]

Winds are generally light to moderate all seasons of the year. Strongest winds generally occur in the spring with moderate to strong southerly flow for several days at a time. The prevailing Castle Valley area winds are from the north through north-northwest during autumn, winter and early spring months with a shift to the south-southeast during last spring and summer.[4] Depending on the proximity to the mountain and canyons a particular location in Castle Valley may experience pronounced diurnal wind flow patterns. Daytime flow may be influenced by upslope easterly winds caused by greater heating of the eastern face of the Wasatch Plateau than in the valley. At night the northwesterly drainage flow from the mountains to the valley may prevail. In summary, no one wind direction or diurnal wind flow pattern is applicable for all locations in Castle Valley. The further a location is from a canyon or mountain the weaker the diurnal wind flow patterns to be expected.

Utah Power and Light Company has recorded continuous meterological data at three sites in Huntington Canyon near the Huntington Station Power Plant. The 1978 wind roses from Wild Horse Ridge, Valley Floor, and Meetinghouse Ridge are contained

11.1.1 Climate (continued)

in Figures 11-1, 11-2, and 11-3, respectively. The elevation, distance, and direction of each site from the Huntington Power Plant (elevation 6,400 feet) follows:

Meteorological Network	Approximate Elevation	Distance and Direction from Huntington Power Plant
Wild Horse Ridge	7,500 feet	2.5 km NNW
Valley Floor	6,500 feet	2.5 km NW
Meetinghouse Ridge	7,500 feet	2.8 km WNW

Relative humidity is highest in the Castle Valley during winter and lower in summer. The average relative humidity is 75% and 40% in winter and summer months, respectively. Mean annual relative humidity is 55%.[5] As a result of low annual precipitation totals, low mean annual relative humidity, high percentage of sunshine (absence of evaporation rates are expected to be rather high in this plateau desert region).

11.1.2 Air Quality

Regional impacts from coal mining operations on particulate air quality is expected to be minimal due to the rapid fallout of particles with distance from the source and the existence of relatively small mining operations in Castle Valley. The closest Class I air quality and visibility protection area is the Capital Reef National Park. The closest mining source to the northern boundary of Capital Reef is approximately 40 km to the north. Sites such as Hunter Power Plant, Castle Dale, Huntington Station Power Plant

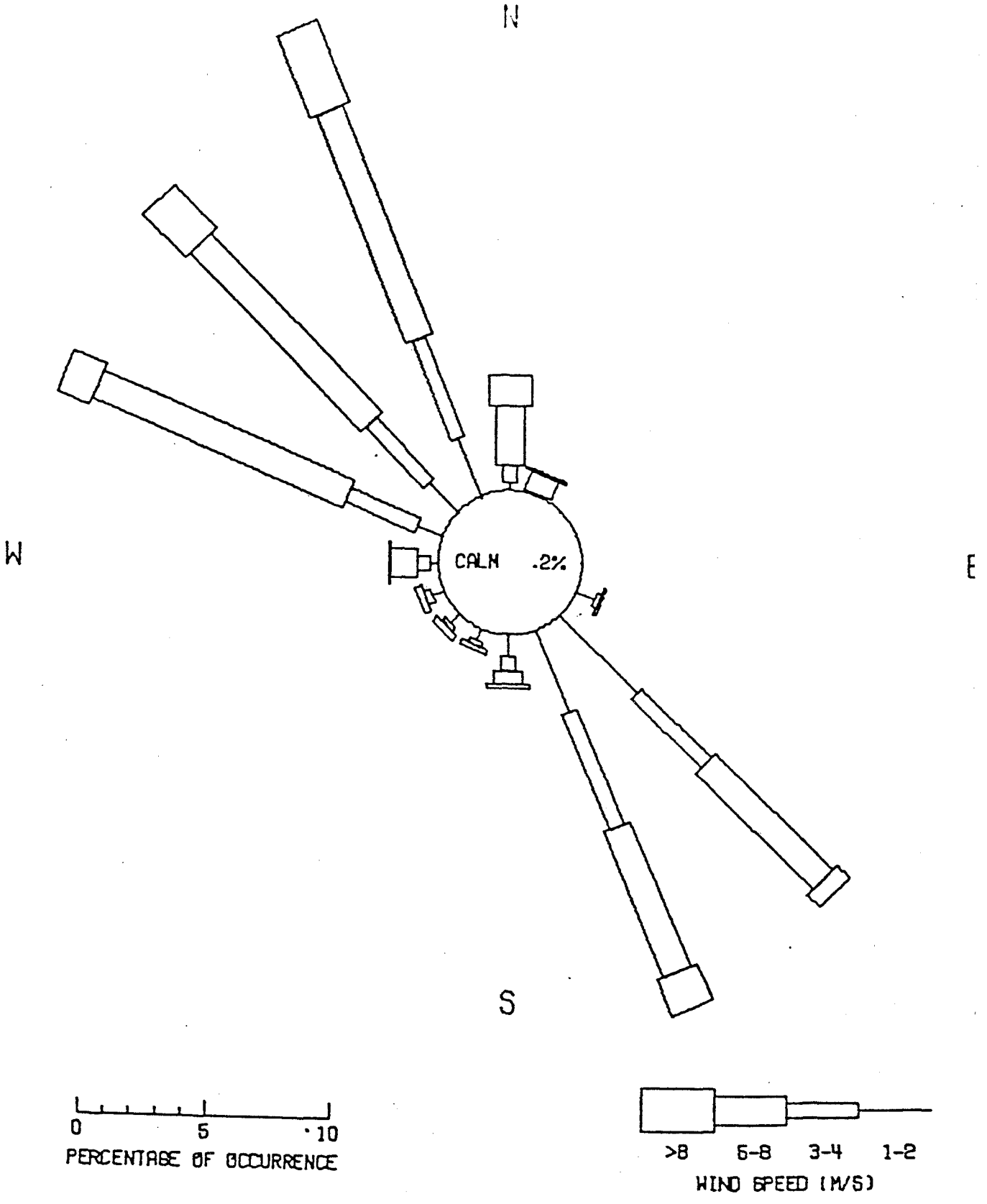
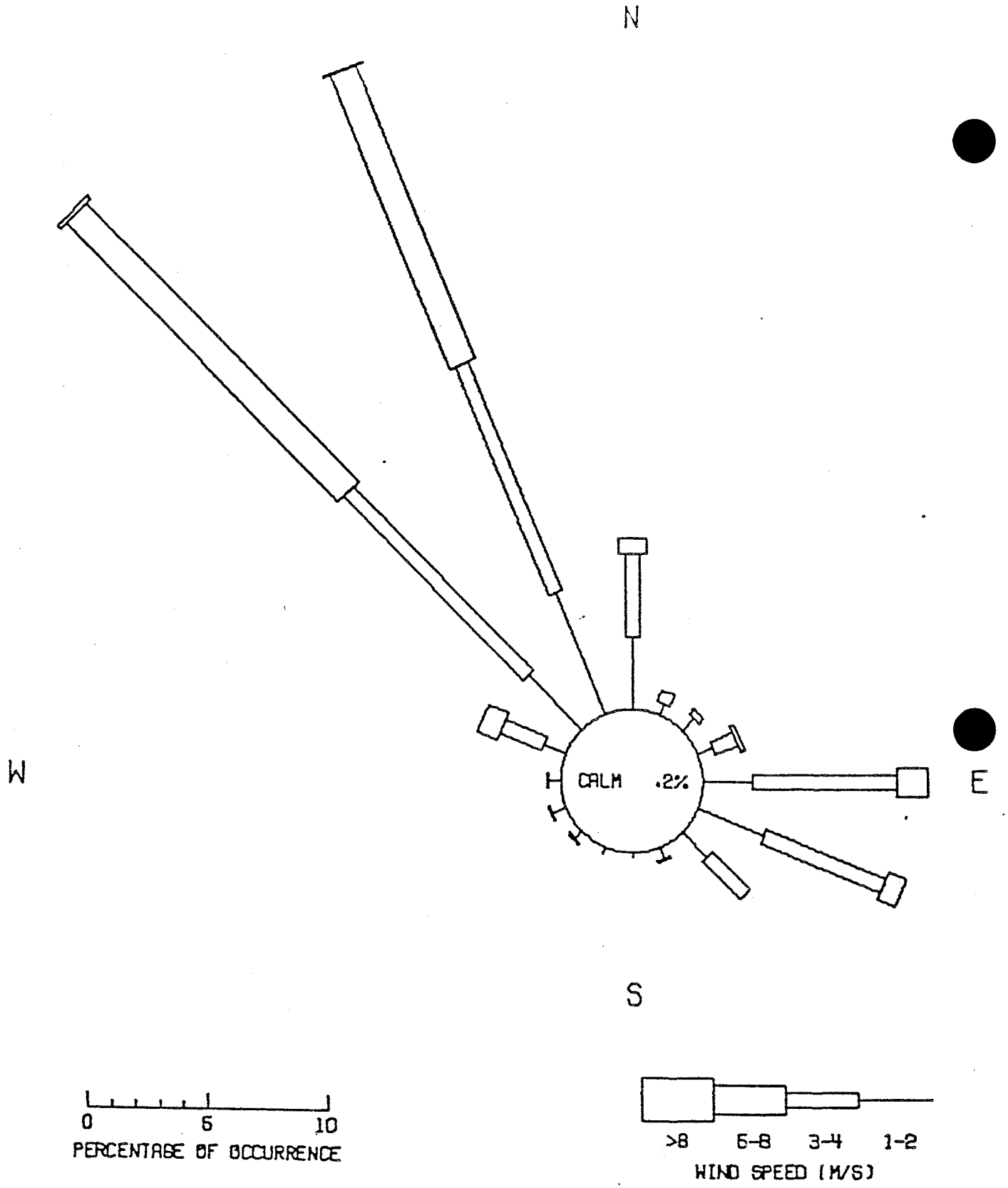


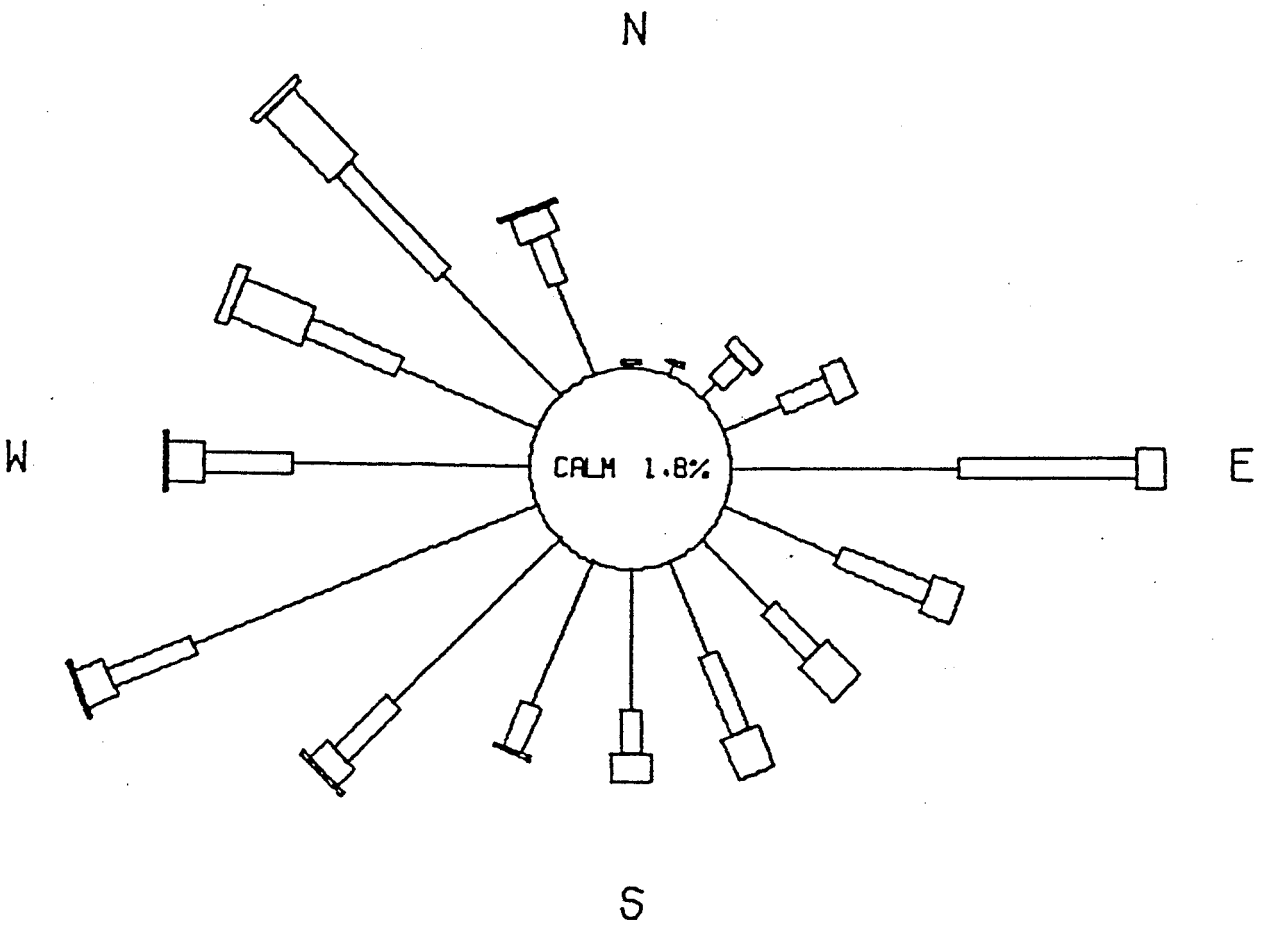
Figure 11-1 Wind Rose for Wild Horse Ridge

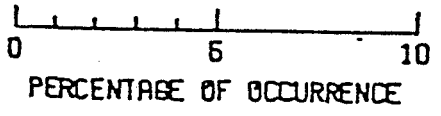


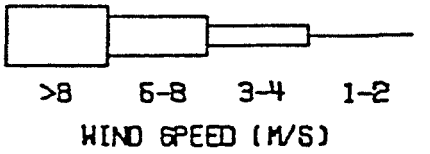
VALLEY FLOOR JAN-DEC 1978

ALL TIMES

Figure 11-2 Wind Rose for Valley Floor







MEETINGHOUSE RIDGE JAN-DEC 1978

ALL TIMES

Figure 11-3 Wind Rose for Meetinghouse Ridge

11.1.2 Air Quality (continued)

and Price are about 70 km, 80 km, 94 km, and 120 km north-northeast of the northern most boundary of Capital Reef National Park, respectively.

The regional annual particulate impact from coal development in Castle Valley on Capital Reef National Park is expected to be less than the Class I increment standard of 10 ug/m^3. Tables 11-3 and 11-4 contain regional total suspended particulate air quality data over a five year period from both State of Utah and Utah Power and Light operated networks, respectively. The regional annual particulate concentration (including background) is generally low at all sites, except for Price, where the annual standard (60 ug/m^3) has been exceeded each year (1975-1978). Price represents an urban monitoring location and higher concentrations are caused by human activity and traffic on roadways leading to proposed new mines in Castle Valley. Since Price has no major industries located within or near the city, air quality standards are exceeded as a result of background sources such as transported dust.

Reduction in visibility in Castle Valley results from light scattering by particles suspended in air. Since particulate concentration in Castle Valley is significant at times, the contribution of various particles was measured by an integrating nephelometer from August 1970 through August 1972. The daily average visual range was 70 miles. A scanning electron microscope determined the contribution of various particles to light scattering.

Results were soil dust (63%), soot (31%), fly ash (3%) and particle -X (3%)[9]. The high percentage of soil dust indicates that dust is easily transported throughout the Castle Valley area.

Table 11-3

STATE OF UTAH TOTAL SUSPENDED PARTICULATE MONITORING

SITES IN CASTLE VALLEY[7]

Station	Year	Annual Geometric Mean (ug/m^3)		24-hour Maximum Concentration (ug/m^3)
Price	1975	72		181
(east edge of	1976	74		306
College of	1977	69		406
Eastern Utah	1978	61	(3/4 year of data recovery)	303
Campus)				
Huntington	1974	22		183
Canyon Site	1975	22		191
(between	1976	28		150
Huntington	1977	34		150
Canyon & City	1978	33	(1/2 year of data recovery)	150
of Huntington)				
Castle Dale	1977	49		*665
(about 65 Km	1978	40		170
SSW of Price)	1979	44		121
	1980	38		125

Exceedences of the total suspended particulate 24-hour standard were due to locally high wind speeds transporting particulates. Each site had daily Hi-Vol readings.

Table 11-4

TOTAL SUSPENDED PARTICULATE READINGS AT STATIONS IN CASTLE VALLEY (OPERATED BY UTAH POWER & LIGHT)[8]

Period of Observation	Station Location	Annual Geometric Mean (mg/m^3)	Notes and Comments
1974 1975 1976 1977 1978 1979	Hunter Station, UT (2-3 miles west of Power Plant)	25 25 34 34 19 20	1) 6 year average Geometric Mean = 26.2 ug/m^3 2) Extreme value 106 ug/m^3 (1979)
1975 1976 1977 1978 1979	Meetinghouse Canyon, UT (approximately 1.0 mile from Huntington Canyon and WNW of Huntington Station)	12 16 -- 20 18	Site moved from a location near the Huntington Canyon Station Power Plant up towards Huntington Canyon in late 1974.
1975 (Aug.-Dec.) 1976 (Jan.-Dec.) 1977 1978 1979	West Station (West of city of Huntington, UT)	39 35 -- 35 30 30	1) Site moved in August 1975 from previous location in the City of Huntington to a site west of the city where traffic does not influence concentrations. 2) Hi-Vol 24-hour concentration of 200 ug/m^3 in April 1978.

1 = National Ambrient Air Quality Standard for maximum 24-hour primary and secondary standards are 150 ug/m^3 and 60 ug/m^3, respectively.

2 = National Ambrient Air Quality Standard for the Annual Geometric Mean is 60 ug/m^3 for the primary standard.

11.2 Effects of Mining Operation on Air Quality

11.2.1 Estimate of Uncontrolled Emissions

Particulate matter is the only air pollutant which might degrade air quality at the mine site. The particulate matter is predominantly fugitive dust. Increases in concentrations of other pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, and photochemical oxidants are insignificant. Estimated uncontrolled fugitive emissions resulting from coal handling sources and coal haulage operations to and from the mine site are shown in Table 11-5.

11.2.2 Description of Control Measures

The potential for fugitive dust emissions from coal handling is minimal due to the moisture content of the coal (4.4%) and the water carryover from dust suppression sprays underground. Water sprays are used on the continuous miner to eliminate coal dust at the underground face. As coal is loaded onto the mine conveyor, it is again sprayed with water for additional dust suppression. The inherent surface moisture of the coal together with the added water sprays agglomerates the small dust particles and reduces the potential for fugitive dust emissions. Water control sprays are estimated to provide between 50 and 75 percent control efficiency.

On the surface the coal travels on a covered conveyor and down a covered chute. This cover prevents wind erosion from the conveyor which is the major cause of fugitive emissions from conveying. The cover provides an additional estimated 90% control efficiency. The coal then drops from the covered chute to the stockpile. The water carryover from the in-mine dust suppression

Table 11-5

Source of Emission	Estimated Uncontrolled Fugitive Emission (tons/year)
Conveyor	20.00
Storage Pile Load-in	1.04
Pile Wind Erosion	0.08
Pile Loadout	0.12
Coal Haulage	142.00

11.2.2 Description of Control Measures (continued)

sprays will aid in minimizing the fugitive dust emissions. Some fugitive dust will be emitted from coal loading by front end loaders onto the haul trucks.

The limited drop distance of a few feet from the loader bucket to the truck will help minimize dust generation.

The coal haulage over the one mile long, gravel-surfaced Forest Service access road has a greater potential for fugitive dust emissions than the coal handling sources.

Administrative controls will be applied to prevent haul trucks from being overloaded and to maintain a strict speed limit not to exceed 25 miles per hour within Mill Fork Canyon. These control measures will aid in reducing the fugitive dust potential. In addition to watering the road on an as needed basis, a chemical which acts as a dust suppressant and road stabilizer will be applied to the road surface on an infrequent basis (contingent upon Forest Service approval) to help alleviate the dust produced by traffic. Frequency of application will be determined by visual observation of the degree of road dustiness. The amount of watering will be based upon levels which will control dust but not make the road muddy or slippery. Watering can be extended to the loading pad and around the stockpile area as needed. The estimated control efficiency of applying water and a chemical stabilizer to the road surface is 75 to 85 percent. Similar control efficiencies can be achieved through natural climatic effects such as rain, snow, frozen surface, and damp surface from dew or frost.

11.2.3 Estimate of Controlled Emissions

As a result of low particulate emissions from mining operations at No. 4 Mine, both the Utah Bureau of Air Quality and the Environmental Protection Agency have not established any air quality monitoring network requirements. An estimate of controlled particulate emissions from mining processes described in Section 11.4.2 are listed in Table 11-6.

The proposed dust control measures are expected to reduce projected coal haulage emissions from 142 to 26.6 tons per year and estimated coal handling emissions from 21.2 to approximately 1.2 tons per year.

11.2.4 Estimated Cost of Emission Control

The cost of conveyor and chute covers, water sprays, water trucks, and chemical dust suppressants for application to the gravel road surface comprise the major expenditures for the No. 4 Mine emission control program. Placing a dollar value on these various control measures at this time is difficult since not all control measures have been fully implemented.

Table 11-6

Source of Emission	Estimated Fugitive Emissions with Controls Listed (tons/year)
Conveyor and Chute	1.00 (90% - 95% control with covers and water spraying of coal)
Pile Wind Erosion	0.03 (50% - 75% control with water sprays)
Pile Loadout	0.05 (50% - 75% control with water sprays)
Coal Haulage	26.60 (80% - 85% control with reduced vehicular speed and water applications and chemical stabilization of road surface)

11.3 Bibliography

[1]Brown, Merle, 1960: The Climate of Utah. Salt Lake City, 14 pp.

[2]Ibid.

[3]Utah Power & Light Company, 1973: Emery Operating Station Applicant's Environmental Analysis - Volume I. Salt Lake City, p. 26.

[4]Utah Power & Light Company, 1974: Emery Generating Station Applicant's Environmental Analysis - Volume II. Salt Lake City, p. 50.

[5]Utah Power & Light Company, 1973: Emery Operation Station Applicant's Environmental Analysis - Volume I. Salt Lake City, p. 26.

[6]U.S. Department of the Interior, 1978: Development of Coal Resources in Central Utah - Draft Environmental Statement, Regional Analysis Part I, Salt Lake City, p. IV-11.

[7]State of Utah Bureau of Air Quality, 1981: Personal communication with Robert Dalley, February 19.

[8]University of Utah Research Institute, Environmental Studies Laaboratory, 1981: Personal communication with Dr. Frank Anderson, February 23.

[9]Utah Power & Light Company, 1973: Emery Operating Station Application's Analysis - Volume I. Salt Lake City, p. 51.

APPENDIX 1

WATER SUPPLY AGREEMENT WITH THE CITY OF HUNTINGTON

AGREEMENT

THIS AGREEMENT entered into on this 24 day of September, 1976, by and between SWISHER COAL COMPANY, a Utah Corporation, and HUNTINGTON CITY, a Municipal Corporation;

WITNESSETH:

THAT WHEREAS, SWISHER COAL COMPANY is undertaking to develop and put into operation a coal mine in Mill Fork Canyon, known as Huntington Canyon #4 Mine, in Emery County, Utah;

AND WHEREAS, HUNTINGTON CITY has received in the past and is now receiving a major portion of its culinary water supply from a spring in Little Bear Canyon in the general proximity of the proposed mining operation;

AND WHEREAS, the parties to this Agreement wish to cooperate with each other so as to assure that SWISHER COAL operation will not in any manner result in a loss or diminution of the water supply available to the CITY from the spring, do hereby AGREE and COVENANT between themselves as follows:

1. That SWISHER COAL COMPANY shall immediately initiate a full-scale hydrologic study of all of the area involved in the plan for the mining operation at Huntington Canyon #4 Mine and the area associated with the spring to be done by a professionally acknowledged hydrologic engineering firm employed by SWISHER COAL, and approved by HUNTINGTON CITY, for the purpose of determining the possible consequences to the flow of the spring as the result of the proposed mining operation.

2. That the CITY will maintain a flow meter at the spring site and shall take measurements from the meter on a continuing basis so that any interference with the water supply or diminuation in the flow can be readily determined and the flow figures as measured shall be made available to SWISHER COAL COMPANY.

3. That explosives will not be used in the course of normal coal extraction in the Huntington Canyon #4 Mine.

4. That in the event that SWISHER COAL COMPANY should encounter substantial volumes of water which may be contributory to Little Bear Spring as a result of the mining operation in the Huntington Canyon #4 Mine, SWISHER COAL will, within seven (7) days after such encounter, take such action as is necessary to divert the flow of water into the supply system of HUNTINGTON CITY in such a manner that will insure the culinary quality of the water. Upon the failure of SWISHER COAL to undertake such diverting action within the time specified, SWISHER agrees to respond in damages at the rate of ONE THOUSAND ($1,000.00) DOLLARS per day until such action is taken.

5. In the event that the mining operation diminishes or interferes with the flow of water from the spring, SWISHER COAL COMPANY agrees to obtain water of a culinary quality from some other source and to place it in the culinary water system of HUNTINGTON CITY in such quantity and quality as would replenish the flow that is lost. In the event that mechanical water treatment is required to bring the water up to Utah State's standards for culinary water, the SWISHER COAL COMPANY agrees to reimburse the CITY for the costs of treating this water thru the CITY'S treatment plant as long as the interruption continues.

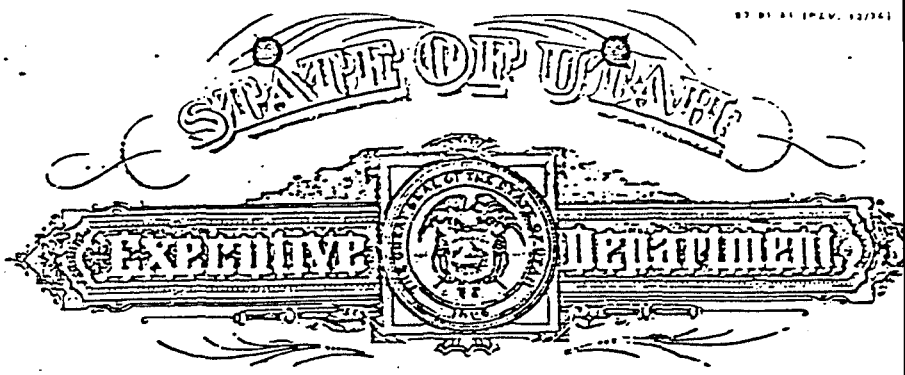
SWISHER COAL COMPANY

By: _____

HUNTINGTON CITY

By: _____

ADD TO
APPENDIX 1.



Office of Lt. Governor/Secretary of State

CERTIFICATE OF AMENDMENT

OF

BEAVER CREEK COAL COMPANY

I, DAVID S. MONSON, Lt. Governor/Secretary of State of the State of Utah, hereby certify that duplicate originals of Articles of Amendment to the Articles of Incorporation of

BEAVER CREEK COAL COMPANY formerly
SWISHER COAL CO.

duly signed and verified pursuant to the provisions of the Utah Business Corporation Act, have been received in my office and are found to conform to law.

ACCORDINGLY, by virtue of the authority vested in me by law, I hereby issue this Certificate of Amendment to the Articles of Incorporation of

BEAVER CREEK COAL COMPANY

and attach hereto a duplicate original of the Articles of Amendment.

File No. #65925

IN TESTIMONY WHEREOF, I ha

Great Seal of the State of Utah at Sa
Lake City, this 19th *day*
February *A.D. 19*7x

DAVID S. MONSON
LT. GOVERNOR/SECRETARY OF STATE

ARTICLES OF AMENDMENT

Feb 19th 80

OF

ARTICLES OF INCORPORATION

MC $25.00

SWISHER COAL CO., a corporation organized and existing under and by virtue of the Utah Business Corporation Act, DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, at a meeting duly held on February 1, 1980, adopted a resolution proposing and declaring advisable the following amendment to the Articles of Incorporation of said corporation:

RESOLVED, That the Certificate of Incorporation of this corporation be amended by changing Article FIRST so that, as amended, said Article FIRST shall read as follows:

"First: The name of the corporation is:
BEAVER CREEK COAL COMPANY"

SECOND: That there are 301 shares of the Common stock of said corporation presently issued and outstanding, all of which are owned by Atlantic Richfield Company.

THIRD: That in lieu of a meeting and vote of stockholders, the sole stockholder has given its written consent on February 1, 1980 to said amendment in accordance with the provisions of Section 16-10-104 of the Utah Business Corporation Act.

IN WITNESS WHEREOF, said SWISHER COAL CO. has caused its corporate seal to be hereunto affixed and this certificate to be signed by A. J. Rogers, its Vice-President and Doris V. Holcombe, its Assistant Secretary, this 1st day of February, 1980.

SWISHER COAL COMPANY

By A. J. Rogers
A. J. Rogers
Vice-President

Attest: Doris V. Holcombe
Doris V. Holcombe
Assistant Secretary

STATE OF COLORADO)
)ss.
CITY AND COUNTY OF DENVER)

I, Marscha Tellis, a notary public, hereby certify that on the 1st day of February, 1980, personally appeared before me, A. J. Rogers, who being by me first duly sworn, declared that he is the Vice-President of Swisher Coal Co., a Utah Corporation, who signed the foregoing Articles of Amendment of Articles of Incorporation and that the statements therein contained are true.

IN WITNESS WHEREOF, I have hereto set my hand and seal this 1st day of February, 1980.

Marscha Tellis
Notary Public

My Commission expires October 14, 1980.

UT-502

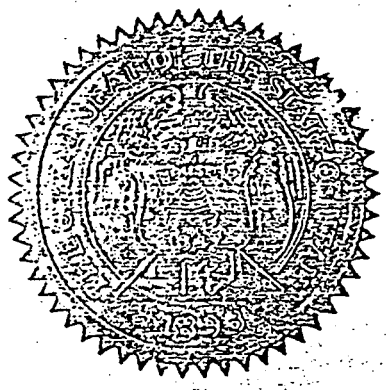
STATE OF UTAH

EXECUTIVE DEPARTMENT

Office of Lt. Governor/Secretary of State

I, DAVID S. MONSON, LT. GOVERNOR/SECRETARY OF STATE OF THE STATE OF UTAH, DO HEREBY CERTIFY THAT the attached is a full, true and correct copy of the Articles of Incorporation and Amendments of SWISHER COAL CO., and said corporation which was filed in this office June 19, 1975, is in good standing,

AS APPEARS OF RECORD IN MY OFFICE.



IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Great Seal of the State of Utah at Salt Lake City, this 9th *day of* May *A.D. 19*77

DAVID S. MONSON
LT. GOVERNOR/SECRETARY OF STATE

AUTHORIZED PERSON

ARTICLES OF INCORPORATION OF

G E X Utah, Inc.

We, the undersigned natural persons of the age of twenty-one years or more, acting as incorporators of a corporation under the Utah Business Corporation Act, adopt the following Articles of Incorporation for such corporation:

FIRST: The name of the corporation is:

G E X Utah, Inc.

SECOND: The period of its duration is perpetual.

THIRD: The purposes for which the corporation is organized are to engage in coal mining and related activities, and to engage in any other lawful business activities.

FOURTH: The aggregare number of shares which the corporation shall have authority to issue is ten thousand (10,000), each with one dollar ($1.00) par value. All stock shall be common stock, of the same class having the same rights and priveleges.

FIFTH: The corporation will not commence business until consideration of the value of at least $1,000.00 has been received for the issuance of shares.

SIXTH: The shareholders shall not have preemptive rights to acquire additional shares of the corporation.

SEVENTH: The post office address of its initial registered office is 607 Kearns Building, Salt Lake City, Utah 84101, and the name of its initial registered agent at such address is Paul B. Cannon.

EIGHTH: The number of directors constituting the initial board of directors of the corporation is three, and the names and addresses of the persons who are to serve as directors until the first annual meeting of the shareholders or until their successors are elected and shall qualify are:

CC CC

NAME	ADDRESS
Eugene E. Nearburg	4219 Sigma Road Dallas, Texas 75240
C. N. Bailey	4219 Sigma Road Dallas, Texas 75240
William G. Ferguson	180 East Broad Street Columbus, Ohio 43215

NINTH: The name and address of each incorporator is:

NAME	ADDRESS
Paul B. Cannon	607 Kearns Building Salt Lake City, Utah 84101
Platte E. Clark	353 East 300 South Salt Lake City, Utah 84111
Mert Rasmussen	353 East 300 South Salt Lake City, Utah 84111

DATED: June 19, 1975

Paul B Cannon
Incorporator

Platte E Clark
Incorporator

Mert Rasmussen
Incorporator

STATE OF UTAH)
: ss:
County of Salt Lake)

I, Virginia Rasmussen, a notary public, hereby certify that on the 19th day of June, 1975, personally appeared before me, Paul B. Cannon, Platte E. Clark, and Mert Rasmussen, who being by me first duly sworn, severally declared that they are the persons who signed the foregoing document as incorporators and that the statements therein contained are true.

IN WITNESS WHEREOF, I have hereto set my hand and seal this 19th day of June, 1975.

Virginia Rasmussen
Notary Public
Residing in Salt Lake City, Utah

My commission expires:
April 17, 1977

ARTICLES OF MERGER

OF

SWISHER COAL CO. with and into GEX UTAH, INC.
with its name changed to SWISHER COAL CO.

The undersigned corporations pursuant to Section 69 of the "Utah Business Corporation Act" hereby execute the following articles of merger:

ARTICLE ONE

The plan of merger is as follows:

See Exhibit A attached hereto and made a part hereof.

ARTICLE TWO

As to each corporation, the number of shares outstanding, and the number and designation of the shares of any class entitled to vote as a class, are:

Name of Corporation	Total Number of Shares Outstanding	Designation of Class Entitled to Vote as a Class (if any)	No. of Shares of Such Class (if any)
Swisher Coal Co.	2,000	N/A	N/A
GEX Utah, Inc.	301	N/A	N/A

ARTICLE THREE

As to each corporation, the number of shares voted for and against the plan respectively, and the number of shares of any class entitled to vote as a class voted for and against the plan, are:

Name of Corporation	Total Shares Voted For	Total Shares Voted Against	Class	Shares Voted For	Shares Voted Against
Swisher Coal Co.	2,000	- 0 -	N/A	N/A	N/A
GEX Utah, Inc.	301	- 0 -	N/A	N/A	N/A

IN WITNESS WHEREOF each of the undersigned corporations has caused these articles of merger to be executed in its name by its

president or vice president and secretary or assistant secretary, as of the 15 day of August, 1975.

SWISHER COAL CO.

By _____ President

and _____ Secretary

GEX UTAH, INC.

By _____ President

and _____ Secretary

STATE OF Utah)
) SS
COUNTY OF Salt Lake)

Before me, Cheryl D. Smith, a Notary Public in and for the said County and State, personally appeared _____ who acknowledged before me that he is the President of SWISHER COAL CO., a Utah corporation and that he signed the foregoing document as his free and voluntary act and deed for the uses and purposes therein are set forth.

Title of office

In witness whereof I have hereunto set my hand and seal this 15 day of August, A.D. 1975.

My commission expires [illegible] 1979.

Notary Public

STATE OF [illegible])
COUNTY OF [illegible]) SS

Before me, [illegible], a Notary Public in and for the said County and State, personally appeared [illegible] who acknowledged before me that he is the President of GEX UTAH, INC., a Utah corporation and that he signed the foregoing document as his free and voluntary act and deed for the uses and purposes therein set forth.

In witness whereof I have hereunto set my hand and seal this 15 day of August, A.D. 1975.

My commission expires [illegible] 1979.

Notary Public

APPENDIX 2

TEMPORARY POINT OF DIVERSION PERMIT

APPLICATION NO. 77-2

DISTRIBUTION SYSTEM

Application For Temporary Change of Point of Diversion, Place or Purpose of Use

STATE OF UTAH

(To Be Filed in Duplicate)

RECEIVED DEC 20 1976 STATE ENGINEER PRICE, UTAH

Place December 14, 1976 Date

For the purpose of obtaining permission to temporarily change the point of diversion, place or purpose of use (Strike out written matter not needed) of water, the right to the use of which was acquired by Rights owned by Huntington-Cleveland Irr. Co. (Give No. of application, title and date of Decree and Award No.) to that hereinafter described, application is hereby made to the State Engineer, based upon the following showing of facts, submitted in accordance with the requirements of the Laws of Utah.

1. The owner of right or application is Huntington-Cleveland Irrigation Company
2. The name of the person making this application is Huntington-Cleveland Irrigation Company
3. The post office address of the applicant is Huntington, Utah

PAST USE OF WATER

4. The flow of water which has been used in second feet is 392.25
5. The quantity of water which has been used in acre feet is 16,365.33
6. The water has been used each year from January 1 (Month) (Day) to December 31 (Month) (Day) inclusive
7. The water has been stored each year from January 1 (Month) (Day) to December 31 (Month) (Day) inclusive
8. The direct source of supply is Huntington Creek & Trib. in Emery County.
9. The water has been diverted into Huntington-Cleveland ditch canal at ~~a point located~~ various points from Huntington Creek and springs tributary
10. The water involved has been used for the following purpose: Irrigation, domestic, stock watering

Total 32,833.01 acres.

NOTE: If for irrigation, give legal subdivisions of land and total acreage which has been irrigated. If for other purposes, give place and purpose of use.

THE FOLLOWING TEMPORARY CHANGES ARE PROPOSED

11. The flow of water to be changed in cubic feet per second is 392.25
12. The quantity of water to be changed in acre-feet is 16,365.33
13. The water will be diverted into the Swisher Coal Co. ditch canal at a point located Diversions (1) West 700 ft. from So. ¼ cor., sec. 16, T. 16 S., R. 7 E., (2) ~~[illegible]~~
14. The change will be made from January 1, 19 77 to December 31, 19 77 (Period must not exceed one year)
15. The reasons for the change are To allow Swisher Coal Co. to divert its shares of stock at these points.
16. The water involved herein has heretofore been temporarily changed ..... years prior to this application. (List years change has been made)
17. The water involved is to be used for the following purpose: Same as here to fore and coal mining.

Total As here to fore acres.

NOTE: If for irrigation, give legal subdivisions of land to be irrigated. If for other purposes, give piece and purpose of proposed use.

EXPLANATORY

This application is filed in behalf of Swisher Coal Company, owner of Certificate #A730 for 800.00 shares of Huntington-Cleveland Irrigation Company stock. The total quantity of water sought to be changed is 80.00 Acre Feet.

A filing fee in the sum of $5.00 is submitted herewith. I agree to pay an additional fee for either investigating or advertising this change, or both, upon the request of the State Engineer.

Walter McEllhaney

RULES AND REGULATIONS

(Read Carefully)

This application blank is to be used only for temporary change of point of diversion, place or nature of use for a definitely fixed period not to exceed one year. If a permanent change is desired, request proper application blanks from the State Engineer.

Application for temporary change must be filed in duplicate, accompanied by a filing fee of $5.00. Where the water affected is under supervision of a Water Commissioner, appointed by the State Engineer, time will be saved if the Application is filed with the Commissioner, who will promptly investigate the proposed change and forward both copies with filing fee and his report to the State Engineer. Applications filed directly with the State Engineer will be mailed to the Water Commissioner for investigation and report. If there be no Water Commissioner on the source, the Application must be filed with the State Engineer.

When the State Engineer finds that the change will not impair the rights of others he will authorize the change to be made. If he shall find, either by his own investigation or otherwise, that the change sought might impair existing rights he shall give notice to persons whose rights might be affected and shall give them opportunity to be heard before acting upon the Application. Such notice shall be given five days before the hearing either by regular mail or by one publication in a newspaper. Before making an investigation or giving notice the State Engineer will require the applicant to deposit a sum of money sufficient to pay the expenses thereof.

RECEIVED DEC 21 1976 STATE ENGINEER SALT LAKE CITY, UTAH

Address all communications to:
State Engineer
State Capitol Building
Salt Lake City, Utah

RECEIVED DEC 20 1976 STATE ENGINEER PRICE, UTAH

STATE ENGINEER'S ENDORSEMENTS

(Not to be filled in by applicant)

Change Application No. 77-2 , _____ (River System)

1. _____ Application received by Water Commissioner _____ (Name of Commissioner)

Recommendation of Commissioner _____

2. DEC 21 1976 Application received ~~over counter~~ by mail in State Engineer's Office by WCK

3. Dec. 23, 1976 Fee for filing application, ~~$5.00~~ $17.50 received by _____; Rec. No 04148

4. _____ Application returned, with letter, to _____ for correction.

5. _____ Corrected application resubmitted over counter / by mail to State Engineer's Office.

6. _____ Fee for investigation requested $_____.

7. _____ Fee for investigation $_____, received by _____: Rec. No. _____

8. _____ Investigation made by _____; Recommendations: _____

9. _____ Fee for giving notice requested $_____.

10. _____ Fee for giving notice $_____, received by _____: Rec. No. _____

11. _____ Application approved for advertising by publication / mail by _____

12. _____ Notice published in _____

13. _____ Notice of pending change application mailed to interested parties by _____ as follows:

14. _____ Change application protested by _____ (Date Received and Name)

15. _____ Hearing set for _____, at _____

16. DEC. 23, 1976 Application recommended for ~~rejection~~ approval by WCK

17. 12/27/76 Change Application ~~rejected~~ approved and returned to applicant.

THIS APPLICATION IS APPROVED SUBJECT TO THE FOLLOWING CONDITIONS:

1. Subject to prior rights.
2. _____
3. _____

Dee C. Hansen, State Engineer

APPENDIX 3

APPROVED ROOF CONTROL, VENTILATION AND DUST CONTROL PLANS

17-1-2M

Coal Mine Safety and Health
District 9

December 20, 1982

Mr. Charles W. McGlothlin
Operations Manager
Beaver Creek Coal Company
P. O. Box AU
Price, UT 84501

Re: Gordon Creek No. 2 Mine, I. D. No. 42-00125
Gordon Creek No. 3 Mine, I. D. No. 42-01254
Huntington Canyon No. 4 Mine, I. D. No. 42-01270
Roof Control Plans

Dear Mr. McGlothlin:

The roof control plans submitted December 8, 1982, have been reviewed by MSHA personnel and are approved. As required by 30 CFR Section 75.200, the plans will be reviewed every six months by MSHA.

Sincerely,

John W. Barton
District Manager

JWB:J.S.Miller:mh

cc: Price
DTSC
State

POST A COPY OF THIS PLAN NEAR EACH PORTAL WHERE WORKERS ENTER THE MINE IN SUCH A MANNER THAT SAID PLAN WILL BE AVAILABLE TO THE MINE WORKERS

ROOF CONTROL PLAN

General Information

A. DATE April 13, 1981 Mine I.D. No. 42-00125

Company Beaver, Creek Company, 1109 South Carbon Avenue

Address P.O. Box AU, Price, (City) Utah 84501 (State)

B. Mine Gordon Creek #2

Mine Location

Price (City) Carbon (County) Utah (State)

C. Location (reference to nearest highway route, direction, and distance)

16 Miles west Off Route No. U.S. 50&6

D. Type(s) of Plan Full Bolting

E. Area(s) of mine covered by the Plan New Development of Entire Mine

F. Maximum cover: 1200 Feet

Main Roof

Immediate Roof

Sandstone
Siltstone & Sandstone
#2 Castle Gate A Seam
Sandstone

Coalbed
Bottom

G. [signature] Company Official's Signature — OPERATIONS MANAGER Title — 11/4/81 Date

Roof Control Investigator _____

The Roof Control Plan approved this date hereby supersedes all previously approved plans.

Approved By _____ Date

Title _____

POST A COPY OF THIS PLAN NEAR EACH PORTAL WHERE WORKERS ENTER THE MINE IN SUCH A MANNER THAT SAID PLAN WILL BE AVAILABLE TO THE MINE WORKERS

ROOF CONTROL PLAN

General Information

A. DATE April 13, 1981 Mine I.D. No. 42-01254

Company Beaver Creek Coal Company, 1109 South Carbon Avenue

Address P.O. Box AU, Price (City) Utah 84501 (State)

B. Mine Gordon Creek #3

Mine Location

Price (City) Carbon (County) Utah (State)

C. Location (reference to nearest highway route, direction, and distance)

14 Miles west Off Route No. U.S. 50&6

D. Type(s) of Plan Full Bolting

E. Area(s) of mine covered by the Plan New Development of Entire Mine.

F. Maximum cover: 1,200 Feet

Main Roof

Immediate Roof

Sandstone
Siltstone & Sandstone
#3 Hiawatha Seam
Sandstone

Coalbed
Bottom

G. [signature] (Company Official's Signature) OPERATIONS MANAGER (Title) 11/4/82 (Date)

Roof Control Investigator _____

The Roof Control Plan approved this date hereby supersedes all previously approved plans.

Approved By _____ Date

Title _____

POST A COPY OF THIS PLAN NEAR EACH PORTAL WHERE WORKERS ENTER THE MINE IN SUCH A MANNER THAT SAID PLAN WILL BE AVAILABLE TO THE MINE WORKERS

ROOF CONTROL PLAN

General Information

A. DATE April 13, 1981 Mine I.D. No. 42-01270

Company Beaver Creek Coal Company

Address P.O. Box AU, Price (City) Utah 84501 (State)

B. Mine Huntington Canyon #4 Mine

Mine Location

Huntington (City) Emery (County) Utah (State)

C. Location (reference to nearest highway route, direction, and distance)

1 Miles west Off Route No. 31

D. Type(s) of Plan Full Bolting

E. Area(s) of mine covered by the Plan New development of entire mine.

F. Maximum cover: 1,400 Feet

Main Roof

Immediate Roof

Sandstone
Sandstone
Blind Canyon Seam 5'-14'
Sandstone

Coalbed
Bottom

G. [signature] OPERATIONS MANAGER 11/4/82

Company Official's Signature — Title — Date

Roof Control Investigator _____

The Roof Control Plan approved this date hereby supersedes all previously approved plans.

Approved By _____ Date

Title _____

ROOF SUPPORT MATERIALS - All components of the roof bolt assembly shall comply with the American National Standards Institute "Specifications for Roof Bolting Materials in Coal Mines."

H. ROOF BOLTS

Manufacturer Birmingham
Mikco Industries or Equiv.
Union Forge, Inc. (Point Anchor)

Manufacturer's Designation

Minimum Length 36 Inch
Extra High Strength 5/8"
Type Steel High Strength 3/4"

Diameter 5/8 Inch 3/4 Inch

Type Thread Rolled Or Cut

Length of Thread 4 Inch Min.

Type Head Standard
(Standard Self-Centering, Cone Neck)

Dimensions of Belt Head: 1-1/8"

Flange 1-3/4"

I. RESIN GROUTED RODS

Manufacturer Bethlehem Steel
Mikco Industries or Equiv.
Union Forge, Inc. (Point Anchor)

Manufacturer's Designation

Minimum Length 48"

Diameter 3/4" - 7/8" - 1-1/8"

Type Steel

Type Head Standard

Minimum Yield

Dimensions of Rod: Head 1-1/8"

Flange 1-3/4"

RESIN

Manufacturer DuPont - Celtite
Carboloy Or Equiv.

Type Fast Lock "A" 22-12 Or Equiv.

J. SPLIT SETS

Manufacturer Ingersoll-Rand

Manufacturer's Designation

Minimum Length 4 Ft.

Diameter 1.25

Type Steel High-Strength Low-Alloy

Minimum Tensile 75,000 psi

Minimum Yield 55,000 psi

Slot Width 9/16" - 3/4"
(Pre-Installed)

Minimum Ultimate Load 20,000 lbs.

Ring Diameter 2.0" O.D.

K. BEARING PLATES

Manufacturer Mikco Industries
Armco Steel Corp. Or Equiv.
Ingersoll-Rand

Manufacturer's Designation

Dimensions 6"x6"x3/16" Embossed
6"x6"x0.16" Min., Dome (Inside Hole Diameter 1.6")

6"x6"x3/8" Flat Or Equivalent

Shape Square Rectangular
(Donut Embossed, Bell Embossed, Flat)

Center Hole Size 11/16" 15/16",

If washers are to be used:

Type Steel Hardened

*Washers shall be hardened to a hardness of 35 to 45 as measured on the Rockwell C Scale.

L. ANCHORAGE UNIT

Manufacturer Ohio Brass / Patton "D" Or Equiv. / DuPont - Celtite / Corboloy (Point Anchor)

Manufacturer's Designation _____

Type Expansion Shell Size

Finishing Bit +.030" Minus Zero

(Finishing bits shall be easily identifiable by sight or feel)

Method of Drilling _____ Dust Control _____

Installed Torque 150 Ft. Lbs. Min.; 250 Ft. Lb. Max.

M. MATERIALS USED IN CONJUNCTION WITH ROOF BOLTS

Cottonwood Blocks - 2" x 6" x 6" Min.

Steel Roof Mats - Wire Mesh Or Equiv.

Prior approval shall be obtained before making any changes in the material listed.

N. ROOF SUPPORT MATERIAL--CONVENTIONAL OR TEMPORARY & SUPPLEMENTAL

Dimensions of Post -- The length of post shall be as required and the diameter must be at least 1 inch for each 15 inches in length, but not less than 4 inches -- Split posts shall have a cross-sectional area equal to that required for round posts of equivalent length. Smaller posts may be used provided they are set in clusters to provide equivalent support.

Type of Post -- Round or split of solid straight grain wood with the end sawed square and free from defects, which would affect their strength.

*Cap blocks, size, and shape -- Cap blocks and footers shall have flat tapered sides and be not less than 2" x 4" x 10" in size.

(Insert Minimum)

Wedges, size, and shape -- 1" x 3-1/2" x 10" Minimum

*Crossbars, type, and size -- Crossbars shall be of straight grain solid wood, and they shall be not less than 3 inches thick by 8 inches wide of varying length.

*Planks, size -- A minimum of 1 inch thick by 8 inches wide of varying length or equivalent.

Cribbing blocks, size, and shape -- Cribbing blocks shall have flat paralleled sides and be not less than 30 inches in length.

Note: Where wood material is used between roof bolt bearing plates and the roof for additional bearing surface, the use shall be limited to short life openings (not to

O. FACE EQUIPMENT USED AT BEAVER CREEK COAL COMPANY

	Name	Model
1.	(1) Lee Norse Miner	546
2.	(2) Lee Norse Miner	455
3.	(2) Lee Norse Miner	HH106
4.	(2) Joy Miners	12CM3
5.	(1) Joy Miner	12CM11
6.	(4) Joy Shuttle Car	21SC
7.	(8) Joy Shuttle Car	10SC
8.	(6) Lee Norse Bolter	TD1-43
9.	(2) Lee Norse Bolter	TD1-29
10.		

P. SEQUENCE OF MINING AND INSTALLATION OF SUPPORTS INCLUDING TEMPORARY SUPPORTS:

Drawings shall be attached showing the maximum width of entries, rooms, intersections, crosscuts, and (if applicable) pillar splits; the sequence of support installation--including temporary supports; the spacing of supports; and where applicable the sequence of mining pillars, including cut sequence in those pillars necessary to establish a uniform pillar line that eliminates pillar points and pillars that project inby the breakline.

SIGHT LINES SHALL BE ESTABLISHED TO ASSURE THAT MINING PROJECTIONS IN ENTRIES, ROOMS, CROSSCUTS, AND PILLAR SPLITS ARE FOLLOWED:

Entry Width 20' Centers 40'-100'

Crosscut Width 20' Centers 40'-100'

Room Width 20' Centers 40'-100'

Room Crosscut Width 20' Centers 40-120'

Slope Width (anthracite) _____

Gangway Width (anthracite) _____

AUTOMATED TEMPORARY ROOF SUPPORT

SAFETY PRECAUTIONS

1) Roof bolting machines used at BCCC:

	Roof Bolter Manufacture	Model Number	Serial Number	Minimal Load Carrying Capacity
1.	Lee Norse	TD1-43	3624	11,500 PSI
2.	Lee Norse	TD1-43	20258	11,500 PSI
3.	Lee Norse	TD1-43	20485	11,500 PSI
4.	Lee Norse	TD1-43	21010	11,500 PSI
5.	Lee Norse	TD1-43	21385	11,500 PSI
6.	Lee Norse	TD1-29	21362	11,500 PSI
7.	Lee Norse	TD1-43	21446	11,500 PSI
8.	Lee Norse	TD1-29	21363	11,500 PSI

2) A registered professional engineer shall certify that each ATS is capable of supporting the minimum load carrying capacities. Evidence of the certification shall be furnished by attaching a plate, label, or other appropriate marking to the ATS system. Written evidence of this certification shall be retained by the operator.

3) The controls necessary to position and set the automated support shall be located in such a manner that they can be operated from under permanent support.

4) No one shall proceed inby the automated temporary support system unless a minimum of two (2) temporary supports are installed. This minimum is applicable only if the supports are not more than five (5) feet apart, within five (5) feet of permanent support, face, or rib, and the work is done between such supports and the nearest face, rib, or permanent support.

5) There will be no installation of roof bolts inby the temporary roof support. Holes will not be drilled or bolts will not be installed to the left or right of the outer roof contact points of the automated temporary support system unless the coal rib or a temporary support is within five (5) feet of these contacts.

6) This temporary roof support will be used in working sections, falls, or construction areas where it can be used safely and correctly. The automated temporary support system shall be placed firmly against the roof not more than five (5) feet inby the last row of permanent supports, before any person proceeds inby permanent support.

7) A check valve or equivalent protection shall be incorporated in the automated temporary support system to eliminate the danger of collapse through sudden loss of hydraulic fluid from a broken hose.

8) An adequate supply of temporary roof support material shall be available at all times, to be used when adverse roof conditions are encountered or the automated support does not supply adequate protection for the bolter operator.

The temporary roof supports as required in the approved roof control plan do not apply where the roof bolting machine is equipped with an acceptable ATS system. This does not preclude the use of temporary supports where needed to make necessary tests or for ventilation purposes.

It should be noted that certification of an ATS by equipment manufacturers does not constitute approval of an ATS system in lieu of temporary supports. Only the District Manager or his representative can approve an ATS system in lieu of temporary supports.

9) Two (2) safety jacks must be kept on the bolting machine at all times to be used when adverse roof conditions are encountered and the automated support does not supply adequate protection for the bolter operator.

SAFETY PRECAUTIONS FULL ROOF BOLTING

1) This is the minimum roof control plan and was formulated for normal roof conditions while using the mining system(s). In areas where sub-normal roof conditions are encountered, indicated, or anticipated, the operator shall provide additional support where necessary. If permanent changes are to be made in the mining system that necessitates any change in the roof control plan, the plan shall be revised and approved prior to implementing the new mining system.

2) All personnel required to install roof supports shall be trained by a qualified supervisor designated by mine management. This training shall insure that such persons are familiar with the functions of the support being used, proper installation procedures, and the approved roof control plan.

   Supervisors in charge and miners who install supports shall be informed of an approved roof control plan and any changes in a previously approved roof control plan. As soon as possible, but no later than three (3) weeks after receipt of this approved plan, all provisions contained herein shall be fully explained to all miners whose duties require them to be on a "working section". All new miners shall have the hazards of mine roof and ribs and the content of this plan explained to them before they start to work.

3) Roof bolting is done throughout the mine where virgin roof is exposed and installed in the pattern and spacing outlined in Sketch #2. Roof bolts will be installed row by row crosswise beginning with the row farthest outby the face and advancing toward the face.

4) Bearing plates used directly against the mine roof will be no less than six (6) inches square or of equivalent area. In exceptional cases, where the mine roof is firm and not susceptible to sloughing, bearing plates five (5) inches square or of equivalent area may be used.

5) The use of wood material (such as cap blocks) between roof bolt bearing plates and the roof will be limited to short-life openings (not to exceed three (3) years), unless such wood is treated with a preservative substance.

6) Conventional Bolting:

   a) A calibrated torque wrench that will indicate the actual torque on the roof bolts by a direct reading will be provided and maintained in operable condition in each working section.

   b) Immediately after the first bolt is installed in each place, the torque shall be tested and thereafter, at least one (1) roof bolt out of every four (4) shall be tested by a qualified person. If any of the bolts tested do not fall within the required torque range, the remaining previously installed bolts on this cycle shall be tested.

c) If the majority of bolts fall outside the required torque range, necessary adjustments will be made immediately. If, after these adjustments are made, the required torque ranges are not obtained, supplementary support, such as posts, cribs, cross bars, or different length bolts with adequate anchorage, will be installed.

d) During each 24-hour period, in a working place that has been utilized for coal production, spot-check torques on at least ten percent (10%) of the roof bolts from the outby corner of the last open crosscut of each work place to the face will be made and a record kept of the results. The record will show the number of bolts tested and the number above and below the required range. If the tests show that the majority of the bolts in any work place are not maintaining at least *105 foot-pounds **75 foot-pounds of torque or have loaded to where they exceed 350 foot-pounds, prompt action will be taken to install supplementary supports, such as cross bars or bolts with adequate anchorage.

e) In active working places during any shift, at least one (1) test hole will be drilled to a depth of at least twelve (12) inches above the anchorage horizon of the bolt being used to evaluate the nature of the strata. Such test holes will be identified in the manner that will distinguish them from other bolt holes in the normal pattern. If the test hole indicates the anchorage zone has changed to the extent that it could affect the ability of roof bolts to adequately support the roof, then adequate supplemental roof supports will be installed.

7) Devices will be used to compensate for the angle when roof bolts are installed at angles greater than five (5) degrees from the perpendicular to the roof line.

8) A bar of suitable length and design will be provided in all areas where loose material is being taken down.

9) A suitable roof-sounding device will be provided with all mobile face equipment, except haulage equipment.

10) Where posts are installed as permanent support they will have one (1) wooden cap block between the post and the roof. Post will be installed tight and on solid footing and no more than two (2) wedges should be used to tighten such posts.

11) All roof-support material will be stored and handled in a manner to minimize rusting and/or damage.

12) The supplementary roof support material will be located so as to accommodate thirty (30)-minute delivery.

13) The minimum length of roof bolts specified in the material list shall apply only if it permits anchorage in at least twelve (12) inches of solid strata.

* Metal Bearing Area
** Wood Bearing Area

14) Where circumstances require a place to be worked or mined where roof bolts are not effective or cannot be installed, roof support will be accomplished by installing crossbars on a maximum of five (5) foot centers or other equivalent protection provided.

a) Mine openings will not be cut through into areas that are not supported by either temporary supports on a maximum of five (5) foot centers or permanent supports installed on pattern as required by the approved plan.

b) When a mine is opening holes in a permanently supported entry, room or crosscut, no work shall be done in or inby such intersection until the new opening is either permanently supported as indicated in the approved plan or timbered off with at least one (1) row of posts on not more than five (5) foot centers across the opening.

In the mining systems using conventional mining equipment, paragraph (b) does not apply until the loading operation is completed.

15) Side cuts will be started in areas that are permanently supported. The first cut on either side of a room or entry will be supported by either temporary or permanent supports before any work is done in or inby the intersection. Where temporary supports are used, the distance between the permanent supports and temporary supports will not exceed five (5) feet and at least one (1) row of posts on five (5) foot centers will be installed across the unsupported place.

a) When crossbars are required, they will be installed so that the load on the support is equally supported.

b) On mobile equipment haulageways, all permanent crossbars or beams will be installed with some means of support that will prevent the beam or crossbar from falling in the event the supporting legs are accidentally dislodged.

16) Upon completion of the loading cycle a reflectorized warning sign, such as "stop" or "caution -- unsupported roof", shall be conspicuously posted to warn persons approaching any area that is not permanently supported, and shall remain in place until permanent supports have been installed.

17) Adverse conditions may require deviation from the normal plan for safety reasons.

18) A bar of suitable length and design will be provided on the continuous miner and on the roof bolter.

19) When mining, advance beyond permanent support will be limited to the distance from the cutter head to the operator's controls, which enables the operator to remain under permanent support at all times.

SAFETY PRECAUTIONS - TEMPORARY SUPPORT

STANDARD

1) Upon completion of the loading cycle a reflectorized warning sign, such as "stop" or "caution - unsupported roof" shall be conspicuously posted to warn persons approaching any area that is not permanently supported, and shall remain in place until permanent supports have been installed.

2) Unless roof bolting machines are equipped with acceptable automated temporary support devices, the installation of temporary supports shall be started no later than thirty (30) minutes after the loading cycle is completed, and after the installation of such supports is started, installation shall be continued until at least the minimum number are installed as required by the approved plan.

3) When installing permanent supports with machines not provided with acceptable automated temporary support devices, temporary supports shall be repositioned in the sequence indicated on the attached sketches. If it is necessary to remove temporary supports before permanent supports are installed, such supports shall be removed by some remote means, or other temporary support shall be installed in such a manner that the workman removing the support remains in a supported area.

4) In areas where temporary supports are required, only those persons engaged in installing the temporary supports will be allowed to proceed beyond the permanently supported roof.

5) Work, such as extending face ventilation devices or making tests for methane beyond permanently supported roof, will not be done unless a minimum of two (2) temporary supports are installed. This minimum is applicable only if the supports are not more than five (5) feet apart, within five (5) feet of permanent support, face, or rib, and the work is done between such supports and the nearest face or rib.

6) Metal jacks will have one (1) wooden cap block between the jack and roof, except a bearing plate with a cross-sectional area of at least 36 square inches may be used in lieu of the cap block.

7) Temporary supports shall be installed tight and on solid fotting. Temporary supports may be installed using a maximum of one (1) cap block on top and one (1) on the bottom plus two (2) wedges.

8) Where acceptable automated roof support devices are provided and maintained on roof bolting machines, such devices will be used in lieu of temporary support in all areas of the mine where the conditions are suitable for safe and proper use of the support system. Roof bolting machine operators will not be permitted inby permanent supports until the automated supports have been pressured against the mine roof at the point where work is to be performed.

CROSSBARS

9) Crossbars will be installed firmly against the roof by means of two (2) jacks or posts, with 10,000# load capacity each. Lagging, cap boards and/or wedges will be used to distribute the load along the beam.

10) Maximum advance, beyond permanent support, will be 110 ft. Maximum advance, beyond temporary support (x-bars), will be to the operator's controls, with the final cut being 10 ft.

11) Crossbars will be installed as soon as possible after a cut sequence is completed.

12) Crossbars will be installed to within 10' of the working face, except on the final cut.

13) Only those persons responsible for crossbar installation will be allowed past temporary supports.

14) Crosscuts will not be started until the intersection, from which they are turned, is bolted.

15) Crosscuts will not be broken through until the intersections to which they will break through are bolted.

16) Bolts will be at the interval specified in the Roof Control Plan.

17) When using the ATRS on the bolter, the crossbar directly ahead of the last row of bolts may be removed prior to installing the next row of bolts, providing the crossbar is within 5' of the last row of bolts.

SAFETY PRECAUTIONS - REHABILITATION WORK

1) Where rehabilitation work is being done, the following temporary support pattern will apply:

   a) Where crossbars or roof bolts are being installed in an area where roof failure is indicated, a minimum of two (2) rows of temporary supports will be installed on not more than five (5) foot centers across the place so that the work in progress is done between the installed temporary supports and adequate permanent support.

   b) Where loose material is being taken down, a minimum of two (2) temporary supports on not more than five (5) foot centers will be installed between the workmen and the material being taken down unless such work can be done from an area supported adequately by permanent supports.

   c) In areas where a roof bolt or roof bolts have been rendered ineffective by damage from mobile equipment, air slack, or other natural or manmade causes, repinning may proceed with use of a roof bolter equipped with a certified ATRS system. Such work will always progress from supported roof into the area requiring rebolting. At no time will the ATRS be advanced further than five (5) feet from supported roof. Temporary supports will be installed in areas where the automated support does not provide adequate protection for the bolter operator.

2) Where roof falls have occurred and at all overcasts, boom holes, and other construction sites that require removal of mine roof material (i.e. by blasting, by ripping with a continuous mining machine, by cutting with a cutting machine, or by any other means) the roof shall be considered unsupported. If miners are required to enter such areas, either to travel over the fallen material, to clean it up, or to perform other duties, the roof shall be supported adequately. Mine management shall devise and have in writing, at the scene of such unsupported roof, a plan incorporating the following procedures:

   a) Such work will be conducted under the constant supervision of a Company official, unless the workmen are specially trained to do such work.

   b) A minimum of four (4) temporary supports on not more than five (5) foot centers will be set near the edge of the roof fall where work is started. Such supports may be removed and relocated as to accommodate a safe method of rock removal and installation of permanent supports.

   c) Bolting or timbering shall proceed from permanently supported roof to the temporary supports before other work is performed and roof supports (temporary and permanent) advanced as cleanup work progresses.

   d) The loading of the fallen roof material will be done with the machine operator under supported roof.

3) All roof falls in active areas, that are not to be cleaned up shall be posted off at each entrance to the area by at least one (1) row of posts (or the equivalent) installed at not more than five (5) foot centers across the opening and "danger" signs placed at all entrances into the fall area.

4) Where roof falls have occurred, or where the mine roof has been intentionally disturbed by any means, roof bolts of a length less than required in the approved roof control plan may be used to support the remaining roof, but the bolt length will not be less than 36 inches and must anchor to at least twelve (12) inches of solid strata.

5) Before any person proceeds inby permanently supported roof to install temporary supports, thorough visual examination of the unsupported roof and ribs shall be made. If the visual examination does not disclose any hazardous condition, persons proceeding inby permanent supports shall do so with caution and shall test the roof by the sound and vibration method as they advance into the area.

SAFETY PRECAUTIONS FOR RESIN GROUTED RODS

1) All safety precautions required in the regular roof control plan will be followed, except the torque tests required for conventional type roof bolts will not apply. Should there be indications or suspected indications that resin is failing, then a torque check shall be made of all the rods installed in that cycle. Should more than two (2) rods turn in its hole, the resin installation shall be discontinued until such failure can be determined, roof bolting procedures will be altered such that the roof will be adequately supported.

2) Persons responsible for the installation of resin rods will be taught the installation procedures recommended by the manufacturer, including the safe handling precautions of the resin material.

3) Drill steels will be equivalent in length to the rods used or adequately marked to assure proper hole depth. Each drill hole will be filled the entire length with resin.

4) All resin grouted rods will be used with bearing plates approved for use. The bearing plate or the wood material between the bearing plate and the roof will be tight against the mine roof.

5) Resin packages will be stored in an area where the temperature is within the range recommended by the manufacturer.

6) Broken cartridges or cartridges which show signs of deterioration will not be used and will be removed from the mine.

7) Resin grouted rods and conventional roof bolts will not be intermixed during systematic bolting cycles, except that intermixing may occur in areas where supplementary supports are required.

8) Resin cartridges will not be used if the recommended shelf life has been exceeded, unless written authorization for use is permitted by the manufacturer or an authorized representative of the manufacturer.

Note: As per our conversation with Rick Callor on November 10, 1982, Item 9 has been added:

9) A. When installing No. 6 Rebar (3/4 inch), the diameter of the bit used for drilling the bolt hole shall not be larger than 1 inch.

B. When installing No. 7 Rebar (7/8 inch), the diameter of the bit used for drilling the bolt hole shall not be larger than 1 ¼ inch.

SAFETY PRECAUTIONS FOR SPLIT SET BOLTS

1. Persons responsible for installation of split set bolts shall be instructed in the correct and safe guidelines for their use.

2. The relationship between hole depth and diameter to the bolt dimensions are critical; therefore, adequate training and supervision shall be provided to assure proper installation.

3. All safety precautions required in the regular Roof Control Plan shall apply, except precautions relating to torque checks.

4. Split set bolts shall be installed as soon as possible after the working place is exposed.

5. Split set bolts shall not be intermixed with conventional and resin bolts unless they are used as supplementary support or a systematic plan has been approved by the District Manager for combining the three support systems. However, areas of one type can follow areas of other types.

6. Drill steel shall be at least two inches longer than the bolt used or adeuqately marked to assure proper hole depth.

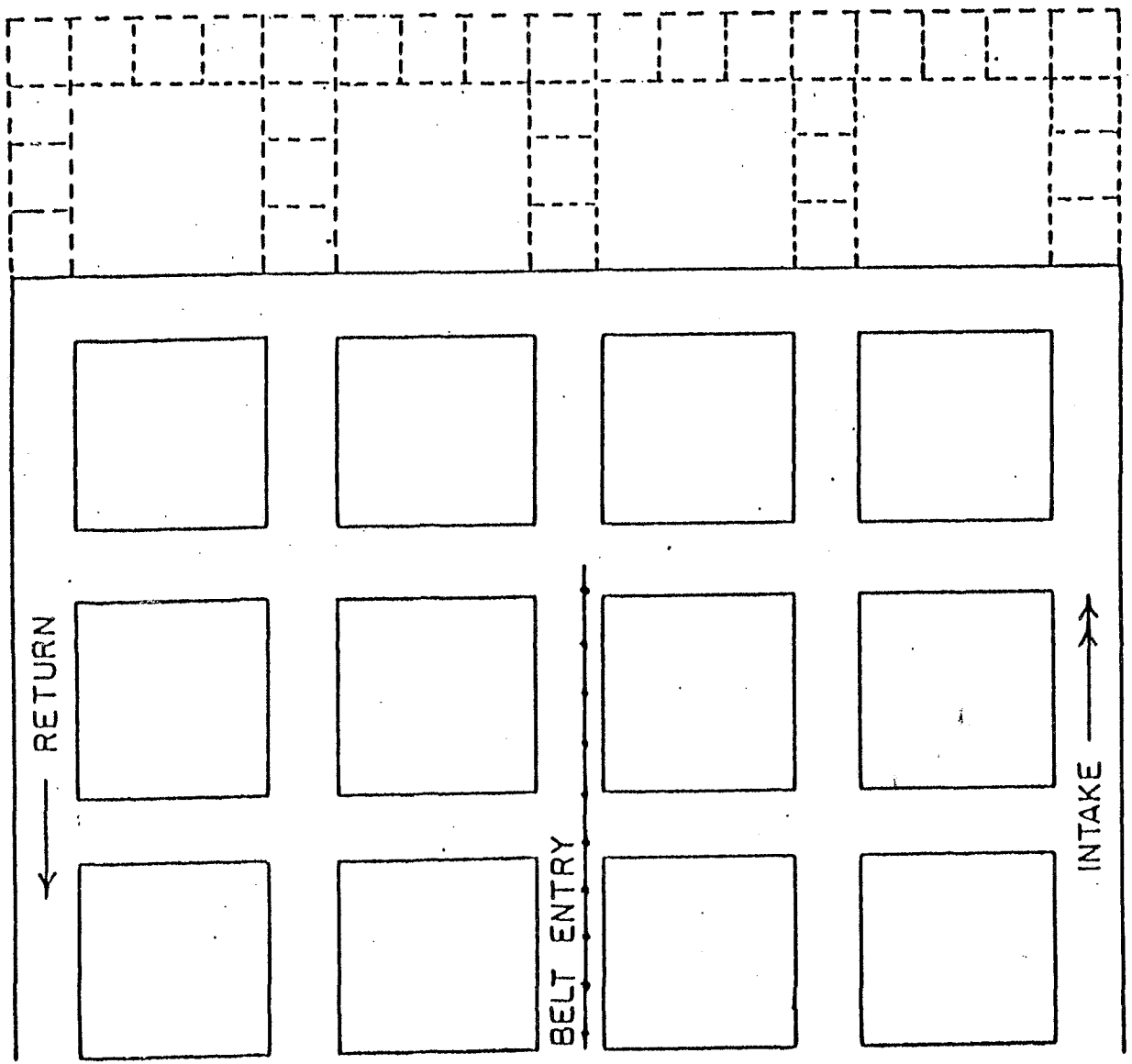
7. a) All split set bolts shall be used with approved bearing plates.

   b) Bearing plates shall be installed tight against the mine roof or header board.

8. For test purposes, the first split set bolt installed in each cycle in each working place shall be tapped with a hammer. A tight bolt will ring, whereas a loose one will not.

9. Split set bolts that are obviously damaged, such as squashed or bent tubes, cracked parts or damaged rings, shall not be used.

MINING SEQUENCE



FULL BOLTING PLANS

Cuts will be limited to the operator's controls and under normal mining conditions, development sections will be mined from the intake to the return entries.

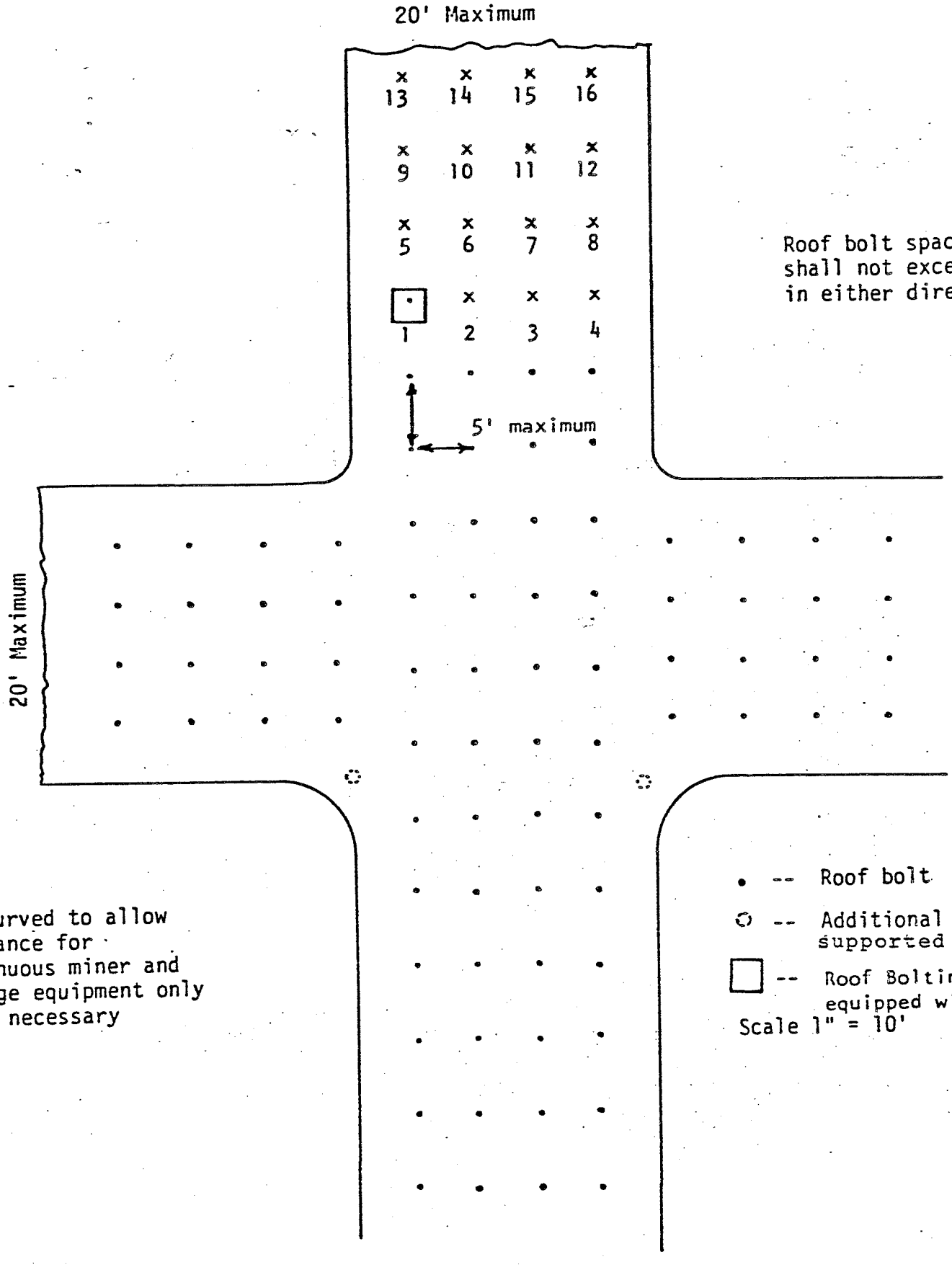
Adverse conditions may require deviation from the normal mining sequence.

SCALE 1"=60'

BEAVER CREEK COAL C

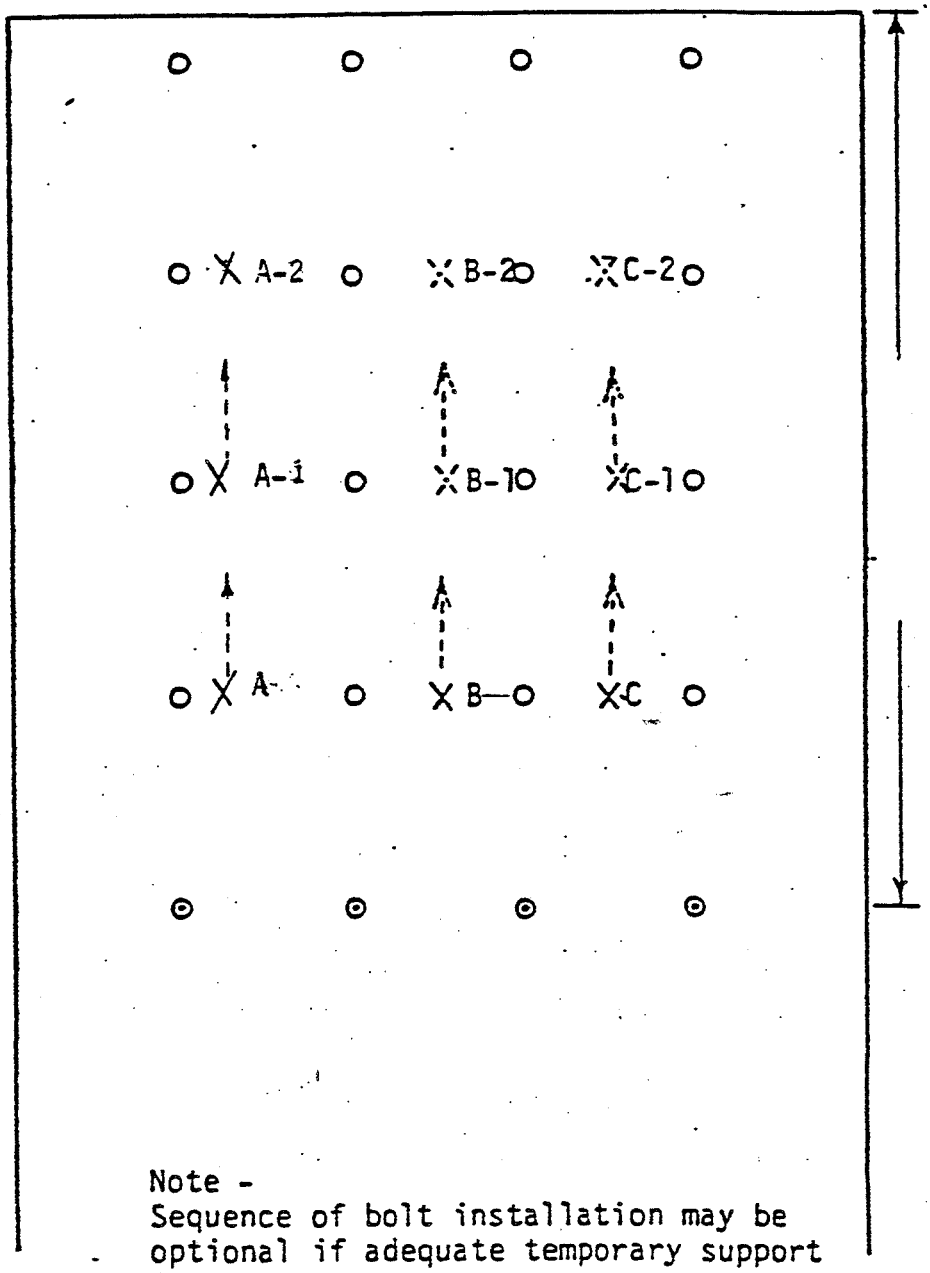
DRAWING NO. 1

Roof Bolting Procedure
For Automated Temporary
Roof Support (TRS)



DRAWING NO. 2

Advancing Temporary Support



Note -
Sequence of bolt installation may be optional if adequate temporary support is provided.

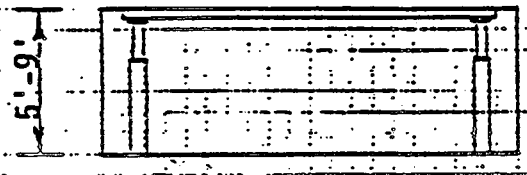
⊙ Roof Bolt

O Location for Roof Bolt

X Temporary Roof Support

NOTE: In situations where bolting is required and ATRS is not available, temporary supports will be advanced as shown as bolting progresses.

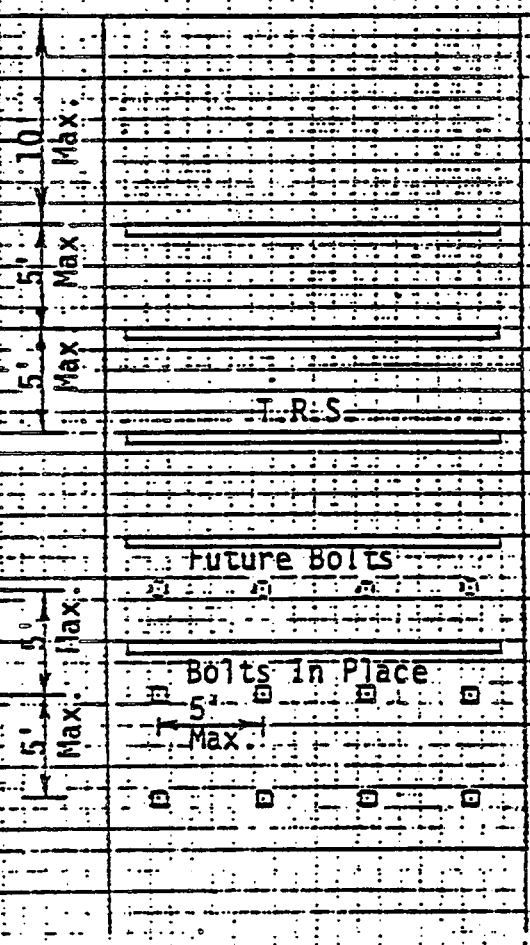
DRAWING NO. 3



Section View

Typical header set using approved beam and supports capable of supporting 20,000 lbs. (Hydraulic jacks or timber may be use

FINAL CUT LOCATION



Maximum distance from last temporary support to face will be the distance from the operater's controls to the cutter heads. Maximum advance ahead of bolts with T.R.S. will be 110'.

Crosscuts will not be turned until intersections are bolted.

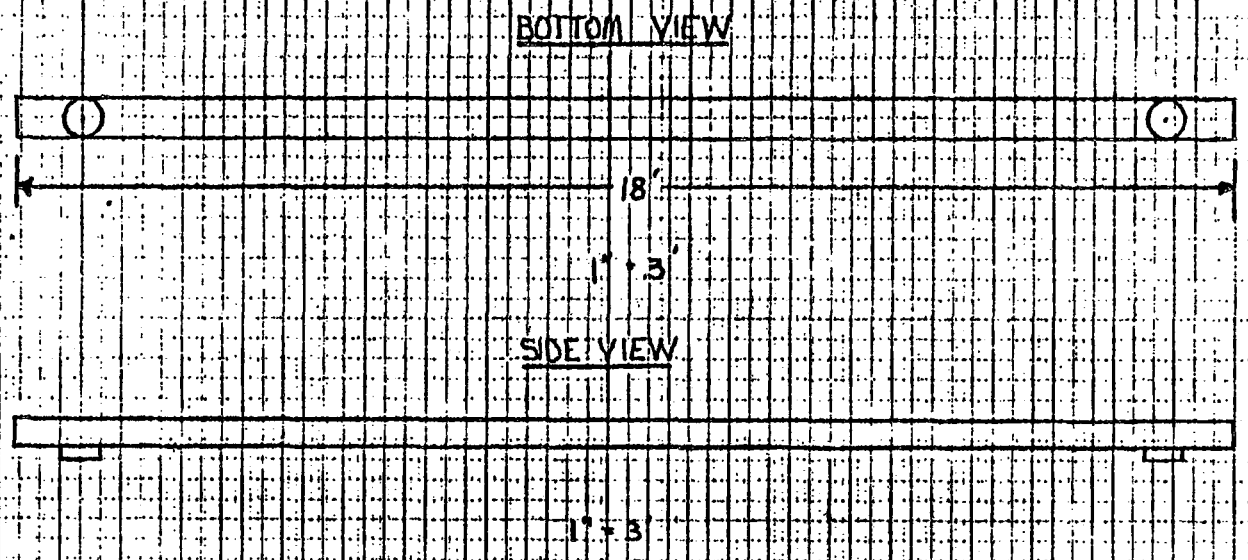
Bolts will be placed at the interval specified in the Roof Control Plan. When using the T.R.S. on the roof bolter, the beam directly ahead of the last row of bolts may be removed prior to installing the next row of bolts, providing the beam is within 5' of the last row of bolts.

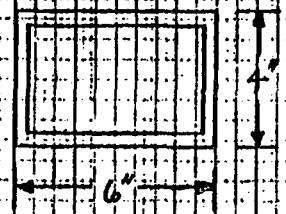
PLAN VIEW

BEAVER CREEK COAL COMPANY
Temporary Roof Support System

Scale: 1" = 100' 3/1/82 Gu

DRAWING 4





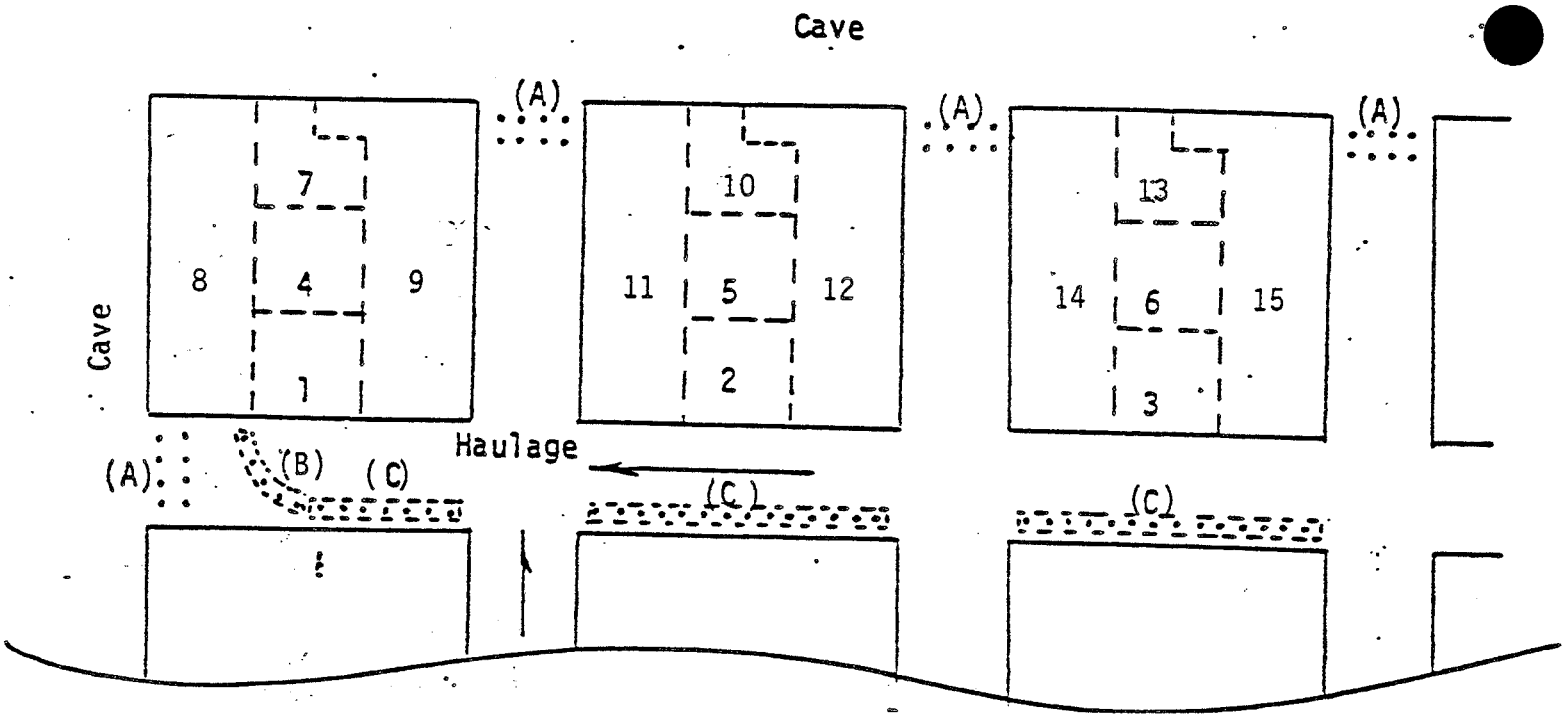
TRS Aluminum Beam

DRAWING - 5

3-2-02

DRAWING 5

TYPICAL PILLARING SEQUENCE



1. No more than 3 pillars per chain row will be split at any one time. Sequence may vary depending upon the mining conditions.

2. Breaker posts will be installed at the locations marked (A) before any pillar splits are begun.

3. When a single roadway into the split is present (due to the cave line configuration), radius timber will be installed at location (B) prior to cutting box cut 2 (cut #4).

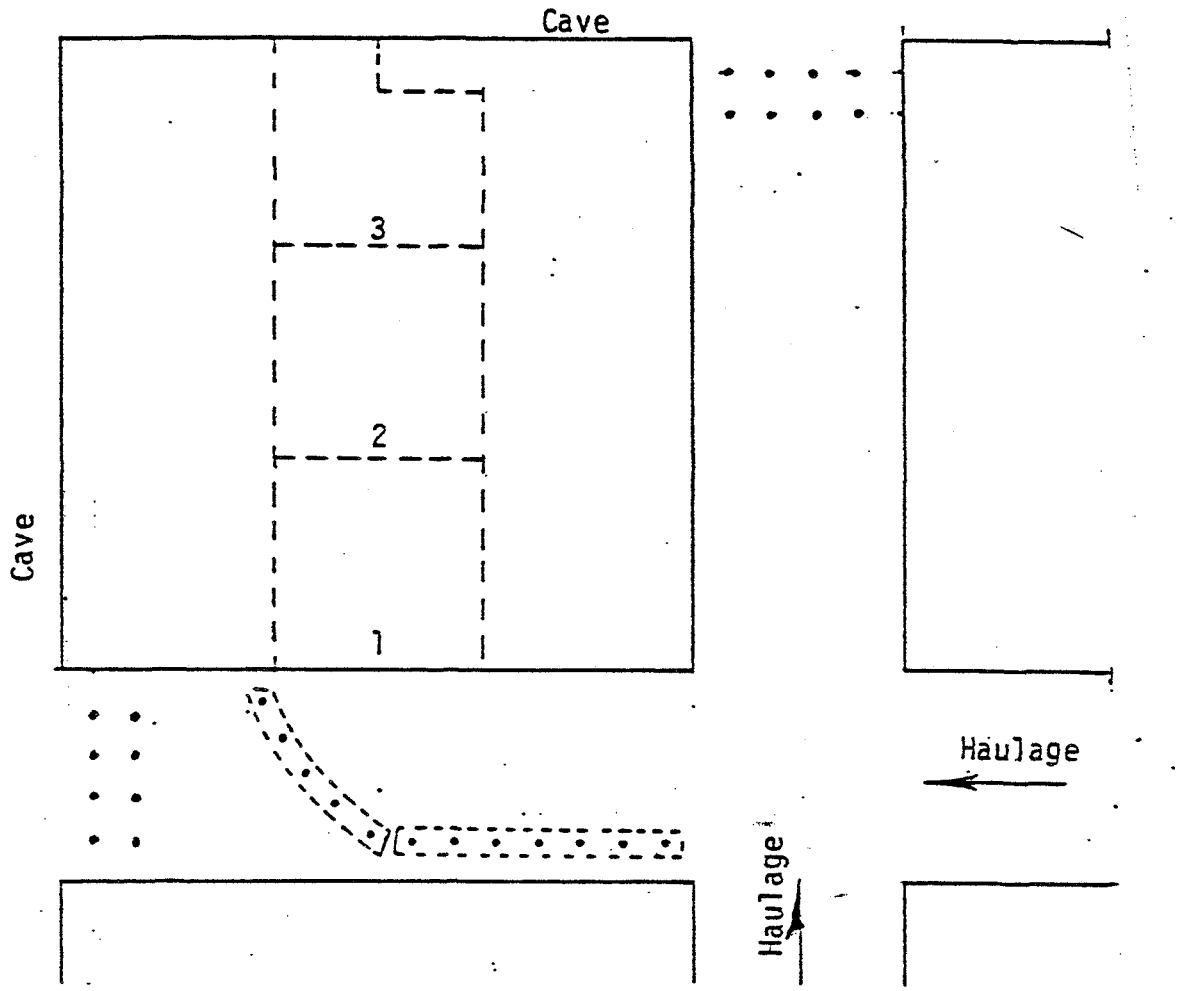
4. Roadway timber will be installed at locations (C) prior to the second box cut being mined (cuts 4, 5 & 6).

5. Roadway timber may be located on either side of the roadway as needed to accommodate shuttle car travel, provide the roadway width does not exceed 18 feet.

6. Roadway timber will be extended one pillar outby the pillar being split where there is only one roadway into the pillar, (due to the cave line, barrier pillar and/or adverse conditions).

DRAWING 6

TYPICAL PILLAR EXTRACTION



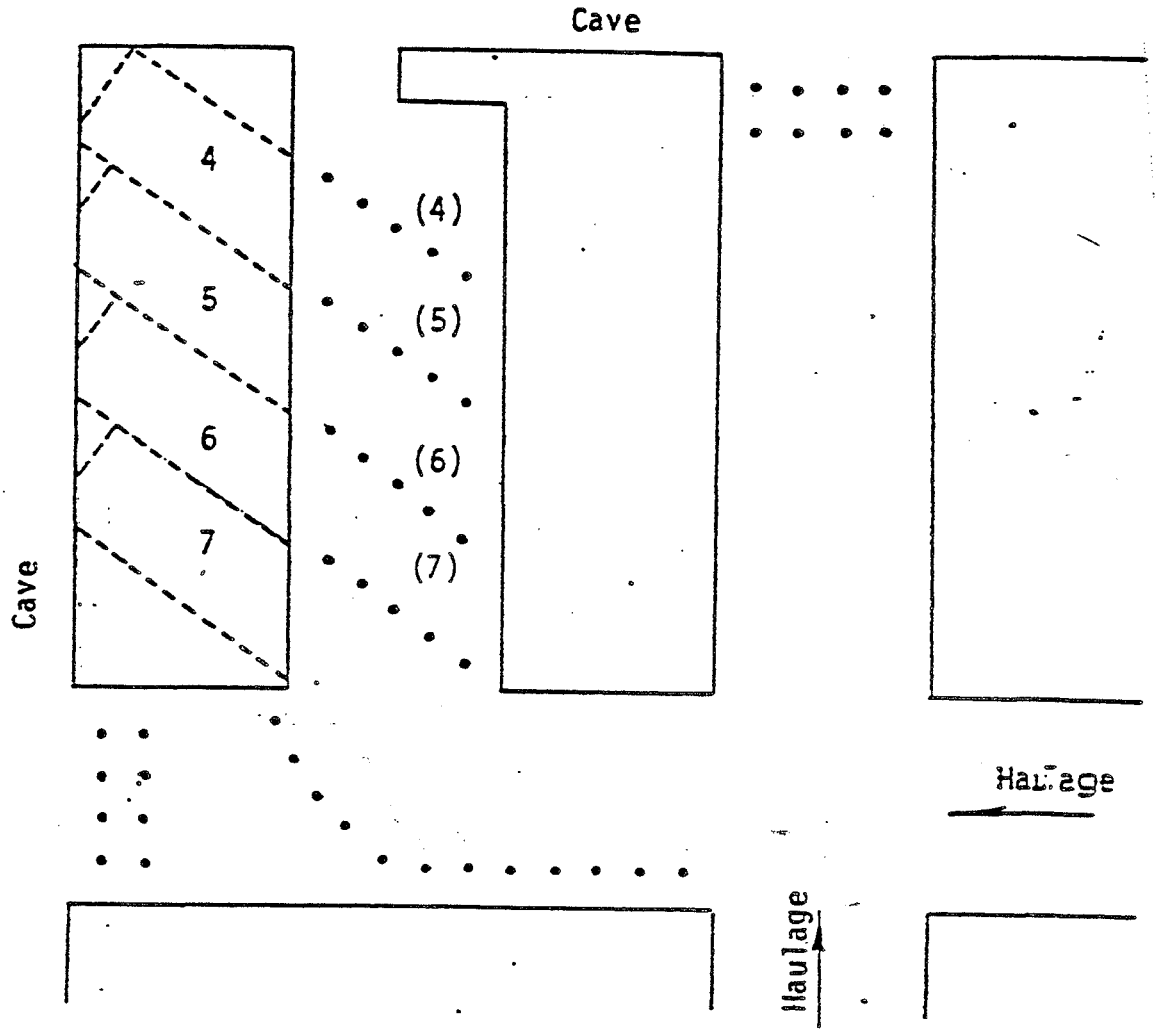
7. All entries, crosscuts and intersections shall be bolted in accordance with the approved Roof Control Plan before starting pillar splits.

8. Box cuts 1, 2 and 3 will be mined as shown. Cuts 1 and 2 will be completely bolted and cut 3 will be bolted as required to allow posting and fendering under permanent support.

9. A five-foot stump may be left at the end of the box cut 3 at the discretion of the foreman. The stump may be on either side of the split or in the center if a Y cut is performed. If cut 3 is mined completely through, without leaving a stump, two rows of breaking post will be installed within five feet of the last row of permanent support.

DRAWING 7

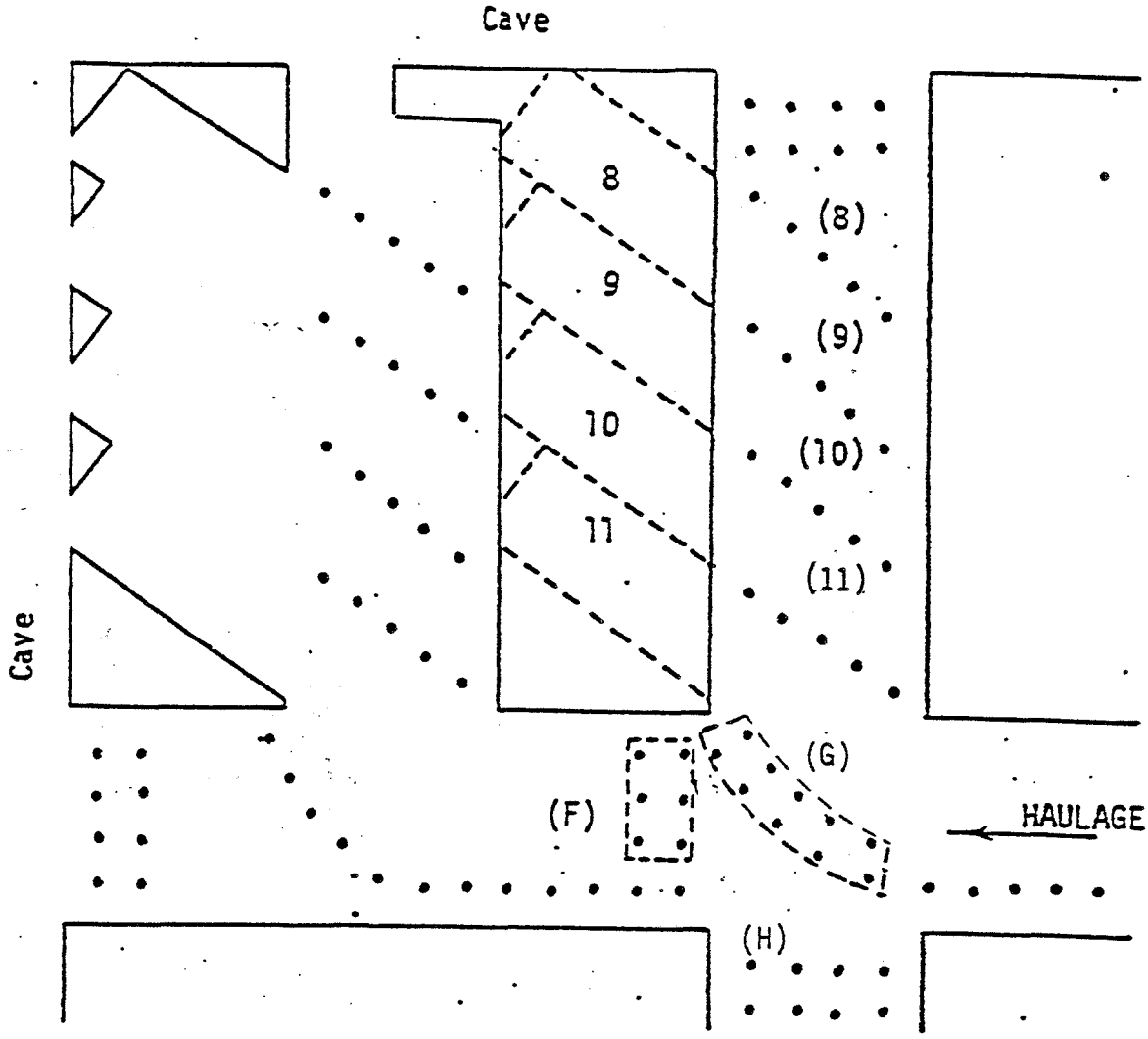
TYPICAL PILLAR EXTRACTION



10. Radius timbers located at (4) will be installed prior to cut 4 being mined. Timbers will be placed at location (5) prior to cut 5 being mined and so on. Each cut will be approximately the width of the continuous miner.

11. The operator controls on the continuous mining machine shall not advance beyond the last roof support.

DRAWING 8



14. Breaker posts shall be installed at location (F), after mining inby is completed.

15. Radius timbers located at (8) will be installed prior to cut 8 being mined. Timbers will be placed at location (9) prior to cut 9 being mined, and so on. Each cut will be approximately the width of the continuous miner.

16. The operator controls on the continuous mining machine shall not advance beyond the last roof support.

17. A double radius row shall be installed at location (G) prior to cut 11 being mined if the roadway is maintained at 16 feet; if the roadway is maintained at 14 feet, only a single radius row is required at location (G).

18. Breaker posts shall be installed at location (H) after mining inby is completed.

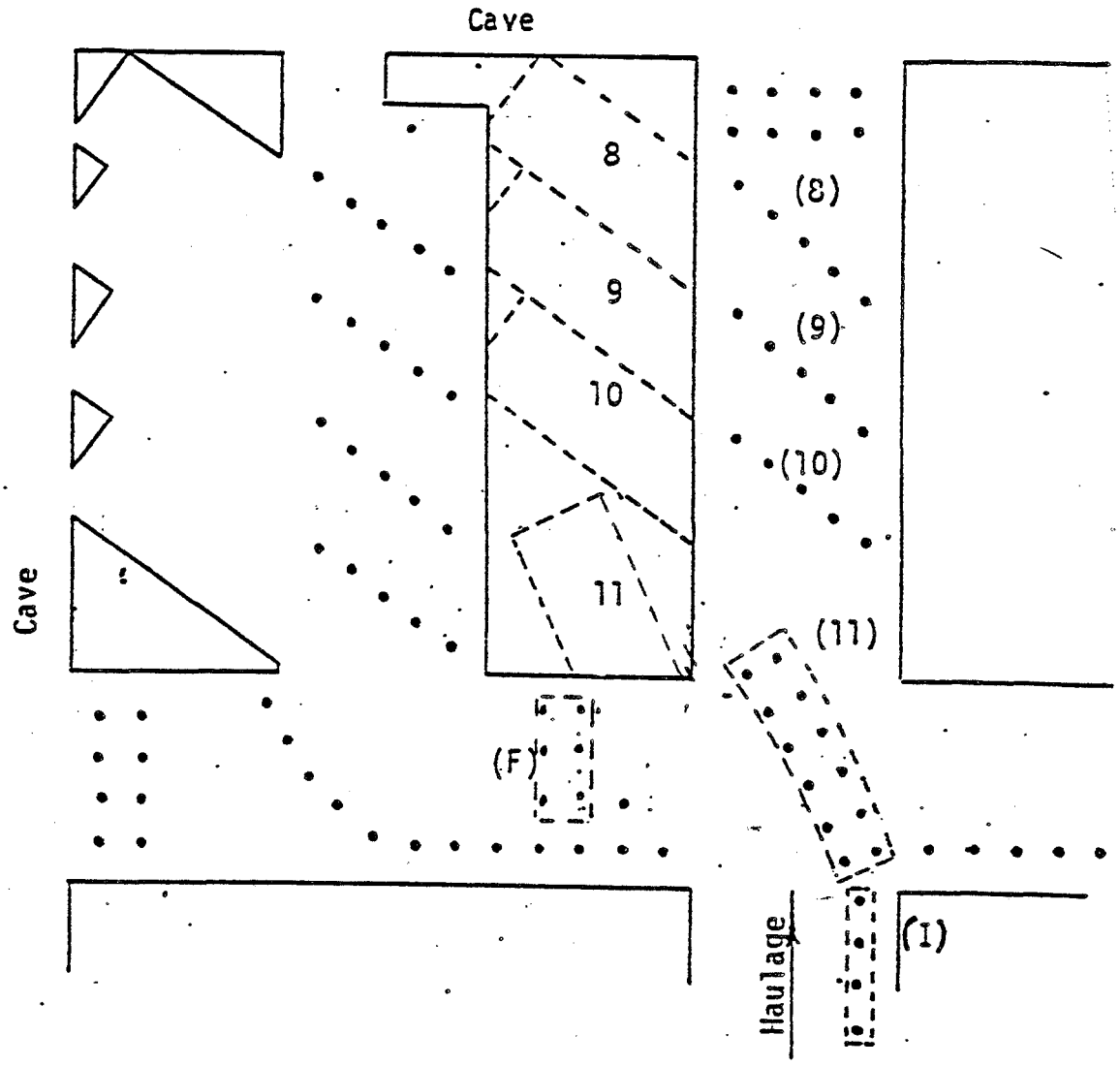
19. The cut sequence may vary depending on pillar location, pillar size, dimension and haulage direction, etc., so long as the timbering procedures outlined in this plan are followed.

20. Direction of pillar attach will be optional, depending on the existing ground conditions.

21. Breaker post, radius timber and roadway timber will be installed on four foot centers; width of entries or crosscuts will determine the number of timber required.

DRAWING 9

ALTERNATE PILLAR EXTRACTION



1. Breaker posts shall be installed at location (F), after mining inby is completed.

2. Radius timber shall be located at location (8) prior to cut 8 being mined. Timbers will be placed at location (9) prior to cut 9 being mined, and so on. Each cut will be approximately the width of the continuous miner.

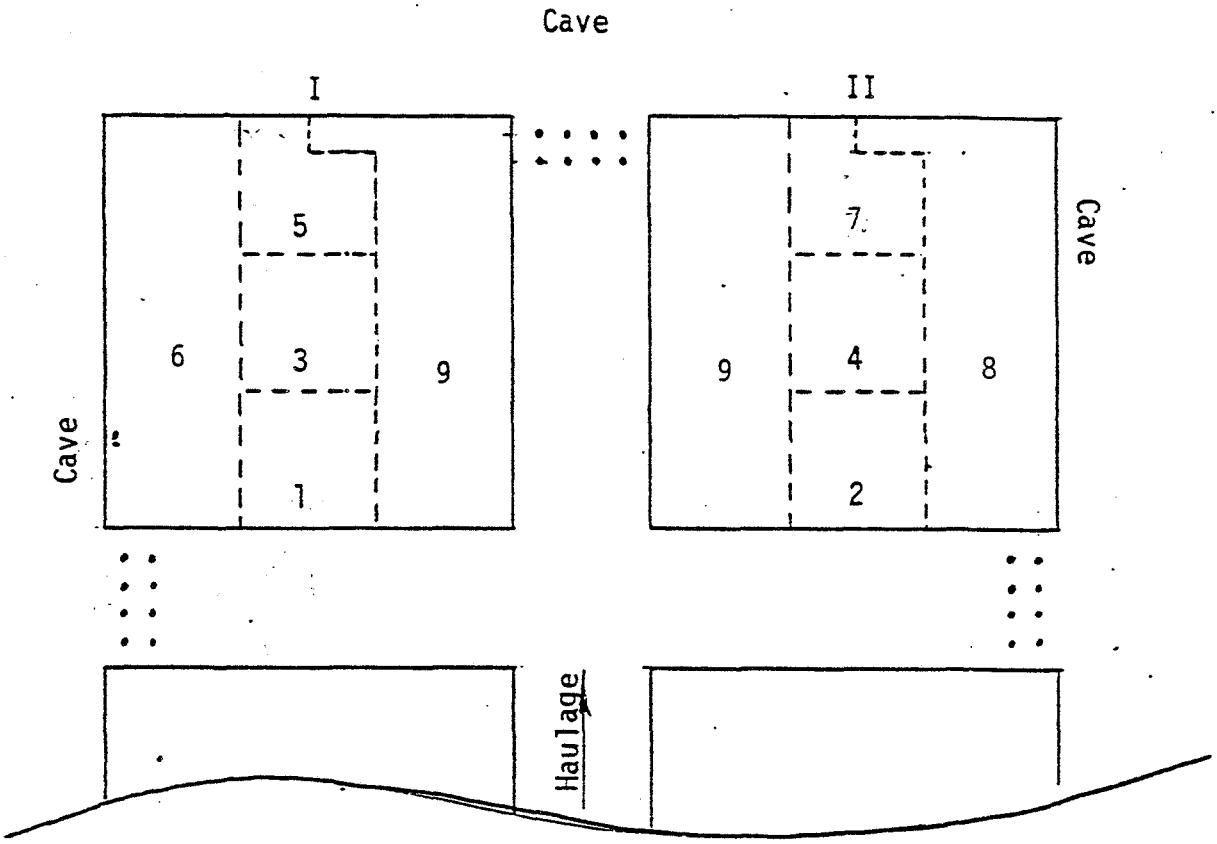
3. Roadway timber shall be installed at location (I) and extending one crosscut outby, before the final lift (cut 11) is extracted.

4. A double radius row shall be installed at location (11) prior to cut 11 being mined, to maintain the roadway at 16 feet.

DRAWING 10

ALTERNATE PILLAR EXTRACTION ---- SINGLE HAULAGE WAY

CHRISTMAS TREE METHOD



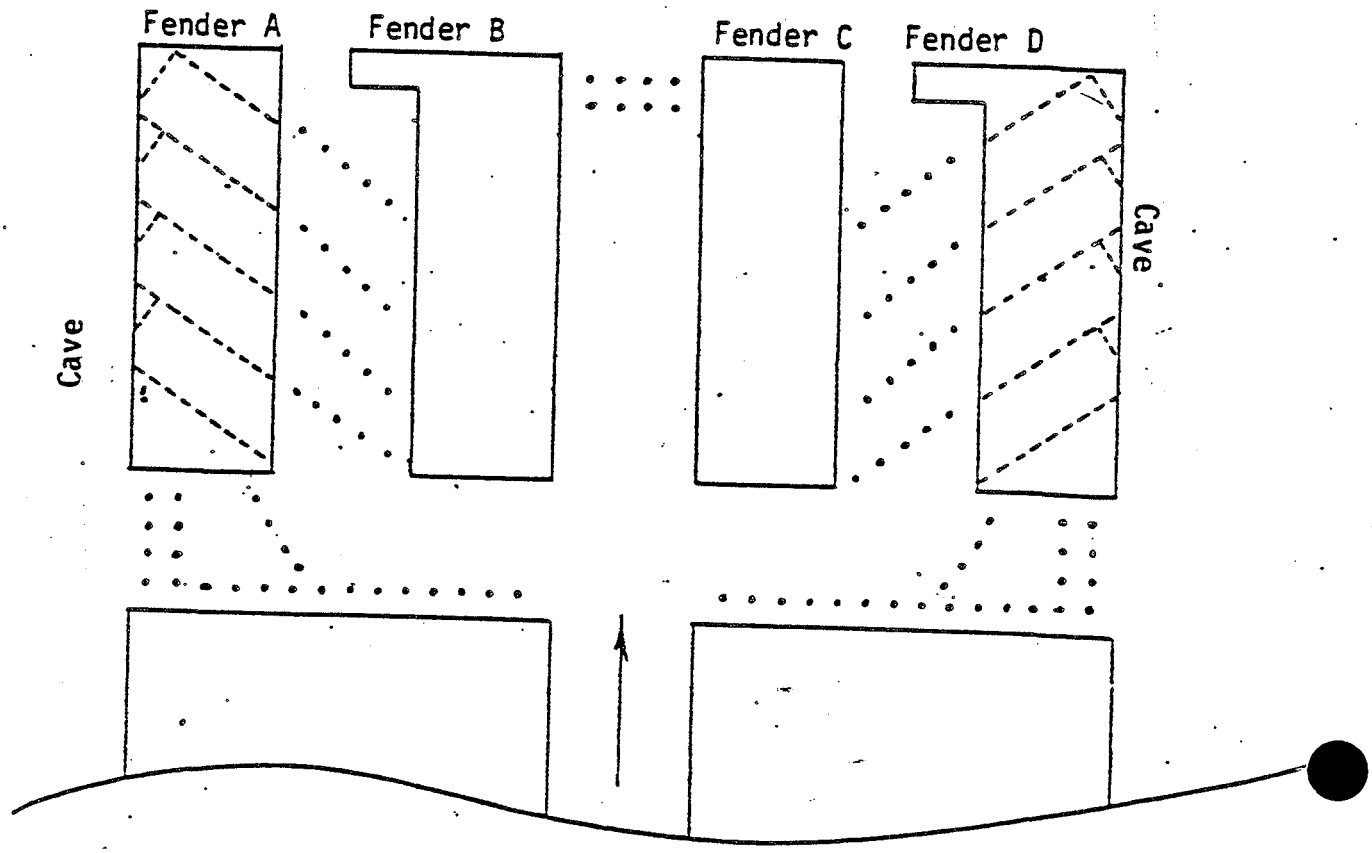
1. Pillars I and II shall be split in accordance to the existing typical pillar plan (Drawings 6 & 7).

2. Cut sequence will follow the numerical order as shown.

DRAWING 11

ALTERNATE PILLAR EXTRACTION ---- SINGLE HAULAGE WAY

CHRISTMAS TREE METHOD

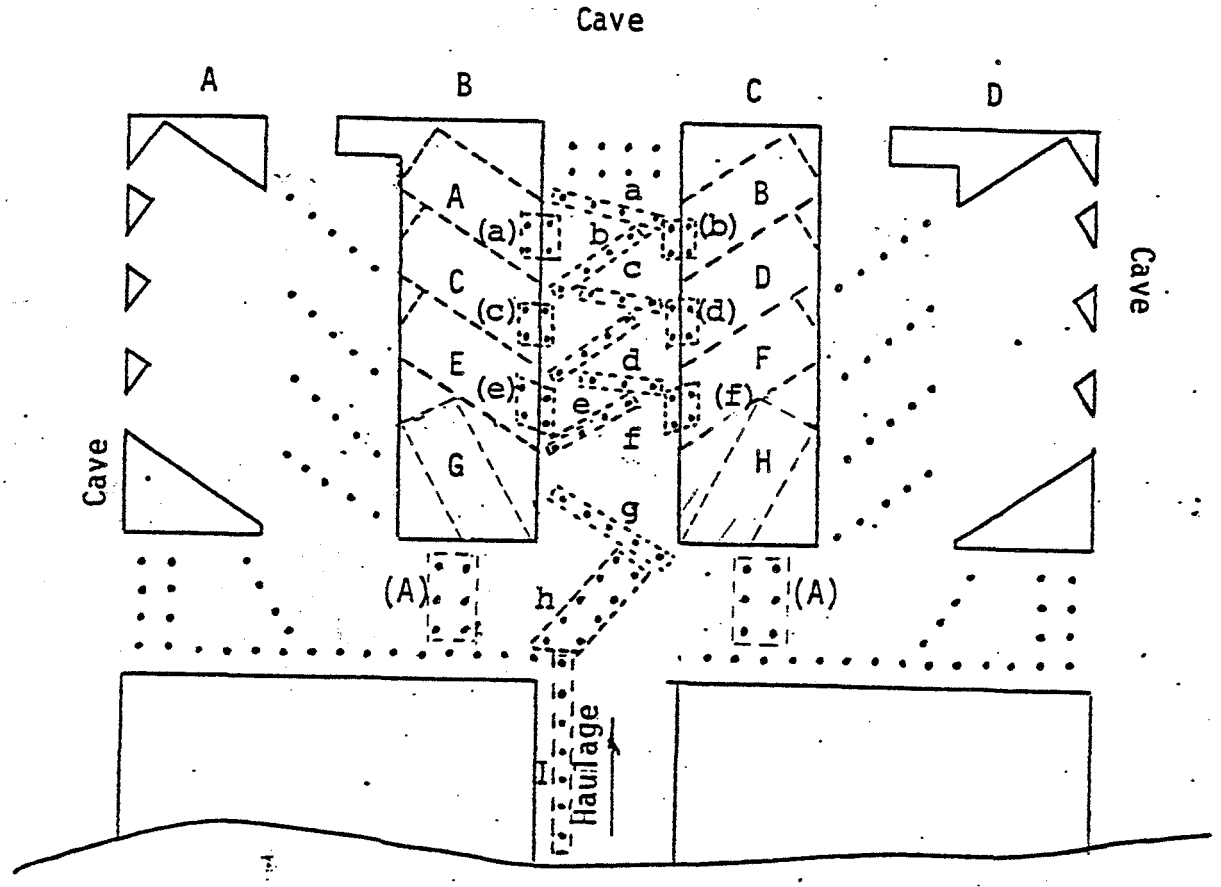


3. Fenders A & D will be extracted as outlined in Drawing 8.

DRAWING 12

ALTERNATE PILLAR EXTRACTION ---- SINGLE HAULAGE WAY

CHRISTMAS TREE METHOD



4. Roadway timber located at position (I) will be installed prior to mining fenders B & C.

5. Breaker posts at location (A) shall be installed when mining inby is completed. (Fender A and/or D)

6. Radius timber will be installed at location "a" prior to cut A being mined. After cut A is complete, the opening will be timbered off with two rows or timbers at location (a) on not more than four foot centers. This sequence will be repeated for cuts B thru F.

7. Radius timber will be installed at location "g" prior to cut G being mined.

8. A double radius row will be installed at location h prior to the final lift (cut H) being mined.

DRAWING 13