

TABLE OF CONTENTS

CHAPTER III PERMIT APPLICATION REQUIREMENTS: BIOLOGY

<u>REGULATION NUMBER</u>		<u>PAGE</u>
R614-301-300	Biology	1
R614-301-320	Environmental Description	1
R614-301-222	Fish and Wildlife Information	1
	Fish and Wildlife Resource Information	1
	Mapping	3
	Fish and Wildlife Inventory	4
	Terrestrial Use Areas	5
	Table III-1 Ranking of Value Per Ecological Association For Wildlife Habitats	20
	Table III-2 Ranking Of Wildlife Value Per Legal Section Of Land	21
	Attachment III-1 Guidelines For Fish and Wildlife Habitat Information	22
R614-301-323	Maps and Aerial Photographs	25
R614-301-330	Operation Plan	25
R614-301-331	Interim Reclamation Plan	25
	Table III-3 Trial Seed Mixture No. 1	27
	Table III-4 Trial Seed Mixture No. 2	29
	Table III-5 Trial Seed Mixture No. 3	31
	Table III-6 Trial Seed Mixture No. 4	34
R614-301-332	Anticipated Impacts Of Subsidence	36
R614-301-333	Fish And Wildlife Impact Avoidance Plan	38
	Fish And Wildlife Plan- U.S. Fuel Permit Area	47
	Table III-7 Acreages Of Areas Not To Be Reclaimed Within U.S. Fuel Permit Area	48

TABLE OF CONTENTS

CHAPTER III PERMIT APPLICATION REQUIREMENTS: BIOLOGY

<u>REGULATION NUMBER</u>		<u>PAGE</u>
	Figure 1 Deer Crossing On King VI Overland Conveyor	51
	Attachment III-2 Deer Crossing Approval letter	52
	Attachment III-3 DOGM Confirmation of Raptor Survey	54
	Table III-8 Vegetative Communities Inside Permit Boundaries	55
	Table III-9 Nursery Stock Required For Revegetation	56
R614-301-340	Reclamation Plan	60
R614-301-341	Revegetation	60
	Field Trial Test Plots	65
R614-301-342	Fish and Wildlife Enhancement - Postmining Phase	65
R614-301-350	Performance Standards	65
R614-301-351	General Requirements	65
R614-301-352	Contemporaneous Reclamation	65
R614-301-353	Revegetation: General Requirements	66
R614-301-354	Revegetation: Timing	66
R614-301-355	Revegetation: Mulching And Other Soil Stabilization Practices	66
R614-301-356	Revegetation: Standards For Success	66
R614-301-357	Revegetation: Extended Responsibility Period	66
R614-301-358	Protection Of Fish, Wildlife And Related Environmental Values	63
	Chapter III Bibliography	66

TABLE OF CONTENTS

CHAPTER III PERMIT APPLICATION REQUIREMENTS: BIOLOGY

CHAPTER III APPENDICES

- APPENDIX III-1 Vegetation Survey Of U.S. Fuel Company Property,
 Hiawatha, Utah
- APPENDIX III-2 Vegetation Of The U.S. Fuel Company Property,
 Hiawatha, Utah: A Consolidation Of Data
 Collected During The 1980 And 1981 Field Season
- APPENDIX III-3 Vertebrate Species Of Southeastern Utah
- APPENDIX III-4 King 6 Interim Revegetation Plan
- APPENDIX III-5 Field Trial Test Plot Studies

R614-301-300 BIOLOGY

R614-301-320 ENVIRONMENTAL DESCRIPTION

321.100 A study of vegetation of the U.S. Fuel mining permit area and adjacent areas was conducted between August 21 and August 27, 1980, and supplementary data was collected October 7, 1980. The purpose of the study was to determine existing conditions of the area in terms of kind and quantities of plants. The study, entitled Vegetation Survey Of U.S. Fuel Company Property, Hiawatha Utah, is located in Appendix III-1 and includes information on the Mohrland area as well. No disturbance is planned for the Mohrland area. In 1981 additional work was done in the permit area and the data from 1980 and 1981 was consolidated into one report entitled Vegetation Of The U.S. Fuel Company Property, Hiawatha, Utah: A Consolidation Of Data Collected During The 1980 and 1981 Field Season. This report is located in Appendix III-2.

321.200 Most of the present disturbed area had been disturbed prior to 1979 by previous mining activities and old townsites. In some cases it is impossible to obtain the productivity of the site prior to disturbance. In Appendix III-1 and Appendix III-2 productivity is estimated for the reference areas in the permit area. Vegetation information is also given in Chapter II, Appendix II-1, "Vegetation Survey for U.S. Fuel Company", Appendix II-2, "Forest Service Soil Identifications in U.S. Fuel Company's Permit Area" and in the publication Soil Survey of Carbon Area, Utah.

R614-301-322 FISH AND WILDLIFE INFORMATION

The following Fish and Wildlife Resource Information was developed to address Division of Oil, Gas and Mining requirements in conjunction with recommendations by the Division of Wildlife Resources. A more general study is provided in Appendix III-3 and is entitled "Species List Of Vertebrate Wildlife That Inhabit Southeastern Utah" Publication Number 78-13.

FISH AND WILDLIFE RESOURCE INFORMATION

General Wildlife Resource Information - All Species

The mine plan area encompasses a portion of the Wasatch Plateau in Carbon and Emery Counties, Utah. This area drains into the Price and San Rafael Rivers. Both rivers are separate tributaries to the Green River which ultimately flows into the Colorado River at a point upstream from Lake Powell. Generally speaking, the Wasatch Plateau is encompassed by cold desert (upper Sonoran life zone), submontane (Transition life zone) and montane (Canadian and Hudsonian life zones) ecological associations. These life zones could be inhabited on

occasion and during different seasons of the year by about 364 species of vertebrate wildlife --14 fish species, 6 amphibian species, 18 reptile species, 242 bird species and 84 mammal species. It is interesting to note that 83 percent of these species are protected.

The mine plan area itself is represented by the Transition and Canadian life zones and provides habitat for approximately 234 species of wildlife --no fish species, 6 amphibian species, 18 reptile species, 139 bird species and 71 mammal species. Fifty-eight of these species are of high interest to the State of Utah.

The Division Publication No. 78-16 "Species List of Vertebrate Wildlife That Inhabit Southeastern Utah" is appended (Appendix III-3) to this chapter since it represents a low level of study for the species listed. It identifies those species having potential to inhabit the region as well as those inhabiting the environs of the mine plan area. Appendix III-3 also identifies which species are considered to be of high interest for the habitats and local area represented.

High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific or educational significance. This definition would include all federally listed, threatened and endangered species of wildlife.

A ranking and display of wildlife habitats and use areas relative to high interest species of vertebrate wildlife has been developed (Table III-1 and III-2). Critical wildlife use areas followed in respective importance by high-priority, substantial value and limited value wildlife use areas require various levels of protection from man's activities and developments. Wildlife habitats and use areas ranked as being of critical or high-priority value to wildlife should be protected from surface disturbance, subsidence impacts and human or industrial disturbance. This can be accomplished through development and implementation of a wildlife plan.

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during crucial periods in their life cycles. These areas are restricted in area and lie within high-priority wildlife use areas. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 1 or 2 are classified as being critical. Biological intricacies dictate that significant disturbances cannot be tolerated by the members of an ecological assemblage on critical sites. Professional opinion is that disturbance to critical use areas or habitats will result in irreversible changes in species composition and/or biological productivity of an area.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in area and in conjunction with limited value use areas form the substantial value distribution for a wildlife species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 3 are classified as being of high-

priority. In addition, wildlife use areas where surface disturbance or underground activities may result in subsidence that could interrupt underground aquifers and result in a potential for local loss of ground water and decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

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

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

MAPPING

Vegetation and Wildlife Habitats

It is recommended that the Company's primary effort be placed on identifying species of vegetation in each wildlife habitat within the various wildlife use areas for purposes of reclamation. The Division does not have site specific information relative to vegetation types at the mine plan area. However, there are nine wildlife habitats present --riparian or wetland types, urban or park, cliffs and tallus, sagebrush, pinion-juniper forest, shrubland, aspen forest, parkland and spruce-fir forest. The Company should identify each of these habitat associations on appropriately scaled maps.

It is believed that if satisfactory reclamation is achieved and man's disturbance does not continue or become a factor, that most species of wildlife displaced from the mine plan area will return. Without doubt, the key to success for enhancing or restoring wildlands will be development of habitats so that the postmining condition as compared to the premining condition will have similar species, frequency and distribution of permanent plants in each vegetative type. This will allow for natural plant succession. Additionally, other habitat features that represent the various life requirements for local wildlife must be provided.

Wildlife Use Areas

Exhibits III-1, III-2 and III-3 display mapable, high value use areas for high interest wildlife on or adjacent to the mine plan area. This display includes stream sections and bodies of water, if any, utilized by high interest fish species. Also displayed are known seeps, springs,

wetlands, and riparian zones. Note that there are high interest wildlife distributions that are so broad that they cover the entire map and therefore are not illustrated. However, all vertebrate species of high interest wildlife and their distributions are discussed in the following narrative.

Water

Due to demands of state and federal coal mining regulations, the Company will probably be required to identify and appropriately monitor all surface waters for potential impacts from subsidence. This information should be correlated with the wildlife use area information due to the value of water to wildlife.

FISH AND WILDLIFE INVENTORY

Aquatic Use Areas

Macrophytes

From a position of the aquatic wildlife resource it is believed that there is no practicality for information relative to macrophytes to be addressed by the mine permit. Such information is generally not available.

Macroinvertebrates

The results from studies of macroinvertebrates may be required for purposes of determining the need for stream buffer zones in stream sections supporting biological communities. Since the permit application does not identify any plans to impact any salmonid fishery or discharge of polluting effluents into local waters, no data relative to macroinvertebrates as a pollution index or a forage base for fishes or other predators dependent upon the aquatic resource need be presented.

Note, impact avoidance procedures that would protect the integrity of the aquatic resource, if any, need to be included with the mine permit application. Deposition of coal particles in any aquatic system could have a variety of negative impacts on invertebrate populations.

Studies relative to macroinvertebrates if desired or needed, must be conducted by a qualified, private consultant.

Fish--Species Occurrence and Use Areas

Aquatic habitats associated with the mine plan area are not known to support any species of fish.

If project operations are planned or develop that would alter, destroy or discharge polluting effluents into any perennial waters, appropriate state and federal permits, a mitigation plan and results from high level studies of the aquatic resource would be required of the

Company. Achievement of mitigation would demand detailed studies of stream velocity correlated to flow, representatives of the stream channel profile, gradient, pool-riffle ratio, substrata types identifying percent representation of each type and surface water information required by the regulations.

If modification of flows is anticipated, instream flow requirements must be considered to meet the needs of the existing "biological community" and maintenance of existing riparian or wetland zones. Such baseline information would allow for development of mitigation or reclamation plans that would allow for avoidance, lessening or mitigation of impacts to the aquatic resource and maintenance or reestablishment of unique habitat types. This baseline information is not generally available and would necessitate the services of a qualified private consultant and/or contracting Utah's Division of Wildlife Resources since special permits would be required.

It is important to note that no species of fish having relative abundances so low as to have caused them to be federally listed as threatened or endangered inhabit the mine plan or adjacent areas. The endangered humpback chub, bonytail chub and Colorado squawfish inhabit the Green and Colorado Rivers. Additionally, the humpback (razorback) sucker also inhabits those rivers; it is likely that this species will one day be federally listed as threatened. It is not believed that implementation and operation of the Company's project will impact any of these species.

TERRESTRIAL USE AREAS

Wildlife Habitat Types

Of the nine wildlife habitat types present on the mine plan area wetlands and riparian habitats which are normally associated with drainage bottoms (ephemeral or intermittent), or perennial streams, seeps and springs within the Transition and Canadian life zones are ranked as being of critical value to all wildlife. Cliffs and their associated tallus areas that lie within the Transition life zones are ranked as being of high-priority value to all wildlife. When compared to all other wildlife habitats the aforementioned situations are considered to represent unique habitat associations (Table III-1).

Riparian and wetland areas are highly productive in terms of herbage produced and used by wildlife as compared to surrounding areas. Experience has shown that as much as 70 percent of a local wildlife population are dependent upon riparian zones. Cliffs and tallus are of special importance to many high interest wildlife. These unique habitat types must be identified in the permit application and protected due to their high value for all wildlife.

Quantitative (acreage) and qualitative (condition, successional stage and trend) data concerning the wildlife habitats in each ecological association should be included as part of the mine permit application. It is important to note that each legal section of land represented by

the mine plan and adjacent areas has been ranked as to its value for the total wildlife resource. Sections 1, 2, 11, 12, 13, 14, 23 and 24 of Township 16 South, Range 7 East have been ranked as being of critical value to wildlife. This is also true for Sections 35 and 36 of Township 15 South, Range 7 East; Sections 4, 7, 9, 17, 18, 19, 20 and 21, Township 16 South, Range 8 East; and Sections 9, 15, 20, 21, 22, 26, 27, 28, 29, 30, 32 and 33 Township 15 South, Range 8 East. Sections 11, 12, 13, 23, 24, 25 and 26 of Township 15 South Range 7 East have been ranked as being of high-priority value to wildlife. This is also true for Sections 2, 3, 5, 6, 8, 10, 11, 14, 15, 16, 22 and 23 of Township 16 South, Range 8; and Sections 7, 8, 10, 11, 14, 16, 17, 19, 23, 26, 30, 31, 32, 33, 34 and 35 of Township 15 South, Range 8 East. These rankings were developed through an analysis of cumulative values for use areas of individual wildlife species inhabiting each legal section of land. (Table III-2).

Amphibians--Species Occurrence and Use Areas

Six species of amphibians, all of which are protected, are known to inhabit the biogeographical area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area (refer to the Division Publication No. 78-16). Only one specie of the amphibians inhabiting the project area has been determined to be of high interest to the State of Utah.

The tiger salamander is a yearlong resident animal of the project area. The substantial value use area for the adult form is represented by any moist underground site or any similar habitat such as inside rotten logs, cellars or animal burrows. Such sites can be found within any wildlife habitat extending from the cold desert (upper Sonoran life zone) through the submontane (Transition life zone) and into the montane (Canadian life zone) ecological association. The larva form, often referred to as a mud-puppy, is a gilled animal that must remain in water within the above described ecological associations. It is interesting to note that the larva may fail to transform into an adult, even after their second season, and they can breed in the larva condition.

Once the larva is transformed into the adult form the animal is primarily terrestrial. Salamanders do migrate to water in the spring for breeding and may remain there during much of the summer. Such an intensive use area would be ranked as being of high-priority value to the animal. In September the newly transformed animals leave the water to find suitable places to spend the winter.

The tiger salamander breeds from March through June and is sexually mature after one year. The male deposits a small tent-shaped structure containing a myriad of sperm on the pool bottom. During courtship the female picks up this structure in her cloaca; then the eggs are fertilized internally before or just at the time they are laid. The eggs, singly or in small clusters, adhere to submerged vegetation; after 10 to 12 days they hatch. Obviously, a critical period for maintenance of the population is when breeding salamanders, eggs or their larva are inhabiting a water.

Post-embryonic development of a salamander's larval form progresses at a pace somewhat controlled by water temperature; in some cold waters the larva may not transform into an adult and dry up of a pool may hasten the process.

Migration to or from water usually occurs at night, during or just after a rain storm. When inhabiting terrestrial sites the tiger salamander is most active at night, particularly on rainy nights, from March through September.

Larva, when small feed on aquatic invertebrates and become predacious to the point of cannibalism when they are larger. Food items for adults include insects, earthworms and occasionally small vertebrates.

No amphibians have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

Reptiles--Species Occurrence and Use Areas

Eighteen species of reptiles, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area (refer to the Division Publication No. 78-16). Only two species of the reptiles inhabiting the project area have been determined to be of high interest to the State of Utah.

The Utah milk snake is a yearlong resident animal of the project area. Its substantial value use area encompasses all wildlife habitats extending from the upper Sonoran (cold desert life zone) through the submontane (Transition life zone) and into the montane (Canadian and possibly Hudsonian life zone) ecological associations. Although its use area spans a multitude of habitats, the animal is extremely secretive, mostly nocturnal and is often found inside or under rotten logs, stumps, boards, rocks or within other hiding places. At night they can be found in the open where they hunt for small rodents, lizards and other small snakes. Occasionally, the milk snake may take small birds or bird eggs.

The milk snake may live beyond twenty years and it becomes sexually mature during its third spring season. After mating, which occurs during spring or early summer when they are leaving the den, female milk snakes produce clutches which average seven eggs. The eggs are secreted in a moist warm environ and then abandoned; incubation lasts 65 to 85 days. The site where an individual snake has deposited its clutch of eggs is of critical value to maintenance of the species.

The Utah mountain kingsnake is a yearlong resident animal of the project area. Its substantial value area encompasses all wildlife habitats extending from the submontane (Transition life zone) into the montane (Canadian and possibly Hudsonian life zones) ecological association. Little is known concerning this animal except that it frequents areas of dense vegetation and that it is often found near water. Its life history and food habits parallel that described for the Utah milk snake.

To date snake dens, which are protected and of critical value to snake populations, have not been identified on or adjacent to the project area. It is important to note that inventory for such has not been attempted. If the Company at some later time discovers a den it should be reported to the Utah Division of Wildlife Resources. If a den(s) is currently known, its location must be included with the permit application.

No reptiles have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

Birds--Species Occurrence and Use Areas

Two hundred forty-two species of birds, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that one hundred thirty-nine of these species inhabit the project area (refer to the Division Publication No. 78-16). Thirty species of the birds inhabiting the project area have been determined to be of high interest to the State of Utah.

Ducks commonly known as waterfowl are not known to inhabit the mine plan area. All of these species are of high interest to the State of Utah. Generally speaking, the riparian and wetland habitats encompassed by the project and adjacent areas would represent substantial valued habitats for waterfowl if any were to ever use the area. Each species has different life requirements and makes various uses of the riparian and wetland environs associated with the project.

For those waterfowl that nest locally, the period of March 15 through July 15 is ranked as being of crucial value to maintenance of the population. Following incubation, which dependent upon the species may vary between 20 and 28 days and extend up until mid-August, the riparian and wetland habitats represent a high-priority brooding area. Additionally, the wetland habitat (large open water areas or dense marshland) is of high-priority for seclusion and protection of adult waterfowl during their flightless period when they moult. Males may begin the moult in early June and both sexes and the young are capable of flight by mid-August.

All wetlands and open water areas can become locally important as high-priority use areas for waterfowl during peak migration periods in the spring (March 15 through May 15) and fall (August 15 through October 15).

The project and adjacent areas provide substantial valued habitat for a multitude of raptors --turkey vulture, bald and golden eagles, four species of falcons (prairie, American peregrine and arctic peregrine falcons; and American kestrel), five species of hawks (goshawk, sharp-shinned, Cooper's, red-tailed and Swainson's, hawks), and seven species of owls (barn, screech, flammulated, great horned, pygmy, long-eared and saw-whet owls). Many of these species are of high

federal interest pursuant to 43 CFR, 3461.1 (n-1). All of these species are of high interest to the State of Utah.

Realistically, nesting habitat does not exist on the project or adjacent areas for most, if not all, of these species. However, if a species were to nest on or adjacent to the project area, it would have a specific crucial period during which the aerie would need protection from disturbance; this period of time lies between February 1 and August 15. Generally speaking, aeries represent a critical valued site and need protection from significant or continual disturbance within a one-half kilometer radius of the nest. This consideration need only be implemented during the period of time that the nest is occupied. Species specific protective stipulations for aeries are available from the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

The current level of data relative to site specific use of the area by raptors is unsatisfactory. Likely, there are aeries that have not been identified. Many of these species are highly sensitive to man's disturbances. Therefore, it is recommended that intensive surveys be initiated proximal (one-half kilometer radius) to areas planned for surface disturbance on the mine plan and adjacent areas. This will allow for determination of locations for raptor aerie territories. Such data needs to be merged with information provided within this report.

Golden eagles are a common yearlong resident of the mine plan area. To date known active aerie territories, if any, on the project area are not known. (Note, an aerie territory is utilized by one pair of eagles but may contain several nest sites).

It is likely that an aerie territory(s) may exist on the project area. This belief is based upon the fact that suitable nesting habitat is widespread on the mine plan area and throughout the local area. It is important to note that the regularity of golden eagle observations and the fact that their status is common has resulted in documentation of mostly opportunistic observations of aerie territories.

An active golden eagle nest site is extremely sensitive to disturbance within a one-half kilometer radius. This buffer zone is ranked as being of critical value to maintenance of the eagle population when the bird is actually utilizing the aerie; that period of time is normally between April 15 and June 15. The radius for a buffer zone may need to be increased to one kilometer if a disturbance were to originate from above and within direct line of sight to the eagle aerie.

To date there are no known high-priority concentration areas or critical roost trees for golden eagles on the project area. The mine plan and adjacent areas have been ranked as being of substantial value to golden eagles.

The northern bald eagle is an endangered winter resident (November 15 to March 15) of the local area. A high-priority concentration area for

this species lies immediately east of the project area, but no critical roost trees are known. The mine plan area has been ranked as being of substantial value to wintering bald eagles. Note that no bald eagles are known to nest in Utah, however, historic data documents nesting activity by these birds in the State. There is no known historic evidence of the northern bald eagle nesting on the mine plan or adjacent areas.

The American peregrine falcon (status is endangered) and the prairie falcon (status is common) are yearlong residents of the mine plan and adjacent areas. Each of these species utilizes cliff nesting sites. To date there are no known aerie sites for cliff nesting falcons on the project area. However, suitable nesting habitat for the prairie falcon is widespread on the project area. Suitable nesting habitat for the American peregrine falcon cannot be found on the mine plan and adjacent areas. The project area has been ranked as being of substantial value to these two nesting falcons.

For any cliff nesting falcon their aerie site while being utilized and a one-half kilometer radius would be ranked as being of critical value to maintenance of their populations. The falcon's period of use at the aerie site spans the spring and early summer period --prairie falcon, April 15 to June 30; peregrine falcon, March 1 to June 30.

The level of data relative to site specific use of the project area by cliff nesting falcons (not including the kestrel) is unsatisfactory and there could be aeries that have not been identified. Therefore, it is recommended that intensive survey be initiated on the area for determination of locations for cliff falcon aerie sites.

The endangered arctic peregrine falcon is a winter resident (November 15 through March 15) of the local area. This species has not been observed to utilize the environs on or adjacent to the mine plan area, however, its occasional presence would not be unlikely. Therefore, the project area is ranked as being of limited value to this species.

The blue grouse is a yearlong resident of the project area. Adult birds prefer open stands of conifers. During winter the blue grouse feeds exclusively upon needles and buds of douglas-fir and spruce trees. Thus, this wildlife habitat (spruce-fir forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February.

Blue grouse annually exhibit what has been termed a reverse vertical migration. That is, during the spring months, they migrate from the high elevation spruce-fir habitat to lower elevation sagebrush, pinion-juniper or shrubland habitats. This movement is caused by a need of the birds to feed on early developing vegetation. Such movement also facilitates successful breeding, nesting and brooding of their young. Then as the year progresses, they move to the higher elevations.

The males are polygamous and will set up and defend territories for booming and breeding activities against other breeding males. Such territories are critical to maintenance of the population during the crucial period of mid-March through mid-June.

After breeding the female develops a nest site which is secreted on the ground; the nest is of critical value to maintenance of the blue grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young blue grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to blue grouse. The crucial period extends from hatching into mid-August. As summer progresses into the fall season the grouse consumes large quantities of berries.

The ruffed grouse is a yearlong resident of the project area. These grouse are usually found in the continuum of habitats extending from aspen to shrubland types. But, during winter they often roost in dense stands of conifers. Generally speaking ruffed grouse prefer habitats lying within 0.25 mile of a stream course; such areas are ranked as being of high-priority value to their population. During winter the ruffed grouse feeds exclusively upon staminate aspen buds. Thus, this wildlife habitat (aspen forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February. During the remainder of the year their diet shifts to include a wide variety of plant and insect material. Ruffed grouse do not exhibit any type of seasonal migration.

The males are polygamous and will set up and defend territories against other breeding males. The focal point for breeding activity is the drumming log; all such logs are ranked as being of critical value to grouse since they represent sites of historical use. Such territories are critical to maintenance of the population during the crucial period of early March through May.

After breeding the female develops a nest site which is secreted on the ground and deep within an aspen grove; the nest is of critical value to maintenance of the ruffed grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young ruffed grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to ruffed grouse. The crucial period for brooding extends from hatching into mid-August.

Chukar, an introduced species, were at one time residents of the cliff and tallus habitat along the east side of the Wasatch Plateau. Currently, there is no evidence of this species on the project area.

The band-tailed pigeon is a summer resident of the project area. This bird is seldom observed to utilize the Wasatch Plateau, but when observed the species is only represented by a single bird, pairs or even less frequently a small flock. Since the band-tailed pigeon's use of the Wasatch Plateau is best described as "occasional", the environs associated with the project are only ranked as being of limited value to the bird. Nesting birds select their nest in trees within the spruce-fir wildlife habitat. Peak on-nest activity occurs in late July and early August.

Mourning doves normally inhabit the project and adjacent areas, which represents a substantial valued use area for these birds, between May 1 and September 15 each year. They nest throughout most of this period and each pair produces two clutches. The pinion-juniper and riparian habitats are ranked as being of high-priority value for nesting. Locally, mourning doves show two peaks in on-nest activity--early July and early August. Successful nesting activities and any water sources are critical to maintenance of the mourning dove population.

The yellow-billed cuckoo is a summer resident of the project area. This bird only nests in the riparian wildlife habitat, therefore, such areas are of critical value to maintenance of this species. Little is known concerning the yellow-billed cuckoo. Its nest is represented by a frail, saucer shaped structure of twigs and is always placed in a bush or tree.

The black swift is a summer resident of the Wasatch Plateau. The montane ecological association represents the swift's substantial valued use area. Normally, the bird is associated with a small flock that represents a colony. Black swifts are usually observed soaring as pairs and they feed upon flying insects. A colony's nests are scattered along precipitous terrain where the nest is often secreted behind a waterfall. Such a moist habitat is not known to exist on the project area. Cliff and talus wildlife habitats are ranked as being of high-priority value to the black swift. There is evidence that pair bonds are long lasting and that a nest may be utilized in successive years.

The pileated woodpecker is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). The spruce-fir and aspen wildlife habitats of the montane ecological association represent this birds substantial valued use area. It is important to note that the pileated woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a yearlong resident with a relative abundance considered to be rare.

The Williamson's sapsucker is another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Typically, the substantial valued use area for this species is the spruce-fir habitat of the Hudsonian life zone in the montane ecological association. Therefore, the spruce-fir habitat of the Canadian life zone on the project site would only represent the substantial valued use area for the

yellow-bellied sapsucker. The yellow-bellied sapsucker is a year long resident of the environs associated with the project area and it has a relative abundance considered to be common. Where as the Williamson's sapsucker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the Williamson's sapsucker is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The Lewis woodpecker is also another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is represented by riparian habitats characterized by cottonwood stands and ponderosa forests. These habitats do not exist on the project site. It is important to note that the Lewis woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a summer resident or only a transient. Its relative abundance is unknown.

The purple martin is a summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. In Utah its substantial valued use area is represented by open spruce-fir, aspen or ponderosa forest habitats of the montane ecological association. The purple martin feeds on flying insects and may secret its nest within any suitable above-ground cavity.

The western bluebird is an uncommon summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. In contrast the mountain bluebird is a common yearlong resident of the area. Both birds are cavity nesting species. The western bluebird nests from the pinion-juniper habitat of the submontane ecological association up into the lower forest habitats within the Canadian life zone of the montane ecological association. The mountain bluebird utilizes the same continuum of habitats for nesting, but also extends its nesting use across the Canadian and Hudsonian life zones and into the Alpine life zone. During winter both species show elevational and longitudinal migrations; they then utilize all habitats associated with the cold desert ecological association. Therefore, the substantial valued use area for each species spans a broad continuum of habitats. It is important to note that trees with cavities located on the project area can be of critical value to bluebirds.

Grace's warbler is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is shrublands and associated ponderosa forest habitats of the submontane and montane ecological associations. This bird's nest is built twenty or more feet above ground in a ponderosa tree. It is important to note that the Grace's warbler has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

Scott's oriole is also a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use areas are riparian

habitats characterized by cottonwood stands and the continuum of habitats extending from the pinion-juniper forest into shrublands of the submontane ecological association. The oriole's nest is characterized as a grassy pouch and is hung in a tree. It is important to note that the Scott's oriole has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The grasshopper sparrow is a rare transient species known to inhabit the environs of the biogeographic area that surrounds the project site. It only frequents dry grassland areas in the desert scrub habitat of the cold desert ecological association during spring and fall migration periods. The project area may border areas with this character of habitat. Since its use of such sites is best described as "occasional", those habitats in the region are only ranked as being of limited value to the bird.

Mammal--Species Occurrence and Use Areas

Eighty-four species of mammals, of which 24 percent are protected, are known to inhabit the biogeographic area in which the project and adjacent areas are located. It is probable that seventy-one of these species inhabit the project area (refer to the Division Publication No. 78-16). Twenty-five species of the mammals inhabiting the project area have been determined to be of high interest to the State of Utah.

The red bat is a summer resident of the biogeographic area that surrounds the project site. The animal roosts in wooded areas (riparian woods and pinion-juniper forests) of the submontane ecological association. Such areas represent this animals substantial valued use area. An occasional individual has been known to utilize caves; those individuals could hibernate and remain over winter.

The western big-eared bat is a yearlong resident of the biogeographic area that surrounds the project site. This animal roosts and hibernates within caves, mine tunnels or suitable buildings located in the pinion-juniper, shrubland and low elevation spruce-fir habitats of the submontane and montane (Canadian life zone) ecological association. Such areas represent this bats substantial valued use area.

The snowshoe hare is a yearlong resident of the biogeographic area that surrounds the project site. Its relative abundance has been determined to be limited, since its substantial valued use area is restricted to the spruce-fir and nearby aspen and riparian habitats of the montane (Canadian and Hudsonian life zones) ecological association. Such areas are ranked as being of high-priority value to the animal during its breeding season which spans the period between early April and mid-August.

The cottontail rabbit (mountain cottontail inhabits sites lying between 7,000 and 9,000 feet in elevation and the desert cottontail inhabits

sites lower than 7,000 feet in elevation) is a yearlong resident of the biogeographic area that surrounds the project site. The entire project area represents a substantial valued use area for cottontails. Their young are born between April and July. This is a crucial period for maintenance of the cottontail population.

The northern flying squirrel is a yearlong resident of the biogeographic area that surrounds the project site. Currently, its relative abundance is unknown. Its substantial valued use area is restricted to spruce-fir or other mixed conifer habitats of the montane (Canadian and Hudsonian life zones) ecological association. This specie is the only nocturnal squirrel in Utah. The flying squirrel may build its nest within an old woodpecker hole or it may build an outside nest of leaves, twigs and bark. Mating occurs twice in each year--February through March and June through July. Afterwhich, two to six young are born after a gestation period of 40 days --April through May and August through September. These periods are of crucial value to maintenance of their populations. During winter flying squirrels are gregarious; 20 or more have been known to den together.

Beaver are yearlong inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is restricted to riparian and adjacent aspen habitats (those located within 100 meters of the riparian zone) in the cold desert, submontane and montane (Canadian life zone) ecological associations. These animals construct a conical shaped lodge in which a family group lives throughout the year. The lodge is of critical value to maintenance of the beaver population. One litter of kits is produced every year; they are born between late April and Early July after a gestation period of 128 days. Kits and yearlings coinhibit the lodge with the adult pair. When they attain two years of age they are forced to leave; females can breed at 2.5 years of age. Due to the animals dependency upon flowing water and the associated riparian vegetation, the riparian wildlife habitat is ranked as being of critical value to beaver populations.

The red fox is a yearlong inhabitant of the biogeographic area that surrounds the project site. The substantial valued use area for the red fox would include all wildlife habitats extending from the cold desert through the montane (Canadian life zone) ecological associations. Almost nothing is known of their population dynamics. Without doubt a crucial period for this species is when they are caring for young in the den. Dens while being inhabited are a critical use area.

The gray wolf is a historic inhabitant of the biogeographic area that surrounds the project site. Currently its relative abundance is so low that the animal is listed as endangered with extinction. The wolf's substantial valued use area would be represented by any remote habitat in any ecological association.

Black bears are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is represented by all natural wildlife habitats (excluding the pasture and fields and

urban or park types) extending from the submontane into the montane (Canadian and Hudsonian life zones) ecological associations. These animals go into a semi-hibernation during winter. During this crucial period, which may last from December through March, the animal secrets itself in a den in order to conserve body energy reserves. The young are born in the den during January or February. Dens while being inhabited represent a critical valued use area for bears.

Many of the members of the family mustelidae are known to inhabit the biogeographic area that surrounds the project site. They are all protected and classified as furbearers --short-tailed and long-tailed weasles, mink, wolverine, marten, badger, striped and spotted skunks. All of these species are of high interest due to their value in the fur market.

The substantial valued use area for short-tailed and long-tailed weasles and mink is the riparian habitat. Weasles, which are inhabitants of the project site, do make some use of other habitats that are proximal to riparian zones. The long-tailed weasle can be found from the cold desert up into the montane (Canadian and Hudsonian life zones) ecological associations. The short-tailed weasle and mink populations extend their use from the submontane into the montane ecological association. It is important to note that the weasle is restricted to the Canadian life zone; where as the mink may utilize the Canadian and Hudsonian life zones.

The substantial valued area for marten and wolverine is the montane ecological association. The marten does not utilize the Alpine life zone but the wolverine can be found at that elevation. Both species could be found in the environs of the project site.

The substantial valued use area for badger and skunks span all wildlife habitats other than dense forests in the cold desert, submontane and montane (Canadian life zone) ecological associations. Skunks show some affinity for habitats proximal to water. Skunks and badgers are dependent upon a suitable prey source.

A crucial period for maintenance of all furbearer populations is when they have young in a nest, den or lodge. Such sites are critical for reproductive success.

Bobcat, Canada lynx and cougar are known to inhabit the biogeographic area that surrounds the project site. For all of these species a crucial period for maintenance of their population is when the female has her young secreted at a den site. Such sites are of critical value when being utilized. It is also crucial to their survival that a female accompanied by young not be killed or harassed.

The substantial valued use area for bobcats extends from the cold desert through the submontane and into the montane (Canadian life zone) ecological association. The bobcat is normally associated with precipitous terrain, but has been observed in every wildlife habitat within the aforementioned ecological associations. Their primary prey

source is represented by small mammals and birds or any other small animal they can catch. It is important to note that bobcats occasionally do kill the young of big game animals.

The substantial valued use area for the Canada lynx is restricted to the Canadian and Hudsonian life zones of the montane ecological association. Normally, this cat would only be expected to utilize riparian and forested wildlife habitats. The lynx is similar in predation habits to the bobcat.

The substantial valued use area for the cougar (locally known as mountain lion) extends from the submontane into the montane (Canadian and Hudsonian life zone) ecological association. Due to the dependency of the cougar upon mule deer as a prey source, a ranking of the lion's seasonal distribution parallels that of the deer.

Mule deer are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the cold desert through the submontane and montane ecological association. In some situations deer show altitudinal migrations in response to winter conditions. There are, however, habitats where deer reside on a yearlong basis.

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

A portion of the project site represents winter range for mule deer herd Units 33 and 34. Winter ranges for mule deer are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions the higher elevation portion of the winter range becomes unavailable to deer due to snow depth. Traditionally, some restricted portions of the winter range have shown concentrated use by the deer; these sites are ranked as being of critical value. Critical valued sites must be protected from man's disturbance when the deer are physically present on the range.

Deer begin their migration back to summer range during mid-May and remain there throughout October. Summer ranges on the project area also represent deer herd Units 33 and 34. They are ranked as being of high-priority value to mule deer.

Mule deer fawn during the month of June. The continuum of wildlife habitats extending from the pinion-juniper through the shrubland and into the aspen type probably represents the fawning area. All riparian areas are of critical value for fawning and maintenance of the deer population. To date no specific areas showing annual use for fawning are known. It is probable that such areas exist; they would be ranked as being of critical value to deer. It is important to note that June represents a crucial period for maintenance of deer populations.

Moose are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats in the montane ecological association except those associated with the Alpine life zone. In some situations moose show altitudinal migrations in response to winter conditions. There are, however, habitats where moose reside on a yearlong basis.

Migration of moose from summer use areas to winter use areas is initiated during late November; probably, changing weather conditions are the initial stimulus. The onset of winter weather reinforces the moose's urge to migrate and continued adverse weather keeps the animal on the winter range.

The project site represents yearlong range for the Southeastern Utah moose herd --Scofield drainage. Winter ranges for moose are not mapable but would be characterized as riparian habitats; such sites would be ranked as being of critical value. Habitats adjacent to riparian areas may also serve as winter range and would be ranked as being of high-priority value to moose. Winter ranges are usually inhabited by moose between December 1 and May 15 each year. During winters with severe conditions the higher elevation portion of the winter range becomes unavailable to moose due to snow depth. Critical valued sites must be protected from man's disturbance when the moose are physically present on the range.

Moose begin their migration back to summer range during mid-May and remain there throughout November. Summer ranges on the project area support animals from the Scofield drainage of the Southeastern Utah moose herd. Summer ranges are ranked as being of high-priority value.

Ranges that support moose on a yearlong basis are ranked as being of critical value.

Moose calf during late May and June. Calving takes place in the riparian or adjacent forest habitats. Without doubt, all riparian areas are of critical value for calving and maintenance of the moose population. To date no specific areas showing annual use for calving are known; they would be ranked as being of critical value to moose. It is important to note that June represents a crucial period for maintenance of moose populations.

Rocky mountain elk are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the submontane through the montane ecological association. Elk do not show as strong of altitudinal migration as mule deer do in response to winter conditions, but they do migrate to wintering areas.

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

A portion of the project site represents winter range for the Manti elk herd --Unit 12. Winter ranges for elk are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions some portions of the winter range becomes unavailable to elk due to snow depth. Traditionally, some restricted portions of the winter range have shown concentrated use by the elk; these sites are ranked as being of critical value. Critical valued sites must be protected from man's disturbance when the elk are physically present on the range.

Elk begin their migration back to summer range during mid-May and remain there throughout October. Summer ranges on the project area support the Manti elk herd --Unit 12; they are ranked as being of high-priority value.

Elk calf during the month of June. Their preferred calving areas are best described as aspen forests with lush understory vegetation. All riparian areas on the summer range are of critical value for calving and maintenance of the elk population. To date no specific areas showing annual use for calving are known. It is probable that such areas exist; they would be ranked as being of critical value to elk. It is important to note that June represents a crucial period for maintenance of elk populations.

Currently, there are no other known high interest wildlife species or their habitat use areas on or adjacent to the project area. It is not unreasonable to suspect that in the future, some additional species of wildlife may become of high interest to the local area, Utah or the Nation. If such is the case, the required periodic updates of project permits and reclamation plans can be adjusted and appropriate recommendations made.

TABLE III-1

Ranking of value per ecological association for wildlife habitats of vertebrate species having high interest to the state of Utah. Crucial-critical (C) habitats are the highest valued followed in respective order by high-priority (H), substantial value (S) and limited valued (L) habitats.

Ecological Association	Wildlife Habitats									
	Riparian and Wetland	Desert Scrub	Pasture and Fields	Urban or Parks	Cliffs and Tallus	Sagebrush P-J Forest	Shrubland	Aspen Forest	Ponderosa Forest	Parkland

20

Warm Desert	LOWER SONORAN LIFE ZONE This ecological association does not exist in the Southeastern Region										
Cold Desert C(H ¹ , S ²)	S	S	S	S	H						
Submontane C(H ¹ , S ²)	S	S	S	H	S	S	S				
Montane C(H ¹ L ²)	S	L	S				S	S	S	S	
Montane H(S ¹ , L ²)					S						S
Montane	ALPINE LIFE ZONE This ecological association does not exist in the Southeastern Region										

- Habitat ranking value for species associated with the riparian-wetland type that represents just the wet meadow situation.
- Habitat ranking value for species associated with the riparian-wetland type that represents just the dirt bank situation.

TABLE III-2

Ranking Of Wildlife Value Per Legal Section Of Land
On Coal Lands Near U.S. Fuel Co. Permit Area

<u>T.</u>	<u>R.</u>	<u>Section</u>	<u>Rank</u>
14S	6E	28-33	1
		1-27-34-36	2
14S	7E	1,4-6,9,12,13,16	1
		2,3,7,8,10,11,14,15,17-36	2
15S	6E	4-6,10-15,22-24	1
		1-3,7-9,16-21,25-36	2
15S	7E	32-36	1
		1-31	2
15S	8E	9,15,20-22,27-29,32,33	1
		1-8,10-14,16-19,23-26,30,31,34-36	2
16S	6E	11,13,14,16,20-26,28,29,31-33,35,36	1
		1-10,12,15,17-19,27,30,34	2
16S	7E	1,5,9-16,21-28,34-36	1
		6-8,17-20,29-33	2
16S	8E	4,7,9,17-21,28-31	1
		1-3,5,6,8,10-16,22-27,32-36	2
17S	6E	4-9,11-14,16-22,24-35	1
		1-3,10,15,23,36	2
17S	7E	1,2,7,12,18,19,25,30	1
		3-6,8-11,13-17,20-24,26-29,31-36	2
17S	8E	5,6,16,19	1
		4,7-9,17,18,20,21,28-33	2
18S	6E	1-3,10,11,13-15,22-27,34-36	1
		12	2
18S	7E	4,5,7-11,13-17,19-27,29-32,34-36	1
		1-3,6,12,18,28,33	2
19S	6E	1-3,10-15,22-27,34-36	1
19S	7E	1-3,5,23,27-34	1
		4,24-26,35,36	2

Crucial-critical (1), sections are the highest valued followed in respective order by high-priority (2), substantial value (3) and limited valued (4) sections.

ATTACHMENT III-1

Hiawatha Mine Complex
ACT/007/001
U.S. Fuel Company

Guidelines for Fish and Wildlife and Habitat
Information Pursuant to UMC 783.20

Aquatic Studies

1. Fish Study D.W.R. MAKES STATEMENT THAT NO FISH SPECIES
 ARE KNOWN TO EXIST IN PLAN AREA

Area: Mine plan area.

Time: N/A.

Purpose: Identify from existing data the potential occurrence, relative abundance, status, population trend and preferred habitat of any fish which inhabit the mine plan area.

Terrestrial Studies D.W.R. RECOMMENDS SURVEYS FOR NEW AREAS ONLY

1. Raptor Survey

Area: Areas to be disturbed plus a zone of 1 km. radius surrounding the sites.

Time: February through June.

Purpose: Assess occurrence and location of any raptor breeding sites and map these areas. Determine raptor use of the areas to be disturbed. DONE

2. Migratory Birds of High Federal Interest Survey

Area: Any new areas of disturbance plus a zone of 1 km. radius surrounding the sites.

DONE

Time: March through July.

Purpose: Determine the relative use by these species of the area to be disturbed. Such studies are on-going or have been complete and data is available from Utah's Division of Wildlife Resources, Southeastern Regional Office.

3. Upland Game Birds Survey

Area: Mine plan area. DONE

Time: N/A.

Purpose: Determine the presence and degree of use by these birds on any areas of new disturbance. The Utah Division of Wildlife Resources office in Price has noted that it has site-specific information to provide to the applicant.

Fish & Wildlife Guidelines

ACT/007/001

Page Two

4. Federally Listed Threatened or Endangered Species Survey

Area: Mine plan area. CONTACT JOHN GILL, U.S. FISH & WILDLIFE,
SALT LAKE CITY, FOR DETERMINATION

Time: N/A.

Purpose: To assess the occurrence of the Bald Eagle and the Peregrine Falcon on the mine plan area. Provide a positive or negative determination as to the occurrence of these species. Some information from the Utah Division of Wildlife Resources office in Price should be available for these species.

5. Big Game Study

Area: Canyons with proposed conveyor systems.

Time: The studies should be conducted during times of Mule Deer migration, October-November, and April-May. The study should be developed in three stages; 1. Collect all existing information from the Utah Division of Wildlife Resources and the U.S. Forest Service or the Mule Deer Herd Unit(s) in the mine plan area. Submit this as background information in the permanent program permit application to the Division with the commitment to carryout the following two provisions. 2. Upon review of the existing data base, the Division will determine the necessity and extent of studies to be conducted in relation to each proposed conveyor in each canyon. 3. Based upon the first-year results of any required big game migration studies in relation to conveyor belts, the Division will determine the necessity of further study.

Purpose: The purpose of the three-phase study is; 1. to determine the use and importance of the resource to Mule Deer which inhabit the area, 2. to determine the possibility of impact to migration of Mule Deer; and 3. to gather information pertinent to the design of a conveyor. (For regulations pertaining to this requirement, see UMC 817.97).

6. Survey of All Other Vertebrates--Amphibians, Reptiles, Birds and Mammals

INCLUDED IN PUBLICATION 78-16

Area: Mine plan area.

Time: N/A.

Purpose: Provide data on presence, status, relative abundance, population trend and preferred habitat type for all species inhabiting the mine plan area. Present habitat preference information to correlate with data collection from habitat (vegetation) studies. A great deal of data has been collected by the Utah Division of Wildlife Resources office. Access to their files should be requested formally of Mr. Larry Wilson, of the Southeastern Region, Price, Utah.

Fish & Wildlife Guidelines
ACT/007/001
Page Three

7. Habitat Survey

Area: Mine Plan Area.

Time: Year-round.

Purpose: To assess the condition, trend and types of habitat within the mine plan area. In the course of other field studies, areas of special use for wildlife, such as heavily used riparian areas, large mammals dens and snake dens, should be noted and mapped. Aquatic areas which occur within the mine permit area such as seeps, springs, streams, ponds and reservoirs should be noted and mapped and their importance to wildlife discussed in the mine permit.

R614-301-323 MAPS AND AERIAL PHOTOGRAPHS

- 323.100 The location of reference areas for determining the success of revegetation can be found on the following maps:
- Exhibit III- 4
 - Exhibit III- 5
 - Exhibit III- 6
- 323.200 Not applicable
- 323.300 Not applicable
- 323.400 Vegetation for areas of the mine plan site have been mapped and placed in the permit. Vegetation maps are as follows:
- Exhibit III- 4
 - Exhibit III- 5
 - Exhibit III- 6
 - Exhibit III- 7

R614-301-330 OPERATION PLAN**R614-301-331 INTERIM RECLAMATION PLAN**

Interim revegetation has been used at several locations in the permit area to stabilize areas until final reclamation or to permanently reclaim sites no longer utilized. An effort is made to consolidate all disturbed area operations at protected locations and to reclaim those areas no longer needed for present operations.

Interim reclamation may be performed on sites where temporary construction activities had created disturbance, or on such structures and locations as: topsoil stockpiles, slopes of sediment ponds, road embankments and conveyorlines to minimize surface erosion. Seed mixes and reclamation techniques will be similar to those outlined for final reclamation. Interim reclamation will focus on minimizing soil erosion and stabilizing slopes. The best species for the application will be utilized. No tree species will be planted due to the temporary nature of the interim revegetation.

After the construction of the King VI conveyorline, truck loadout facility and sediment pond, U.S. Fuel performed interim revegetation at this site in South Fork canyon. The revegetation program was performed to establish a permanent and effective vegetation cover to reduce erosion and stabilize slopes. The program was completed in October of 1982. Included in Appendix III-4 is the Interim Revegetation Plan as it was approved and carried out. The interim reclamation sites at the King IV loadout are shown on Exhibit III-5.

In August of 1983, several of the interim revegetation study areas that were previously seeded were examined. Estimates of plant cover by

species were made, as well as estimates of non-living cover (rock, soil, litter). The results of these studies along with photographs are given in Appendix III-4.

These results show living cover values ranging from 18 percent to 60 percent, which demonstrates the ability of the test plot areas to support revegetation. The seed mixes used, however, included several non-native and annual species. These mixes are now to be abandoned and the new seed mixes described in Tables III-4 through III-7 are to be used for future studies and eventual reclamation work. The new mixes emphasize native plants, enhanced diversity, balanced growth forms (shrubs, grasses, forbs, and in two mixes, trees), enhanced forage value, and preselected relative abundances based on seed size and desired plant densities.

TABLE III-3

Trial seed mixture No. 1: For use on slurry impoundment and on sagebrush-dominated soil borrow area

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended shrub density ^e (plants/acre)
				(seeds/ft ²) pure live seed	(lb/acre)	
<u>SHRUBS</u>						
<u>Artemisia tridentata</u> var. <u>tridentata</u>	Big sagebrush	NS	2,500,000	11	0.2	500
<u>Atriplex canescens</u>	Fourwing saltbush	NS	55,000	8	6	300
<u>Chrysothamnus nauseosus</u> var. <u>albicaulis</u>	Whitestem rubber rabbitbrush	NS	400,000	9	1	400
<u>Eurotia (Ceratooides)</u> <u>lanata</u>	Winterfat, white sage	NHS	70,000	10	6	450
				38	13.2	1700
<u>GRASSES</u>						
<u>Agropyron smithii</u>	Western wheatgrass	NPG	125,000	14	5	—
<u>Agropyron trachycaulum</u>	Slender wheatgrass	NPG	160,000	15	4	—
<u>Elymus cinereus</u>	Giant wildrye	NPG	100,000	11	5	—
<u>Oryzopsis hymenoides</u>	Indian ricegrass	NPG	188,000	13	3	—
<u>Sporobolus cryptandrus</u>	Sand dropseed	NPG	5,100,000	12	0.1	—
				65	17.1	
<u>FORBS</u>						
<u>Aster chilensis</u>	Pacific aster	NPF	2,670,000	12	0.2	—
<u>Cleome serrulata</u>	Rocky Mountain beeplant	NAF	50,000*	6	5	—
<u>Melilotus officinalis</u>	Yellow sweetclover	IBF	260,000	12	2	—

TABLE III-3

Trial seed mixture No. 1: For use on slurry impoundment and on sagebrush-dominated soil borrow area (continued)

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended shrub density ^e (plants/acre)
				(seeds/ft ²) pure	(lb/acre) live seed	
<u>Penstemon palmeri</u>	Palmer's penstemon	NPF	610,000	14	1	—
<u>Stanleya pinnata</u>	Desert prince's plume	NHSF	80,000*	9	5	—
				53	13.2	
					43.5	

^aIncluded species selected in consultation with Lynn M. Kunzler, Reclamation Biologist, Division of Oil, Gas and Mining, State of Utah, 10/26/83.

^bHabit codes: A = Annual, B = Biennial, F = Forb, G = Grass, GL = Grasslike (sedges and rushes), HS = Half-shrub (woody at base only), I = Introduced or adventive, N = Native, P = Perennial, S = Shrub, T = Tree.

^cSource: Personal communication, Lynn M. Kunzler, 10/28/83, from published references. Starred entries (*) are estimates.

^dRationale provided by Lynn M. Kunzler. First column (seeds/ft²) explained below: Remaining columns are calculated from seed weights and sowing rate (1 acre = 43,560 ft²).

Shrubs: Sow 1,000 x desired reclaimed density due to mortality rate for shrubs.

Grasses and Forbs: Sow a total of 80 to 150 seeds per square foot for combined grasses and shrubs.

^eRounded to nearest 50 or 100. Grass and forb densities are intentionally omitted.

TABLE III- 4

Trial seed mixture No. 2: For use on sagebrush-dominated soil borrow area

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended shrub density ^e (plants/acre)
				(seeds/ft ²) pure live seed	(lb/acre) pure live seed	
<u>SHRUBS</u>						
<u>Amelanchier utahensis</u>	Utah serviceberry	NS	26,000	6	10	250
<u>Artemisia frigida</u>	Fringed sagewort	NHS	4,535,000	10	0.1	450
<u>Ephedra viridis</u>	Green ephedra	NS	25,000	6	10	250
<u>Eurotia (Ceratoides) lanata</u>	Winterfat, white sage	NHS	70,000	8	5	350
<u>Purshia tridentata</u>	Antelope bitterbrush	NS	15,000	2	5	100
				32	30.1	1400
<u>GRASSES</u>						
<u>Agropyron dasystachyum</u>	Thickspike wheatgrass	NPG	160,000	15	4	—
<u>Agropyron spicatum</u>	Slender wheatgrass	NPG	117,000	13	5	—
<u>Elymus cinereus</u>	Giant wildrye	NPG	100,000	11	5	—
<u>Oryzopsis hymenoides</u>	Indian ricegrass	NPG	188,000	13	3	—
<u>Sitanian hystrix</u>	Sand dropseed	NPG	119,000	5	2	—
<u>Stipa comata</u>	Needle-and-thread grass	NPG	115,000	8	3	—
				65	22	
<u>FORBS</u>						
<u>Achillea millefolium</u>	Yarrow	NPF	3,000,000	7	0.1	—
<u>Artemisia ludoviciana</u>	Louisiana sagewort	NPF	4,500,000	10	0.1	—
<u>Astragalus cicer</u>	Cicer milkvetch	IPF	115,000	11	4	—
<u>Hedysarum boreale</u>	Northern sweetvetch	NPF	33,000	4	5	—
<u>Linum lewisii</u>	Lewis flax	NPF	290,000	13	2	—
				45	11.2	
					63.3	

TABLE III-4

Trial seed mixture No. 2: For use on sagebrush-dominated soil borrow area (continued)

^aIncluded species selected in consultation with Lynn M. Kunzler, Reclamation Biologist, Division of Oil, Gas and Mining, State of Utah, 10/26/83.

^bHabit codes: A = Annual, B = Biennial, F = Forb, G = Grass, GL = Grasslike (sedges and rushes), HS = Half-shrub (woody at base only), I = Introduced or adventive, N = Native, P = Perennial, S = Shrub, T = Tree.

^cSource: Personal communication, Lynn M. Kunzler, 10/28/83, from published references. Starred entries (*) are estimates.

^dRationale provided by Lynn M. Kunzler. First column (seeds/ft²) explained below: Remaining columns are calculated from seed weights and sowing rate (1 acre = 43,560 ft²).

Shrubs: Sow 1,000 x desired reclaimed density due to mortality rate for shrubs.

Grasses and Forbs: Sow a total of 80 to 150 seeds per square foot for combined grasses and shrubs.

^eRounded to nearest 50 or 100. Grass and forb densities are intentionally omitted.

TABLE III- 5

Trial seed mixture No. 3: For use on disturbed areas in South and Middle Forks where existing surfaces will be prepared for seeding without addition of more topsoil (continued)

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended tree and shrub density ^e (plants/acre)
				(seeds/ft ²) (pure live seed)	(lb/acre)	
<u>NURSERY-GROWN STOCK (TREES)</u>						
<u>Abies concolor</u>	White fir	NT	—	—	—	150
<u>Acer glabrum</u>	Smooth maple	NT	—	—	—	100
<u>Picea pungens</u>	Blue spruce	NT	—	—	—	150
<u>Pseudotsuga menziesii</u>	Douglas fir	NT	—	—	—	100
						500
<u>SEED-GROWN VEGETATION</u>						
<u>SHRUBS</u>						
<u>Amelanchier utahensis</u>	Utah serviceberry	NS	26,000	6	10	300
<u>Artemisia tridentata</u> var. <u>vaseyana</u>	Mountain big sage	NS	2,500,000	11	0.2	500
<u>Cercocarpus ledifolius</u>	Curlleaf mountain mahogany	NS	52,000	12	10	500
<u>Rhus trilobata</u>	Squawbush, skunkbush sumac	NS	20,000	5	10	200
<u>Sambucus caerulea</u>	Blue elderberry	NS	217,000	5	1	200
<u>Symphoricarpos oreophilus</u>	Snowberry	NS	54,000	5	4	200
				44	35.2	1,900

TABLE III-5

Trial seed mixture No. 3: For use on disturbed areas in South and Middle Forks where existing surfaces will be prepared for seeding without addition of more topsoil (continued)

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended tree and shrub density ^e (plants/acre)
				(seeds/ft ²)	(lb/acre)	
<u>SEED-GROWN VEGETATION (continued)</u>						
<u>GRASSES</u>						
<u>Agropyron spicatum</u>	Bluebunch wheatgrass	NPG	117,000	11	4	—
<u>Bromus carinatus</u> or <u>B. marginatus</u>	Mountain brome	NPG	80,000	9	5	—
<u>Dactylis glomerata</u>	Orchard grass	IPG	540,000	12	1	—
<u>Elymus cinereus</u>	Giant wildrye	NPG	100,000	11	5	—
<u>Festuca ovina</u> var. <u>duriuscula</u>	Sheep fescue, hard fescue	IPG	560,000	13	1	—
<u>Oryzopsis hymenoides</u>	Indian ricegrass	NPG	188,000	13	3	—
<u>Phleum alpinum</u>	Timothy	NPG	1,300,000	9	0.3	—
				78	19.3	—
<u>FORBS</u>						
<u>Hedysarum boreale</u>	Northern sweetvetch	NPF	33,000	6	7	—
<u>Medicago sativa</u>	Ranger alfalfa	IPF	210,000	16	3	—
<u>Sphaeralcea coccinea</u>	Scarlet globemallow	NPF	500,000*	16	1	—
				38	11	—
					65.5	

TABLE III-5

Trial seed mixture No. 3: For use on disturbed areas in South and Middle Forks where existing surfaces will be prepared for seeding without addition of more topsoil (continued)

^aIncluded species selected in consultation with Lynn M. Kunzler, Reclamation Biologist, Division of Oil, Gas, and Mining, State of Utah, October 26, 1983.

^bHabit codes: A = Annual, B = Biennial, F = Forb, G = Grass, GL = Grasslike (sedges and rushes), HS = Half-shrub (woody at base only), I = Introduced or adventive, N = Native, P = Perennial, S = Shrub, T = Tree.

^cSource: Personal communication, Lynn M. Kunzler, October 28, 1983; from published references. Starred entries (*) are estimates. Remaining columns are calculated from seed weights and sowing rates (1 acre = 43,560 ft²).

^dRationale provided by Lynn M. Kunzler. First column (seeds/ft²) explained below:

Shrubs: Sow 1,000 x desired reclaimed density due to mortality rate for shrubs.

Grasses and forbs: Sow a total of 80 to 150 seeds per square foot for combined grasses and shrubs.

^eRounded to the nearest 50 or 100. Grass and forb densities are intentionally omitted.

TABLE III-6

Trial seed mixture No. 4: For reclamation of disturbed riparian areas in South and Middle Forks where stockpiled topsoil will be used

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended tree and shrub density ^e (plants/acre)
				(seeds/ft ²)	(lb/acre) (pure live seed)	
<u>NURSERY-GROWN STOCK:</u> All woody plants in this habitat will be planted from nursery stock.						
TREES						
<u>Betula occidentalis</u>	Water birch	NT	—	—	—	300
<u>Populus angustifolia</u>	Narrowleaf cottonwood	NT	—	—	—	200
<u>Prunus virginiana</u>	Chokecherry	NT	—	—	—	300
						800
SHRUBS						
<u>Cornus stolonifera</u>	Redosier dogwood	NS	—	—	—	750
<u>Rosa woodsii</u>	Wood's rose	NS	—	—	—	500
<u>Salix exigua</u>	Coyote willow	NS	—	—	—	1,000
						2,250
						3,050
<u>SEED-GROWN VEGETATION</u>						
GRASSES, SEDGES, AND RUSHES						
<u>Agropyron dasystachyum</u>	Thickspike wheatgrass	NPG	160,000	15	4	—
<u>Agropyron smithii</u>	Western wheatgrass	NPG	125,000	11	4	—
<u>Bromus ciliatus</u>	Fringed brome	NPG	90,000	8	4	—
<u>Carex rossii</u> or other C. as available	Ross sedge	NPGL	100,000*	10	4.5	—
<u>Juncus balticus</u>	Baltic rush, wiregrass	NPGL	100,000*	9	4	—
<u>Phleum alpinum</u>	Timothy	NPG	1,300,000	9	0.3	—
<u>Poa pratensis</u>	Kentucky bluegrass	IPG	2,150,000	10	0.2	—
				72	21	

TABLE III-6

Trial seed mixture No. 4: For reclamation of disturbed riparian areas in South and Middle Forks where stockpiled topsoil will be used (continued)

Scientific name ^a	Common name	Habit ^b	Seed count factor (seeds/lb) ^c	Proposed broadcast rate ^d		Intended tree and shrub density ^e (plants/acre)
				(seeds/ft ²) (pure live seed)	(lb/acre)	
<u>SEED-GROWN VEGETATION</u> (continued)						
FORBS						
<u>Aquilegia coerulea</u>	Colorado columbine	NPF	370,000	8	1	—
<u>Balsamorhiza sagittata</u>	Arrowleaf balsamroot	NPF	55,000	3	2	—
<u>Geranium richardsonii</u> or <u>G. fremontii</u>	Richardson's geranium	NPF	52,000	5	4	—
<u>Lupinus sericeus</u>	Silky lupine	NPF	13,000	3	10	—
<u>Vicia americana</u>	American vetch	NPF	41,000	5	5	—
				24	22	
				96	43	

^aIncluded species selected in consultation with Lynn M. Kunzler, Reclamation Biologist, Division of Oil, Gas, and Mining, State of Utah, October 26, 1983.

^bHabit codes: A = Annual, B = Biennial, F = Forb, G = Grass, GL = Grasslike (sedges and rushes), HS = Half-shrub (woody at base only), I = Introduced or Adventive, N = Native, P = Perennial, S = Shrub, T = Tree.

^cSource: Personal communication, Lynn M. Kunzler, October 28, 1983; from published references. Starred entries (*) are estimates. Remaining columns are calculated from seed weights and sowing rates (1 acre = 43,560 ft²).

^dRationale provided by Lynn M. Kunzler. First column (seeds/ft²) explained below:

Shrubs: Sow 1,000 x desired reclaimed density due to mortality rate for shrubs.

Grasses and forbs: Sow a total of 80 to 150 seeds per square foot for combined grasses and shrubs.

^eRounded to the nearest 50 or 100. Grass and forb densities are intentionally omitted.

R614-301-332 ANTICIPATED IMPACTS OF SUBSIDENCE

No subsidence will occur under the present disturbed areas, however, some subsidence may be possible in other locations of the permit area. Underground mining operations at U.S. Fuel Company's properties have been ongoing since the turn of the century. All previous mining was done by room and pillar methods. No significant subsidence effects have been observed to date. Other than access roads, fences and three or four stock watering points, there are no structures existing above past or projected mining areas. The majority of existing roads and ponds occur above areas that have been mined out more than ten years ago. No significant effects on these structures are evident.

Future plans will include room and pillar mining with full or partial extraction. No longwall mining is planned. These methods could possibly have some effect on renewable resource lands. If subsidence occurs, it should occur uniformly over mined out panels. Fractures resulting from subsidence could contribute to changes in existing water patterns. Springs, seeps and stream flows could possibly be affected. Diminution of existing surface and ground water sources could possibly affect some livestock and wildlife watering sites at higher elevations. Water presently being used for municipal, industrial and irrigation purposes should not be diminished to any great extent since water diverted into the ground would most likely return to mine openings, springs and streams near the top of the Star Point sandstone formation. No mining will be done below this horizon which is well above municipal, industrial and irrigation points of use. The affect of mining on the water supply is discussed in greater depth in the chapter dealing with hydrology.

Beginning in 1979 a cooperative agreement to monitor subsidence was signed by U.S. Fuel Company and the U.S. Forest Service. U.S. Fuel maintained ground control survey targets and the Forest Service provided aerial photography. Monitoring was done on a yearly basis. Color and infrared photographs have been secured for past years. The Forest Service has had difficulty establishing subsidence point readings and has recently expressed its intent to discontinue photogrammetric monitoring. U.S. Fuel will, therefore conduct its own subsidence monitoring program as outlined below:

1. Additional ground control survey monuments will be established in the area of existing and proposed future mining areas to provide adequate control for aerial photogrammetric monitoring. These monuments will be established by U.S. Fuel and will be checked and maintained on a yearly basis. Monuments will be located on the same coordinate system as the mine workings so that precise correlations can be made between underground workings and surface topography.
2. Aerial monitoring, including full analytical aero-triangulation and computer digitized point readings to an accuracy of 0.5 feet will be provided by a reputable photogrammetric engineering company. Monitoring will be done on a yearly basis.

3. New baseline photography covering the entire permit area above existing and projected mine workings was taken during the fall of 1988. This photography has documented the existing surface configuration and can be used for future comparison.
4. Subsidence monitoring point readings will be taken over areas where mining has occurred during the past two years and all areas where future mine workings are developed. Mining plans are subject to frequent change due to a variety of geologic, economic and technological factors. For this reason, baseline point readings will not be taken over a mining panel until development has begun but prior to pillar extraction. Once pillar extraction has begun, point readings will be taken annually for a period of two years following abandonment of the panel.
5. The number and location of point readings taken over a mining panel will be greatly affected by vegetation cover especially in forested areas. Where possible, point readings will be taken along a line near the center of a panel and parallel to its long dimension. Enough readings will be taken to identify the occurrence and general magnitude of subsidence.

All surface lands above existing and proposed mining operations are owned by either U.S. Fuel or the U.S. Forest Service. There are no other surface owners. In the event subsidence results in significant damage to structures, they will be repaired or replaced to the reasonable satisfaction of the surface owner. Where material damage or significant diminution of value of the foreseeable use of lands occur, it will be restored to the extent reasonably possible to the satisfaction of the surface owner. Where significant livestock or wildlife watering sites are diminished and found necessary to be replaced, they will be mitigated by constructing watering ponds or troughs and pipelines from alternate water sources.

R614-301-333 FISH AND WILDLIFE IMPACT AVOIDANCE PLAN

The following plan provides a description of how the operator will attempt to minimize disturbances and impacts to fish and wildlife and related environmental values during coal mining and reclamation operations.

Mitigation And Impact Avoidance Procedures General To All Wildlife

Utah Division of Wildlife Resources provides the following recommendations in order to minimize disturbances and impacts on wildlife and their habitats that could be impacted during developmental, operational and reclamation operations at the Company's mining project. The recommendations address how enhancement of the wildlife resource and their habitats as discussed in the previous discussion concerning wildlife in the project area can be achieved. They are also consistent with the performance standards set forth in the regulations. In instances where it would be necessary to restore or could be beneficial to enhance or develop high value habitats for fish and wildlife, recommended plant materials and rates of application are provided as "Appendix B" of Appendix III-3. This list should prove useful in meeting the additional requirements to be imposed upon the operator if the primary or secondary land use will be for wildlife habitats.

The project and adjacent areas are represented by nine basic wildlife habitats which are inhabited on occasion and during different seasons of the year by about 234 species of vertebrate wildlife. The wildlife habitats and use areas for the "high interest" species from this group of wildlife have been ranked into four levels of importance. The most valuable to an individual species or ecological assemblage are the critical sites followed in respective importance by high-priority, substantial value and limited value sites. Each type of use area requires various and specific levels of protection from man's activities. Additionally, due to the variability of vegetation communities in each use area, various and specific technologies in site development will need to be evaluated for possible mitigations, enhancements of wildland habitats or the required level of reclamation. It is recommended that all land clearing impacts be designed so that irregular shaped openings are created in contrast to openings that would have straight edges.

It is recommended that the Company make significant efforts to educate all employees associated with their coal handling operation of the intricate values of the wildlife resource associated with the project and adjacent areas and the local area. Each employee should be advised not to unnecessarily or without proper permits harrass or take any wildlife. It is especially important that wildlife not be harrassed during winter periods, breeding seasons and early in the rearing process. Exploration should be limited as much as possible during these crucial periods.

During winter wildlife are always in a depleted condition. Unnecessary disturbance by man causes them to use up critical and limited energy

reserves which, often times, results in mortality. In less severe cases, the fetus being carried by mammals may be aborted or absorbed by the animal, thus reducing reproductive success of a population.

During breeding seasons, disturbance by man can negatively affect the number of breeding territories for some species of wildlife. Disturbance can also interrupt courtship displays and preclude timely interactions between breeding animals. This could result in reduced reproductive success and ultimate reductions in population levels.

Early in the rearing process, young animals need the peace and tranquility normally afforded by remote wildlands. It is also during this crucial period that young animals gain the strength and ability to elude man and other predators. This allows the young animal to develop in relatively unstressed situations and to utilize habitats that are secure from predators. Disturbance by man can compromise this situation and result in abandonment of the young by the female, increased accidents that result in mortality to young animals or increased natural predation. It is recommended that employees be cautioned against disturbing young animals or females with young if accidentally located.

Employees associated with coal handling operations should be instructed that when wildlife are encountered during routine work that they not stop vehicles for viewing purposes. Moving traffic is less disturbing to wildlife than traffic that stops or results in out-of-vehicle activities. If viewing is desirable, the vehicle should only be slowed, but not stopped.

Hunting and other state and federal wildlife regulations must be adhered to by sportsmen utilizing the project area.

Mitigation And Impact Avoidance Procedures For Aquatic Wildlife

There are no recommendations for a wildlife plan that would enhance any fisheries since none are associated with the Company's proposed operation.

If ultimate operations are planned or occur that could physically or chemically impact any perennial stream beyond the impact of more crossings, detailed reclamation plans will be required. A reclamation plan for a stream or lake would have to provide for measurement of the physical characters of the water prior to disturbance. Such measurements should consider surface water information, data on stream velocity, gradient, width, depth, pool-riffle ratio and substrata types.

Reclamation that would achieve development of a lake bed or stream channel similar in character to that which existed prior to disturbance should result in natural re-establishment of macroinvertebrates and macrophytes. If merited, the Division could then introduce desired fishes into those waters. This would adequately mitigate for disturbance and temporary loss of aquatic resources. There would be no mitigation for displacement and possible loss of other wildlife species

dependent upon the aquatic wildlife as a prey source. It is believed that impacts on such species would not be significant.

It is also recommended that adequate precautions be taken to keep all forms of coal or other sediments from being inadvertently deposited along or within perennial stream channels. Similar precautions should be taken to preclude deposition of coal particles or sediments in or along other drainages from which the material could be transported during a precipitation event into a perennial stream. This would include blow-coal from haulage trucks, railroads or other transportation systems and storage piles. Control of larger coal particles from the above sources is equally important to control of fugitive dust. If needed, haulage vessels or storage sites should be covered, or the surface of the coal appropriately sprayed in order to solidify it against wind movement. Travel speeds of haulage vessels could be reduced so that coal is not allowed to leave the transportation system. The impact of coal or other sediments on aquatic ecosystems are many and varied; therefore, sediments must be kept out of those systems.

Mitigation And Impact Avoidance Procedures For Terrestrial Habitats

It is recommended that all wetland and riparian habitats be maintained. Roads and other facility developments should not destroy or degrade these limited, highly productive and unique habitats. Roads crossing through those areas should do so in a manner that is least damaging to the habitat. Wetlands and riparian habitats are ranked as being of critical value and are the most productive sites in terms of herbage and biota produced as compared to other local habitat types. It is probable that a majority of the vertebrate wildlife that inhabit the project area make some use of riparian or wetland areas.

It is important to note that roads and other surface facilities to be constructed should as far as practicable be placed at sites where they will not compromise wildlife or their use areas. Also, surface facilities, including roads, should be screened if possible from wildlife use areas by vegetation or terrain.

In situations where wildland habitats have been or will be disturbed, reclamation is required. Also, there are sites where development or enhancement of wildland habitats through vegetation treatments and/or seedings and transplants of seedlings could benefit wildlife. "Appendix B" of Appendix III-3 depicts the Division's recommendation for plant materials to be utilized for various wildlife habitats on wildland treatments that are intended to benefit wildlife. If circumstances arise where seed or seedling transplants for a recommended plant species are not available, suitable alternates are also recommended.

Seedling transplants from nursery stock as well as nearby rangelands would also be acceptable for some wildland treatments.

Temporary control of rodents may be required to ensure a successful rangeland treatment. It is recommended that the county agent be consulted in this area of concern. Poisoned oats are the most common and acceptable method for rodent control; however, only licensed persons may apply the treatment.

Currently, there are some new concepts in methodology for revegetation that are being successfully implemented in other parts of the nation and world. One promising method is a procedure where a large scoop removes, from a natural and stabilized site, a small area of earth intact with vegetation and subsurface soils for placement on a site to be restored. This same procedure can be utilized when disturbing pristine sites, except that the native vegetation is stored for use in latent reclamation. Another meritorious method for stimulating natural revegetation, in combination with other reclamation techniques, is to plan facility developments so that islands of natural, native vegetation remain. This will allow for natural vegetation to spread from the islands. These techniques can also be useful for enhancement of poor quality sites that currently exist on the mine plan area.

Encapsulation of seed and fertilizer for several releases over a period of years after a single application is a new and possibly advantageous procedure. This technique along with soil stabilizing structures has been successfully used in South Africa. Dr. J. Van Wik in the Department of Botany at Potchetstroom University in South Africa could provide additional information on this new technique.

There are also new specialized techniques coming to the forefront for stabilization of problem sites such as roadbanks and steep slopes. It is important that these sites be promptly and permanently revegetated in order to reduce siltation into local river systems. It is believed that natural, nonpoint sources represent 50 percent of the salinity in the upper basin of the Colorado River system into which this mine plan area drains.

It is recommended that the Company make numerous contacts with appropriate agencies, institutions and persons to ensure that enhancement or reclamation projects achieve the required degree of permanency, plant diversity, extent of cover and capability of regeneration to ensure plant succession. Generally speaking, seeding should be accomplished as late in the fall as possible. Seedling transplants need to be coordinated with local soil moisture conditions which are usually at optimum in the early spring just as the snow melts.

It is paramount that suitable vegetation be maintained and/or re-established if the life requirements of wildlife are to be satisfied in the postmining period. Success in this area of concern along with cessation of man's disturbances will likely result in a natural reinvasion and the resultant inhabitation by most wildlife species of an impacted site.

It is important to note that enhancement or reclamation projects that are to benefit wildlife must be properly designed so that all the life requirements of the target species are considered in conjunction with forage. Water must be provided or be present and thermal cover along with escape and hiding cover has to be in abundance. Loafing areas and travelways between the many types of use areas must also be provided. In order to meet these goals, a considerable degree of consultation will be required between the Company and Utah Division of Wildlife Resources.

As a service and also to ensure that the needs of wildlife are met, the various expertism within the Division of Wildlife Resources are available to the Company for consultation. For the most part, Larry Dalton, Resource Analyst, For the Southeastern Regional office at 455 West Railroad Avenue in Price, Utah 84501 (phone 637-3310) will coordinate any needed contacts. Richard Stevens, Wildlife Biologist, at the Great Basin Research Center, Box 704, Ephraim, Utah 84627 (phone 283-4441) is available for consultation and site specific analysis concerning species for vegetation plantings, timing and techniques to achieve the best results.

In instances where revegetation projects are to be planned over coal waste areas, heavy metal uptake by the plants must be evaluated. It is recommended that the Company initiate an appropriate long-term monitoring program to determine the magnitude and resolutions, if needed, for this problem.

It is recommended that persistent pesticides not be utilized on the project area. Other alternate pesticides or forms of control should be utilized.

All hazards associated with the project operation should be fenced or covered to preclude use by wildlife; of special concern would be sites having potential to entrap animals or toxic materials.

Mitigation And Impact Avoidance Procedures For Amphibians And Reptiles

Enhancement or development of habitats that provides a diversity of vegetation will benefit amphibians and reptiles. It is important to note that all of these species are protected by Utah law. Due to the myriad of myths that surround these animals, it is urged that individual specimens not be destroyed. This is especially true for snakes since they are a valuable component of the ecosystem.

Snake dens are ranked as being of critical value to the population and are protected by law. If a den is located, it should be reported to the Utah Division of Wildlife Resources. Snake dens can be moved, but only with intensive efforts that may take a year or more (snakes are caught and removed in the spring and fall). Thus, construction of facility developments may take place in denning locations if there is sufficient lead time to relocate the occupants.

Mitigation And Impact Avoidance Procedures For Avifauna

It is recognizable that development and operation of a mining project will in some cases negatively impact many avian species through physical destruction of habitats and continual disturbance that makes other habitats unavailable or less desirable to an individual bird. It is also true that impacts that are negative to one species may be beneficial to another species. It is recommended that the Company plant native and/or ornamental berry producing shrubs around surface facilities. When mourning doves are a target species, sunflowers or blazing star should be planted. This will provide food and cover for many of the smaller species of birds, resulting in enhancement of their substantial value and high-priority habitats. This action would also mitigate for disturbances and destruction of avifauna habitats at other sites associated with project operations.

It is important to note that the nests of all avifauna (except the house sparrow, starling and ferral pigeon) when active and their eggs are protected by federal (Federal Migratory Bird Treaty Act) or state laws (Utah Code 23-17-1 and 23-17-2). All avifauna utilize a nest during their reproductive process. Dependent upon the species, some nests are well developed while others may be represented by only a scrape on the ground. These sites when being utilized are critical to maintenance of individual bird populations; each species has a specific crucial time period in which the nest is occupied. It is during this crucial period that the nest must be protected from disturbance.

Several species of raptors frequent the project area. Their nests when active should not be disturbed and abandoned stick nests are never to be damaged. Every effort should be made to eliminate man's disturbance within visual sight or one-half kilometer radius of an active raptor nest. This distance would have to be increased to a one-kilometer radius if the cause for disturbance were to originate within view and from above the nest. This effort is demanded in the instance of golden eagles and cliff nesting falcons since they are sensitive to disturbance and could abandon the nest. Termination of man's use of a site would not be required if eagles or falcons constructed their nest after mining had been initiated, since it would demonstrate the individual bird's willingness to tolerate mining activities and the associated disturbance by man.

Roost trees for eagles, if located, must not be disturbed or destroyed. Similarly, activities planned for high-priority concentrations areas of eagles must be designed and implemented so that they are not of significant disturbance to the birds.

As a general comment, whenever active raptor nests are observed or roost trees for eagles located, they need to be reported to the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

Design and construction of all electrical power lines and other transmission facilities shall be designed in accordance with guidelines set forth in "Environmental Criteria for Electric Transmission System"

published by the USDA and USDI in 1970 and/or the REA Bulletin 61-10 "Powerline Contacts by Eagles and Other Large Birds". It is also recommended that placement of utility poles over flat or rolling terrain be planned so that they are out of view of roads or at least 300 meters away from any roads. This will lessen opportunity for illegal killing of these valuable birds, since the poles can serve as suitable hunting perches for raptors. In some instances poles can result in an extension of raptor hunting territories, which would represent a beneficial impact.

During the crucial period of December through February spruce-fir forests and aspen forests need to be protected from man's disturbance so that blue grouse and ruffed grouse will not be impacted. Destruction of these wildlife habitats at any time of the year need be minimized due to their value to wildlife.

During the spring period (mid-March through mid-June) care needs to be taken that the male blue grouse are not disturbed or precluded from establishing breeding territories. Similar precautions need be taken for male ruffed grouse (March through May) in the area of drumming logs.

Mature trees with natural cavities and dead snags need to be protected for use by cavity nesting birds. Trees with such a character are ranked as being of critical value to cavity nesting birds. The project should be planned so that three such trees are left standing per acre within 500 feet of forest openings or water and two such trees per acre in dense forested areas.

Mitigation And Impact Avoidance Procedures For Mammals

The lodges, nests and dens of all mammals or roosts in the instance of bat like mammals represent a critical use area for maintenance of their individual populations. The crucial period for any species is when the lodge, den, nest or roost is occupied. Therefore, such sites for any mammal must be protected from disturbance during that period when it is being utilized.

Many species of mammals develop food caches in order to carry individual animals or family groups through periods when they cannot forage. Such sites are of critical value to maintenance of their populations and if located should not be destroyed or subjected to regular disturbance by man.

It important to realize that within natural ecosystems there exists a predator-prey relationship. One species of animal may represent a prey source for other species. Therefore, it is important that project operations be designed and implemented so as to not unnecessarily disturb or destroy any wildlife or their habitats.

Big game ungulates --mule deer, moose and elk -- each have seasonal use areas ranked as being of critical value to an individual herd. Such sites need to be protected from any of man's activities or developments

that could result in destruction, loss or permanent occupancy of the site by man or his facility developments. If these types of impacts cannot be avoided the site must ultimately be reclaimed and revegetated. Also, critical valued areas need protection from disturbance during their appropriate crucial period.

High-priority valued use areas for all wildlife and particularly big game ungulations need to be protected from man's activities or facility developments. Actions that would result in loss or permanent occupancy of significant acreages (25 or more acres) of habitat are of special concern. In any event impacts to high-priority valued areas should be limited and ultimate reclamation planned. Many impacts can be avoided simply by precluding exploration, developmental or other activities during the period of time when a high interest specie is present.

Haulage of coal between the various mine projects and distribution points should be planned so that impacts to wildlife are lessened; of special concern is haulage of coal through wintering areas for big game. It is recommended that the Company develop coal haulage contracts that require personnel involved with coal haulage to use extreme caution so that accidental collisions between motor vehicles and big game are reduced. Without doubt, a reduction in speed across winter ranges would alleviate this problem during the period between November 1 and May 15 each year.

In instances where conveyors, slurry lines or any other structure having potential to be a barrier to big game movement is to be developed, passage structures must be provided. Generally speaking overpass and underpass type structures are recommended in order to allow passage of big game to habitats either side of any barrier. These crossings should be placed at the points to be identified from intensive study of big game movements in relation to the mine plan area. Such study would not be required if the structure was adequately elevated to allow uninhibited passage of big game along its entire length.

Underpasses should have an minimum clearance of three meters maintained across a span of at least five meters. Overpasses should be designed as a circular earthen ramp with the barrier bisecting the ramp into two equal halves as follows:

On either side of the conveyor an half-round ramp with a slope no greater than 3:1 on a five meter wide path placed at an angle of 90 degrees to the conveyor and tapering around to a slope of 5:1 at paths adjacent and parallel to the conveyor. The platform over the conveyor should be concrete or some other material that would not echo when being crossed by big game and should be of a character similar to rock or natural earth.

Soils associated with either crossing style should be of the A or B horizons to allow for development of vegetation. Vegetative cover must be established in association with all crossing sites. This will

lessen anxiety of individual animals using the site through development of a natural appearing environment.

Mature pinion or juniper trees and an abundance of browse plants need to be placed proximal to crossing points in order to provide a safe travelway. The browse plants will also serve as a permanent attraction for big game to crossing points. Additionally, a mixture of grass and forb seeds should be broadcast over each crossing point to stabilize the soil and enhance the forage situation.

Appropriately sized boulders may need to be placed at crossing sites in order to control off-road vehicles utilized in outdoor recreation.

Industrial developments are encouraged on habitat use areas that are ranked as being of limited value to wildlife. It should be noted, however, that reclamation is ultimately expected on any wildlife use area, regardless of its value to wildlife.

Fish and Wildlife Plan - U.S. Fuel Permit Area

Three major concerns must be addressed in a wildlife protection plan for a coal mining facility situated such as the U. S. Fuel operation in Hiawatha. First, one must devise a plan to minimize the destruction of wildlife habitat during facility construction, and determine how to restore that habitat after completion of mining. Second, an assessment of operating impacts to wildlife must be made, and again a mitigation plan to minimize these impacts should be devised. Finally, any unique wildlife impacts (e.g. construction within a critical habitat as defined in Section 7 of the Endangered Species Act of 1973) need to be assessed and mitigated.

In the case of King IV, King V and King VI, and their associated prep-plant at Hiawatha most of the options connected with protecting and/or minimizing such wildlife impacts related to construction have been precluded. The facilities are in place and very little additional construction is planned. To date, approximately 332 acres have been disturbed. Approximately 121 acres of the 332 developed acres will not be reclaimed after the mine closes, see Table III-7. This consists of the town of Hiawatha, railroad (owned by Utah Railway), and paved roads. Another 25 acres may be disturbed during topsoil borrow operations. These 25 acres, plus the 210 acres of disturbed lands that will not remain as town or roads will be reclaimed to wildlife and range habitat.

Aquatic and Riparian Habitats

There are no fishes residing in the watershed associated with King IV, V, and VI mines; therefore, the management strategy for aquatic and riparian habitats need be only concerned with protecting wildlife values. The perennial stream flows have limited value as aquatic habitats, but do support furbearers such as beaver; in addition, these flows ensure the continued existence of the narrow riparian habitat alongside the streams. The value of this community is exemplified by the fact that over 50 percent of the species utilizing the U. S. Fuel permit area can be found associated with riparian habitat. Also, U. S. Fuel is aware of Executive order 11988 that mandates protection of riparian habitat by federal agencies. All flows are the result of natural runoff which are not controlled by U. S. Fuel except for a diversion on the North Fork placed on the creek in the 1920's. There are no plans to interfere with this natural runoff process.

Additional measures taken by U. S. Fuel to protect the aquatic and riparian habitats include sedimentation ponds at all points where ground-clearing disturbances could result in runoff carrying sediments into Miller Creek. Refueling and vehicle maintenance areas are situated so that accidental spillages of petroleum products can not enter the creek; and in-as-much-as possible, isolation of the creek from coal mines by installing runoff basins and placing roads away from the creek should prevent siltation.

TABLE III-7

Acreages Of Areas Not To Be Reclaimed Within U.S. Fuel Permit Area

HIAWATHA AREA	ACRES
Roads	6.6
Railroad Yard	15.2
Town	66.3
TOTAL	<u>93.1</u>

All existing haul roads in the permit area are paved and culverts are riprapped at both ends. No new crossings are proposed, however, should any new crossings be required, impacts to riparian areas will be reduced or avoided by providing stream buffer zones of at least 100 feet from the edge of the stream to the road or other disturbance. At crossings or at other places where new disturbance is unavoidable, variances will be sought for such disturbance. At any areas so impacted, the vegetation will be restored to a riparian conditions when disturbance is corrected by the use of seed mixture No. 4 (Table III-8) which also has nursery grown stock for trees and shrubs.

Reclamation will be done on 10.5 acres of the 15 total acres of disturbed riparian habitat within the permit area. Some riparian areas originally disturbed will not be reclaimed; these amount to 3.5 acres which include areas in the town of Hiawatha and railroad intrusions into riparian habitat. These lie outside of U. S. Fuel's responsibility for reclamation. Road crossings associated with mining amount to about 1.0 acres. This permanent loss will be mitigated onsite by adding to riparian habitat at Middle Fork during the pad restoration (Exhibit III-6).

Should U. S. Fuel find it necessary to disurb riparian vegetation, it will contact the Division for guidance on this matter.

OSM has requested that a determination be made of wildlife usage of springs on the plateau above the mine. No species-by-species quantitative data exist, but according to Larry Dalton, Utah Division of Wildlife Resources (personal communication 2 November 1983), approximately 70 percent of the wildlife species depend on the springs for one reason or another. Mr. Dalton believes that trying to quantify usage on a species specific basis would yield ambiguous information; hence would be a waste of U. S. Fuel's money. U. S. Fuel therefore pledges that should spring surveys reveal that mining is diminishing the wildlife water supply, they will develop another source. (see Big Game section following), and also take measures, such as plantings to make improvements at such developed sites for all wildlife not just big game.

Big Game Habitat

The Hiawatha permit area has important herds of big game animals residing in the area on a yearlong basis. On the mountains to the west and above the mining operations is summer range for mule deer and Rocky Mountain elk. Most of this area is located on outcrops of the North Horn Formation where subsidence is not expected to impact springs. Within those areas potentially affected by subsidence, a combined spring flow of 24 gallons per minute was measured in October 1983 from 11 springs issuing from formations stratigraphically lower than the North Horn Formation. These springs are located in the upper Miller Creek watershed in sections 7, 18, 19, 30 and 31 of T. 15 S., R. 8 E.

The groundwater monitoring program for the area has been revised to include three of the springs that issue from the Castlegate Sandstone, below the North Horn Formation. Monitoring of these springs and streamflow in the various forks of Miller Creek above surface operations will provide sufficient data to assess subsidence impacts. As sections within the mines are fully extracted and subsidence is detected on the surface either by the subsidence monitoring program or during routine sampling trips, the areas of subsidence will be checked for loss of spring flow. If any springs or streams are eliminated due to subsidence, U. S. Fuel will immediately notify DOGM for a regulatory agency assessment of the magnitude of the impact. Based on regulatory findings, mitigation, if necessary will be implemented. Such mitigations could include installation of guzzlers, development of new springs, windmills, and perhaps location of any developed water sources will be coordinated with the regulatory agency in charge.

The canyon bottoms and lower slopes provide important winter range for elk and deer. The small amount of habitat now occupied by facilities represents a rather minor area impact on the wintering range, but the proximity of mining personnel to these animals during weakened winter conditions is a greater threat. Poaching and harrassment at these times can result in severe losses.

All efforts will be made to educate company personnel on these matters. U. S. Fuel commits to providing the Utah Division of Wildlife Resources (DWR) wildlife education program and to discourage the carrying of weapons in vehicles on company property. Furthermore, U. S. Fuel will terminate any worker found poaching on company time and cooperate with authorities in investigating poaching on company property.

Conveyors and similar facilities have been known to impede movements of migratory big game species. Therefore, a means of passage, either over or under such facilities is desirable. An overland conveyor extends between the King VI Mine portal and the King VI truck loading facility. It has been designed to permit deer to cross under it, with passages of at least one meter in height spaced at intervals as suggested in DWR publications Coal Conveyors and Mule Deer Movement (1981). This conveyor has been inspected and passed by the DWR (see attached letter in Attachment III-2). The deer crossing is shown in Figure 1.

Those big game habitats that have been modified or destroyed by the Hiawatha operations will be restored to original or better conditions (see revegetation plan for details). This includes the mine portal areas (the roads will remain in place) where shrubbery and tree species will be replanted, and at the refuse piles and topsoil substitute area where grasses and forbs of high nutritional value to wildlife will be planted (see Revegetation Plan).

51

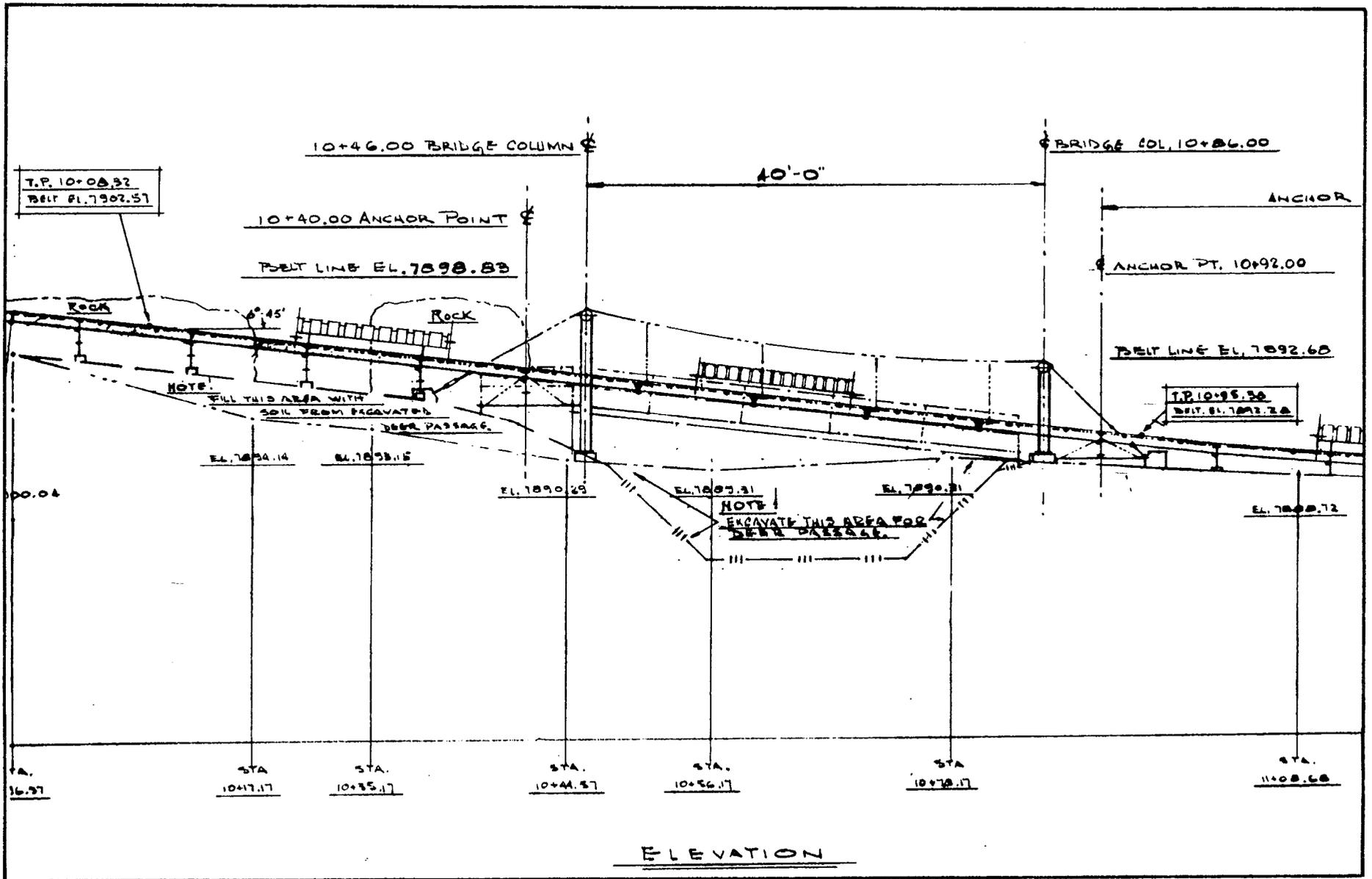


Figure 1 Deer Crossing on King VI Overland Conveyor



STATE OF UTAH
NATURAL RESOURCES & ENERGY
Wildlife Resources

ATTACHMENT III-2

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Douglas F. Day, Division Director

1596 West North Temple • Salt Lake City, UT 84116 • 801-533-9333

FILE ACT/007/011
Folders # (3) # 7

April 19, 1983

Mr. Jim Shirazi, Director
Utah Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, UT 84114

Attention: Mary Boucek and Sandy Pruitt

Dear Jim:

The Division on April 8, 1983, inspected the modification to the U.S. Fuel Company's King 6 conveyor. The modifications made by the company relative to passage of deer are appropriate and considered to be complete. The conveyor now does not represent a barrier to deer movement.

Thank you for the cooperation and assistance provided by your staff.

Sincerely,

Douglas F. Day
Director

RECEIVED
APR 20 1983

DIVISION OF
OIL, GAS & MINING

A determination of deer and elk numbers utilizing critical and high priority habitats in the permit area has been requested by OSM. According to Larry Dalton of Utah Division of Wildlife Resources (DWR) (Personal Communication 2 November 31) no such numbers are variable from year-to-year. Instead, DWR has identified critical and high priority habitat. The amount of such habitat in the permit area is shown below:

Critical elk winter range	8,360 acres
High priority elk winter range	1,017 acres
High priority elk summer range	3,335 acres
Critical deer winter range	8,360 acres
High Priority deer summer range	3,335 acres

Exhibits III-1, III-2 and III-3 show big game utilization of the permit area.

Raptors

Raptors which are of high federal and state interest include hawks, eagles, owls and ravens. Impacts to these species should not increase over the next permit term because additional construction that would destroy or encroach upon nests or perches is not anticipated. Since disturbance has occurred in the mining area for generations, it is assumed the any nesting raptors are acclimated to it. Should occupied raptor nests be found in areas where future mine expansions are planned, U. S. Fuel will notify the Division and conduct a special study if the Division recommends it.

A survey of the U. S. Fuel power lines was conducted by the U. S. Fish and Wildlife Service to determine whether their construction meets Federal. A letter confirming this to be the case is attached (Attachment III-3). U. S. Fuel will follow the guidelines contained within Environmental Criteria for Electric Transmission Systems (U. S. Department of Interior, Forest Service, 1970) and Rural Electrical Administration Bulletin 61-10 for design of all future power line installations associated with mining operations at Hiawatha.

General Wildlife Mitigation

- * Utilizing past vegetation surveys, high resolution vegetation maps have been prepared (Exhibits III-4, III-5 and III-6). This will assist in reclamation of areas of future disturbance, as well as assist in estimating what habitat types have been previously disturbed. Table III-8 depicts total vegetation community acreages in the permit area, plus disturbance. Based on this information U. S. Fuel pledges to restore disturbed lands to at least equal conditions as prior to disturbance by utilizing plant species with high nutritional values, perhaps exceed the original wildlife values. Table III-9 shows the vegetation approach that will be used on a habitat-by-habitat basis.



STATE OF UTAH
NATURAL RESOURCES & ENERGY
Oil, Gas & Mining

ATTACHMENT III-3

Scott M. Matheson, Governor
Temple A. Reynolds, Executive Director
Cleon B. Feight, Division Director

4241 State Office Building • Salt Lake City, UT 84114 • 801-533-5771

March 5, 1982

Mr. Charles J. Jahne
Sharon Steel Corporation
136 East South Temple
Salt Lake City, Utah 84111

RE: Raptor Protection on Power Lines
U. S. Fuel Company
Hiawatha Complex
ACT/007/011
Carbon County, Utah

Dear Mr. Jahne:

Enclosed are the results of the U. S. Fish and Wildlife Service survey of August 24-28, 1981. As you will note, all existing lines on U. S. Fuel Company's permit area were surveyed.

After reviewing the results of the survey, the Division feels that modifying additional poles would not be required at this time. Should problems arise in the future, or if it becomes evident that raptors are using the "Unmodified" poles, it may be necessary to modify additional poles. U. S. Fuel Company should contact the Division to make the necessary arrangements to have the lines resurveyed and approve modification designs.

Sincerely,

LYNN M. KUNZLER
RECLAMATION BIOLOGIST

Enclosure

LMK/lk

TABLE III-8
VEGETATION COMMUNITIES INSIDE PERMIT BOUNDARY

Vegetation Type	Existing Conditions (Acres)			Proposed To Be Disturbed
	Undisturbed	Disturbed	Total	
Aspen	233	0	233	-
Barren Land	11	0	1	-
Grassland	693	0	693	-
Mountain Brush	1447	35	1482	-
Mixed Conifer	5160	15	5175	-
Mixed Conifer & Aspen	1755	0	1755	-
Pinyon-Juniper	1695	242	1937	24
Riparian	155	15	170	-
Sagebrush	198	25	223	-
High Elevation Sagebrush-Grassland	911	0	911	-
TOTAL	12,258	332	12,590	24

*Source of information: Measurements from map Exhibit III-7 "Vegetation Types"

TABLE III-9
Nursery Stock Required for Revegetation, with Spacing Distances

<u>Location, Habitat, & Species</u>	<u>Corresponding Reference Area</u>		<u>Area To Be Reclaimed</u>		<u>Average Spacing of Plantings (feet)</u>			
	<u>Species % Of Total Density</u>	<u>Density (#/acre)</u>	<u>Disturbed Area To Be Revegetat- ed (acres)</u>	<u># Nursery Plants Needed To Revegetate</u>	<u>Uniformly Spaced Single Plants</u>	<u>By Clumps Of 3</u>	<u>By Clumps Of 5</u>	<u>By Clumps Of 9</u>
King 4 & 5 (Middle Fork Pads)			13.8 Tot.					
Mountain Brush Habitat	MBR1	-	10.3	0	-	-	-	-
No trees in this habitat	-	-		(All growth to be from seeds - See Mix #3)	-	-	-	-
Mixed Conifer Habitat	MCR2	3556	3.5	12,447 T.	3.5	6.1	7.8	10.5
<u>Abies concolor</u>	62%	2205		7,718	4.4	7.7	9.9	13.3
<u>Pseudotsuga menziesii</u>	15%	533		1,886	9.0	15.7	29.2	27.1
<u>Populus tremuloides</u>	14%	498		1,743	9.4	16.2	20.9	28.1
<u>Acer glabrum</u>	8%	284		994	12.4	21.5	27.7	37.2
<u>Picea pungens</u>	1%	36		126	34.8	60.2	77.2	104.4
King 6 (South Fork Pad)			6.9 Tot.	2,184 T.				
Pinyon-Juniper Habitat	PJR4	185	5.9	1,092	15.3	26.6	34.3	46.0
<u>Pinus edulis</u>	55%	102		602	20.7	35.8	46.2	62.0
<u>Juniperus osteosperma</u>	44%	81		478	23.2	40.2	51.9	69.6
<u>Pseudotsuga menziesii</u>	1%	2		12	147.6	225.6	330.0	442.7
Mixed Conifer Habitat	MCR2	3556	1.0	3,556 T.	3.5	6.1	7.8	10.5
<u>Abies concolor</u>	62%	2205		2,205	4.4	7.7	9.9	13.3
<u>Pseudotsuga menziesii</u>	15%	533		533	9.0	15.7	20.2	27.1
<u>Populus tremuloides</u>	14%	498		493	9.4	16.2	20.9	28.1
<u>Acer glabrum</u>	8%	284		284	12.4	21.5	27.7	37.2
<u>Picea pungens</u>	1%	36		36	34.8	60.2	77.8	104.4

TABLE III- 9

Nursery Stock Required for Revegetation, with Spacing Distances
(Continued)

<u>Location, Habitat, & Species</u>	<u>Corresponding Reference Area</u>		<u>Area To Be Reclaimed</u>		<u>Average Spacing of Plantings (feet)</u>			
	<u>Species % Of Total Density</u>	<u>Density (#/acre)</u>	<u>Disturbed Area To Be Revegetat- ed (acres)</u>	<u># Nursery Plants Needed To Revegetate</u>	<u>Uniformly Spaced Single Plants</u>	<u>By Clumps Of 3</u>	<u>By Clumps Of 5</u>	<u>By Clumps Of 9</u>
North Fork Pad								
Mixed Conifer								
Habitat								
	MCR2	3446 T.	0.7 Tot.	2,490 T.	3.5	6.1	7.8	10.5
<u>Abies concolor</u>	62%	2205		1,544	4.4	7.7	9.9	13.3
<u>Pseudotsuga menziesii</u>	15%	533		373	9.0	15.7	20.2	27.1
<u>Populus tremuloides</u>	14%	498		349	9.4	16.2	20.9	28.1
<u>Acer glabrum</u>	8%	284		199	12.4	21.5	27.7	37.2
<u>Picea pungens</u>	1%	36		25	34.8	60.2	77.8	104.4
South Fork Canyon								
Bottom								
Riparian Habitat								
	RR 13(a)	138 T.	0.5 Tot.	71 T.	17.8	30.8	39.7	53.3
<u>Juniperus scopulorum</u>	33%	45		23	31.1	53.9	69.6	93.3
<u>Populus angustifolia</u>	28%	39		20	33.4	57.9	74.7	100.3
<u>Rosa woodsii</u>	25%	35		18	35.3	61.1	78.9	105.8
<u>Betula occidentalis</u>	10%	14		7	55.8	96.6	124.7	167.3
<u>Abies concolor</u>	2%	3		2	120.5	-	-	-
<u>Salix exigua</u>	1%	2		1	147.6	-	-	-
Middle Fork Canyon								
Bottom								
Riparian Habitat								
	RR13 (a)	138 T.	0.7 Tot.	97 T.	17.8	30.8	39.7	53.3
<u>Juniperus scopulorum</u>	33%	45		32	31.1	53.9	69.6	93.3
<u>Populus angustifolia</u>	28%	39		27	33.4	57.9	74.7	100.3
<u>Rosa woodsii</u>	25%	35		25	35.3	61.1	78.9	105.8
<u>Betula occidentalis</u>	10%	14		10	55.8	96.6	124.7	167.3
<u>Abies concolor</u>	2%	3		2	120.5	-	-	-
<u>Salix exigua</u>	1%	2		1	147.6	-	-	-

TABLE III-9

Nursery Stock Required for Revegetation, with Spacing Distances
(Continued)

<u>Location, Habitat, & Species</u>	<u>Corresponding Reference Area</u>	<u>Area To Be Reclaimed</u>		<u>Average Spacing of Plantings (feet)</u>				
	<u>Species % Of Total Density</u>	<u>Density (#/acre)</u>	<u>Disturbed # Area To Be Revegetat- ed (acres)</u>	<u># Nursery Plants Needed To Revegetate</u>	<u>Uniformly Spaced Single Plants</u>	<u>By Clumps Of 3</u>	<u>By Clumps Of 5</u>	<u>By Clumps Of 9</u>
North Fork Canyon Bottom								
Riparian Habitat	RR13(a)	138 T.	0.3 T.	43 T.	17.8	30.8	34.7	53.3
<u>Juniperus scopulorum</u>	33%	45		14	31.1	53.9	69.6	93.3
<u>Populus angustifolia</u>	28%	39		12	33.4	57.9	74.7	100.3
<u>Rosa woodsii</u>	25%	35		11	35.3	61.1	78.9	105.8
<u>Betula occidentalis</u>	10%	14		4	55.8	96.6	124.7	167.3
<u>Abies concolor</u>	2%	3		1	120.5	-	-	-
<u>Salix exigua</u>	1%	2		1	147.6	-	-	-

(a) Numbers are estimated. Although RR13 is a designated reference area, no density data are available.

U. S. Fuel will take all efforts to avoid disturbing dense stands of aspens, conifers and mixed stands of each. The value of these habitats to wildlife is recognized so that precautions will be taken to ensure their integrity.

U. S. Fuel is providing water to the BLM from its Mohrland water supply for wildlife and cattle use on BLM lands south and east of Mohrland. This water is being used for habitat enhancement as part of a BLM pinyon-juniper chaining project. Since the water is being provided at a loss to U. S. Fuel, it is the contention that this should be considered a U. S. Fuel wildlife enhancement project.

U. S. Fuel will cooperate with the Division of Wildlife Resources (DWR) in big game habitat improvements in the permit area. Presently U. S. Fuel is revegetating 10 acres accidentally burned by fire during the summer of 1984. Prior to that time the area was dominated by sagebrush and provided little wildlife forage. In an attempt to enhance the forage value at this site seed mix #1 from our final reclamation plan was applied and the area was hydromulched at the rate of one ton per acre with Conwed 2000 mulch and tackifier.

Any denning areas for bears or snakes discovered in the permit area will be reported to the Division. Should a snake den be found where worker harassment is likely, U. S. Fuel will construct a chainlink fence around it.

U. S. Fuel will clear pesticides with DWR prior to utilizing them in outdoor situations that could impact wildlife.

Any temporary exploration roads will be reclaimed by a revegetating them with appropriate techniques. They will be blocked by boulders or some other method to ensure that they do not become permanent roads.

R614-301-340 RECLAMATION PLAN**R614-301-341 REVEGETATION**

Since reclamation plans for the various sites of the mine permit area have been presented in Chapter II Soils R614-301-244, this section will emphasize vegetation and planting techniques in regard to these sites.

- 341.100 Detailed timetables for reclamation of the various sites are given in Chapter II under R614-301-240, Reclamation Plan.
- 341.200 Species, Amounts and Methods of Planting
- 341.210 Tables III-3 - III-6 list the four seed mixes and amount of application per acre. The four seed mixes will be applied to the various sites as follows: Seed Mix (1) the areas affected by coal refuse and other coal materials, (2) the alluvial-fan sites, (3) the mine pads, roads and sediment ponds in South, Middle and North Fork and (4) riparian areas. Mixture No. 3 includes nursery grown stock for trees. Mixture No. 4 includes nursery grown stock for both trees and shrubs.
- 341.220 Two basic methods to be used for seed planting are drilling and broadcasting. Hydroseeding is another method sometimes use. Drilling distributes and covers the seed in one operation and consequently gives the best results where topographic conditions allow. The drilling rate is to be one-half the broadcast rate shown in Tables III-3 through III-6.

Planting techniques will utilize drilling of seed where slopes are level enough and areas to be reclaimed are large enough. Otherwise, broadcasting by hand, using portable spreaders, will be used. Nursery stock will be planted in clumped arrangements in areas that are to receive trees or shrubs (portions of the mine pads and riparian areas). The intended plant densities and seeding rates are provided in the seed mix tables (Tables III-3 to III-6).

Any roads that will be reclaimed will be ripped, surface material removed, and planting done according to the procedures described with seed mixture no. 3, as may be modified by the results of field trial tests to be conducted. Revegetation will achieve the necessary standards provided by the appropriate reference areas except that forage values will be enhanced at the expense of undesirable shrub density as has been explained in the rationale accompanying the discussion of field trial test plot studies.

Revegetation success will be measured during monitoring studies conducted after reclamation is complete. Reference areas will be compared in these studies.

Nursery stock will be planted at the time of final reclamation for the sites where tree species are to be utilized.

The density of tree and shrub plantings at areas where nursery stock is to be used in revegetation (mine pads and riparian areas) will be based on the density of woody plants found in the corresponding reference areas. For example, at the mine pad in Middle Fork, where an area of about 20.6 acres will eventually be revegetated, the nearby designated reference areas are numbers 1 and 2 representing mountain brush and mixed conifer communities, respectively. The boundary between these two communities, runs through the mine pad area, so that about 2/3 of the area to be reclaimed lies in the mountain brush zone (south-facing slope) and 1/3 lies in the mixed conifer zone (north-facing slope). The woody plant density in each area (number of plants per acre), multiplied by the area to be reclaimed, yields the number of plants to be set during revegetation. About 10 percent excess plants will be used to allow for mortality. The plants will not be uniformly spaced, but will be clustered in groups of about 3 to 10 plants per group, with clusters also set at various distances apart. The total plant density, however, will match that of the corresponding reference areas. As an example, if shrub density at reference area 1 were 600 per acre, and there were four dominant shrub species making up this total, then to determine the number of shrubs to be planted in 6 acres, a total of $6 \times 600 = 3600$ shrubs should be ordered. A 10 percent excess for mortality would require 3,960 shrubs to be ordered. These would be apportioned between the four dominant species in the same proportions as exist at the reference area. If these plants were uniformly distributed in single plantings, they would have to be spaced every 8.5 feet to achieve 600 plants per acre, or every 8.1 feet to achieve 660 plants per acre, or every 8.1 feet to achieve 660 plants per acre which includes the 10 percent excess allowance. Clustered plantings, for example, five plants together in a small area, would require distances between such clumps of 18.2 feet to achieve 660 plants per acre. The general formula for determining plant spacing is:

$$D = 43,560/d^{1/2}$$

Where D = the distance in feet between plants for any desired plant density, and

d = density of plants (number per acre)

43,560 = number of square feet per acre

If several plant species are involved, the distance formula can be solved for each individual using d-values appropriate to each species. When clumped plantings are desired, then the distance

between the clumps is to be calculated rather than individual plant distances. To do this, the desired plant density, d , is divided by the average number of plants per clump before solving the distance formula.

Table III-9 shows the areas to be revegetated with nursery grown plants in addition to seeds. The number of plants required for each revegetation situation are shown. These are based on the appropriate reference areas. Columns showing planting distances for equally spaced and clumped arrangements are also shown.

341.230 Mulching Techniques

Various mulching techniques will be used at the mine plan site during final reclamation. The technique being used depends on the site, slope, method by which the seed is applied and other variables.

In one case, at the mine yards, the existing culverted stream diversions will be restored to open channels. After the channel has been re-established, riprapped and reseeded using seed mix number 4, the area will be mulched using tacked hay to prevent excessive erosion of the newly restored channel.

When applying mulch to the regraded area at the borrow sites the mulch may be included in the hydroseeding mixture. Mulching of the roadways leading to the borrow sites will be applied at a rate of 2,000 pounds per acre and will be either crimp-disked or hydroseeded.

At the mine sites after seeding is conducted, either a hydromulch with internal chemical binders (Conwed-2000) will be applied to the site or a hay or straw mulch will be staked down with netting material for stability or crimped into the soil by discing.

Reclamation plans at the preparation plant and associated facilities call for mulch (either hydromulch, straw or native grass hay) to be applied at a rate of one ton per acre. If the straw or hay is applied by hand or farm type equipment, a nylon overnet will be placed directly on the mulch and tacked to the soil or , crimped into the soil by discing. If hydroseeding is implemented, a binder or adhesive additive would be utilized to ensure the seed, mulch and amendments remain in place. In either case the recommended application is critical to reducing the erosion potential, controlling runoff and re-establishing vegetation.

Reclamation of the North Fork, Middle Fork and South Fork roads will include hydromulching at a rate of one ton per acre using Conwed 2000 with tackifiers. Only on the steep slopes, where deemed necessary to prevent erosion, will tacked hay mulch be applied also at a rate of one ton per acre.

341.240 Because native species suitable for long term growth have been selected for each site, no irrigation will be used to achieve final reclamation of the permit area.

No pest and disease control measures should be needed.

341.250 Criteria And Tests For Demonstrating Successful Revegetation

During the first year of reclamation, no studies will be done to estimate revegetation success. During the second, third and succeeding years, if necessary, however, each different plant community in the reclaimed areas will be sampled quantitatively for comparison to the appropriate reference areas, which will also be similarly sampled.

The method will be by quadrat sampling, using randomly located 1m x 1m = 1 meter-square quadrats. The plant responses to be measured will include percent cover by species, density by species, and percent non-living cover by the categories of rock, soil and litter. All cover values are to add to 100 percent per quadrat. An adequate sample size in terms of numbers of quadrats per plant community will be estimated by use of the statistic:

$$N = \frac{t^2 s^2}{p^2 x^2}$$

in which N = The number of samples required for statistical adequacy at the confidence levels specified in the DOGM guidelines for vegetation sampling (90% confidence at $\pm 10\%$ precision for herbaceous plant communities and 80 - 100% for tree and shrub communities).

t = Student's t-value for the appropriate confidence level and for degrees of freedom = $t_{90} = 1.645$ and $t_{80} = 1.282$.

s = Standard deviation

p = Precision of test. P = .10 in all tests, meaning that the population mean has been estimated to \pm of its true value at the statistical confidence level corresponding to the t-values used (90% or 80% confidence).

x = The mean of the samples used in the sample adequacy test. The mean of all cover values (total living cover) is normally used.

After a minimum of 10 quadrats have been sampled, the sample adequacy test will be tried. Normally it will indicate that more sampling will be required. Sampling may stop when the actual sample size equals or exceeds N, the adequate sample size. Utah DOGM guidelines also allow sampling to be considered adequate when 40 or 50 quadrats have been observed, even if the formula for sampling adequacy has not been satisfied.

Trees, saplings and larger shrubs (i.e. bushes, not the small woody shrubs like Oregon grape) densities will be sampled by the point-quarter method.

When cover and density values for woody plants and understory vegetation at reclaimed areas are similar to those at the corresponding reference areas (within ± 10 percent), productivity measurements will be taken. This will be done by the clipped quadrat method using 15 to 40.5 m x .5 m = .25 m² quadrats. Clippings are to be separated by the categories shrub, grass, and forb. Tree vegetation is not clipped. The clippings are to be oven dried at 105 C for 24 hours and weighed to the nearest 0.1 gram. Productivity of shrubs, grasses and forbs in pounds per acre or kilograms per hectare will then be calculated from the weights and areas from which they were clipped. Reference areas will also be sampled in the same way.

Comparison of reclaimed areas to reference areas will be by unpaired t-test using the sample means per quadrat for cover, density and productivity (total living cover - not individually by species).

The null hypothesis for each t-test shall be $H_0: x_d - x_r = 0$. "There is no difference between the means for the measured parameter in the disturbed community and the reference area." The null hypothesis shall be rejected when the calculated t-value exceeds the table t-value for 90 percent statistical confidence and degrees-of freedom = $N-1$ where N is the number of samples in the test. Whenever a test results in rejection of the null hypothesis, the alternative hypothesis must be accepted. In each case the alternative hypothesis is $H_1: x_d - x_r \neq 0$. "There is a difference between the means of the measured parameter in the disturbed and referenced communities." If the alternative hypothesis is accepted, and the value $s_d - x_r$ is negative, reclamation has not yet achieved a standard of success sufficient to release the bond. If the alternative hypothesis is accepted and $s_d - x_r$ is positive, successful reclamation is proven and further testing of that community is no longer necessary. If the null hypothesis is accepted, the standard for success has also been met and no further testing of that community will be required (i.e., there is no difference between the disturbed community and the reference area).

R614-301-341-300 Field Trial Test Plots

At the request of OSM and DOGM, U.S Fuel conducted a field trial program that consisted of five field test plots at different locations and field work to follow the progress of the sites and summarize the results of the program. The intent of the program was to verify that reclamation can be accomplished at various sites around the permit area. The complete program summary and results can be referenced in Appendix III-5.

R614-301-342 FISH AND WILDLIFE ENHANCEMENT - POSTMINING PHASE

342.100 The primary post-mining land use that reclamation will attempt to provide for is wildlife habitat and secondarily for cattle grazing. The mine site areas will be reclaimed primarily with wildlife usage in mind, while the reclamation around Hiawatha will be designed to accomodate both wildlife and cattle grazing.

Revegetation in the mine plan area will seek to enhance forage values of the reclaimed area sites thus tailoring them to the needs of wildlife and minimizing the undesirable shrubs found in adjacent areas.

Existing culverted stream diversions will be removed during the regrading operations at the mine sites. Open channels will be restored and riparian habitat re-established along the channel. Riprap will be placed in the channel to prevent excessive erosion.

342.200 Species of plants to be utilized for reclamation purposes have been chosen based on their nutritional value for wildlife and their ability to enhance the wildlife habitat long after bond release has been obtained. The selected plants will be grouped and distributed in a manner which optimizes the edge effect, cover and other benefits they will provide.

R614-301-350 PERFORMANCE STANDARDS**R614-301-351 General Requirements**

All coal mining and reclamation operations will be carried out according to plans provided under R614-301-330 through R614-301-340.

R614-301-352 Contemporaneous Reclamation

Revegetation on land that was disturbed by the active, permitted mining plan will occur as contemporaneously as practicable.

R614-301-353 Revegetation: General Requirements

A vegetative cover that is in accordance with the approved permit and reclamation plan or otherwise acceptable, will be established on regraded disturbed areas. The cover will be: diverse, effective and permanent; comprised of native species or desirable introduced species approved by the Division; equal in extent of cover to the natural vegetation of the area; and capable of stabilizing the soil surface.

The reestablished plant species will: be compatible with the approved postmining land use; have the same seasonal characteristics of growth as the original vegetation; be capable of plant succession and self-regeneration; be compatible with the plant and animal species of the area; and meet the requirements of applicable Utah and federal species laws or regulations.

R614-301-354 Revegetation: Timing

Disturbed areas will be planted during the first normal period for favorable planting after replacement of the plant-growth medium.

R614-301-355 Revegetation: Mulching And Other Soil Stabilizing Practices

Suitable mulch and other soil stabilizing practices will be used on areas that have been regraded and covered with topsoil when necessary to control erosion and stabilize soil. Specific details for various sites can be found in Chapter III, Soils and part 341.230 of this chapter.

R614-301-356 Revegetation: Standards For Success

Successful revegetation will be judged according to DOGM approved methods for the postmining land use of fish and wildlife habitat. Siltation structures will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated.

R614-301-357 Revegetation: Extended Responsibility Period

No response necessary.

R614-301-358 Protection Of Fish, Wildlife, And Related Environmental Values

The operator will, to the extent possible using the best technology currently available, minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and will achieve enhancement of such resources where practicable.

Chapter III Bibliography

Bio/West, Inc., 1980, Vegetation Survey Of U.S. Fuel Company Property, Hiawatha, Utah, Final Report PR-41-1.

Bio/West, Inc., 1983, Vegetation Of The U.S. Fuel Company Property, Hiawatha, Utah: A Consolidation Of Data Collected During The 1980 And 1981 Field Season.

Department of the Interior, 1980, Development Of Coal Resources In Central Utah, United States Geological Survey, Denver, Colorado FES 79-27.

Soil Conservation Service, 1981, Vegetation Survey For U.S. Fuel Company.

Soil Conservation Service, June, 1988, Soil Survey of Carbon Area, Utah

User Guide To Vegetation, Mining And Reclamation In The West. Ogden, Utah, U.S.D.A. Forest Service General Technical Report INT-64.

Utah Division of Wildlife Resources, 1987, Species List of Vertebrate Wildlife That Inhabit Southeastern Utah.

Utah Division of Wildlife Resources, Nov., 1981, Coal Conveyors and Mule Deer Movement.

APPENDIX III-1

VEGETATION SURVEY OF U.S. FUEL COMPANY PROPERTY,
HIAWATHA, UTAH

Bio/West, Inc.

October, 1980

Final Report
VEGETATION SURVEY OF U.S. FUEL COMPANY PROPERTY,
HIAWATHA, UTAH

PR-41-1

Submitted to
United States Fuel Company
Hiawatha, Utah
Order No. H-13716

Prepared by
Christopher A. Call
and
Jerry R. Barker
Range Ecologists

Submitted by
BIO/WEST, Inc.
P. O. Box 3226
Logan, Utah 84321

October 1980

10/30/80

Bob Eccli

U.S. Fuel Co.

Hiawatha, Utah 84527

Dear Bob,

I'm sorry about the confusion concerning the endangered plant species near the proposed King 5 and King 6 facilities. After calling several of the "experts" in the state, I finally found a publication which states that Eriogonum corymbosum var. dauidsei has been removed from the Endangered Species List for taxonomic reasons. So, you can delete the following statements from the vegetation report:

pg. 7 delete " (including the endangered species Eriogonum corymbosum var. dauidsei) "

pg. 25 delete the entire sentence " The endangered plant species Eriogonum in the mountain brush vegetation type at higher elevations. "

In the proposed disturbance section of the report, make the following negative declaration " There are no threatened or endangered plant species in any of the areas of proposed disturbance." The red hatch marks and the legend for Eriogonum corymbosum var. dauidsei will have to be removed from the accompanying maps. If there are any more questions or problems please let me know.

Sincerely,

Chris Call

TABLE OF CONTENTS

	Page
INTRODUCTION	1
METHODOLOGY	1
Disturbed Areas	6
Areas of New Disturbance	8
Reference Areas	45
LITERATURE CITED	80

LIST OF TABLES

Table		Page
1	Acreages of each vegetation type and their percentages of the total permit area acreage	2
2	Acreages of each vegetation type found in disturbed areas (and areas of new disturbance) and their percentages of the total acreage of each type in the permit area	2
3	Major plant species assumed to have been present prior to disturbance at the portal site in the Right Fork of Miller Creek	9
4	Major plant species assumed to have been present prior to disturbance at the King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek	10
5	Major plant species assumed to have been present prior to disturbance at the King 6 Mine (King Mine) in the Left Fork of Miller Creek	14
6	Major plant species assumed to have been present prior to disturbance at the coal preparation plant and waste material disposal site near the town of Hiawatha	18
7	Major plant species assumed to have been present prior to disturbance at the Blackhawk Mine	19
8	Major plant species assumed to have been present prior to disturbance at the Mohrland Mine in Mohrland Canyon	21
9	Tree composition by size class for the mixed conifer vegetation type within the proposed King 7 and King 8 mine areas in Mohrland Canyon	26
10	Tree composition by size class for the pinyon-juniper woodland type within proposed disturbance areas	29
11	Tree composition by size class for the riparian vegetation type within the proposed King 7 and King 8 mine areas in Mohrland Canyon, sampling site 9 (possible yard area, transportation area)	31
12	Major species within proposed King 7 and King 8 mine areas in Mohrland Canyon, sampling site 6 (alternative site for upper seam portal above old Mohrland Mine)	33

LIST OF TABLES (Continued)

Table	Page
13 Major species within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 7 (alternative seam portal sites and possible yard areas near old Mohrland Mine)	35
14 Major species present within proposed disturbance below King 6 Mine (King Mine) in the Left Fork of Miller Creek, sampling site 4 (conveyor system, coal storage and loading areas)	37
15 Major species present with proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 8 (conveyor system and loading area)	39
16 Major species present within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 11 (mine facilities, loading and transportation areas)	40
17 Major species present within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 9 (possible yard area, transportation area)	41
18 Major species present within proposed conveyor system route from King 4 and King 5 mines in the Middle Fork of Miller Creek to the coal preparation plant at Hiawatha, sampling site 3	43
19 Major species present within proposed King 7 and King 8 mine area, sampling site 10 (mine facilities, loading and transportation areas)	44
20 Major species present within reference area 1 (above King 4 and King 5 Mines [Hiawatha Mine] in the Middle Fork of Miller Creek)	46
21 Major species present within reference area 2 (above King 4 and King 5 mines [Hiawatha Mine] in the Middle Fork of Miller Creek)	48
22 Major species present within reference area 3 (along side lower portion of proposed conveyor system from King 4 and King 5 mines [Hiawatha Mine] to the coal preparation plant in Hiawatha)	49
23 Major species present within reference area 4 (near proposed conveyor system and coal storage and loading area below King 6 Mine [King Mine] in the Left Fork of Miller Creek)	50

LIST OF TABLES (Continued)

Table	Page
24 Major species present within reference area 5 (near perimeter of waste disposal area near town of Hiawatha)	52
25 Major species present within reference area 6 (next to proposed, alternative upper seam portal site above old Mohrland Mine in Mohrland Canyon)	53
26 Major species present within reference area 7 (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon)	55
27 Major species present within reference area 8 (near proposed conveyor system and loading area of King 7 and King 8 mine area in Mohrland Canyon)	57
28 Major species present within reference area 9 (near proposed yard and transportation areas of King 7 and King 8 mine area in Mohrland Canyon)	58
29 Major species present within reference area 10 (near proposed mine facilities and loading and transportation areas of King 7 and King 8 mine area in Mohrland Canyon)	60
30 Major species present within reference area 11 (near proposed mine facilities and loading and transportation areas of King 7 and King 8 mine area in Mohrland Canyon)	61
31 Similarities between reference area 1 and disturbed areas at the King 4 and King 5 mines (Hiawatha Mine) and the Blackhawk Mine	62
32 Similarities between reference area 2 and disturbed areas at the portal in the Right Fork of Miller Creek, the King 4 and King 5 mines (Hiawatha Mine), the King 6 Mine (King Mine), and the Blackhawk Mine	63
33 Similarities between reference area 3 and the proposed conveyor system from King 4 and 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek to the coal preparation point near Hiawatha	64
34 Similarities between reference area 4 and the disturbed area at the King 6 Mine (King Mine), the proposed conveyor system from King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek to the coal preparation plant near Hiawatha, and the proposed conveyor system and coal storage and loading area below the King 6 Mine (King Mine)	65

LIST OF TABLES (Continued)

Table	Page
35 Similarities between reference area 5 and the disturbed waste disposal area near the town of Hiawatha	66
36 Similarities between reference area 6 and proposed alternative upper seam portal site above old Mohrland Mine in Mohrland Canyon	67
37 Similarities between reference area 7 and proposed King 7 and King 8 mine alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon	68
38 Similarities between reference area 8 and proposed King 7 and King 8 mine conveyor system and loading area in Mohrland Canyon	69
39 Similarities between reference area 9 and proposed King 7 and King 8 mine yard and transportation areas in Mohrland Canyon	70
40 Similarities between reference area 10 and proposed King 7 and King 8 mine facilities and loading and transportation areas in Mohrland Canyon	71
41 Similarities between reference area 11 and proposed King 7 and King 8 mine facilities and loading and transportation areas in Mohrland Canyon	72
42 Tree composition by size class for reference areas within the mixed conifer vegetation type	73
43 Tree composition by size class for the reference area in the riparian vegetation type	79

INTRODUCTION

Several vegetation types occur within the boundaries of the U.S. Fuel mining permit area. This diversity of vegetation is primarily due to differences in elevation, moisture, temperature, topography, aspect, and soils. Ten vegetation types were used to describe the vegetation on the permit area: 1) barren land; 2) pinyon-juniper woodland; 3) riparian; 4) sagebrush; 5) mountain brush; 6) grassland; 7) mixed conifer; 8) mixed conifer-aspen; 9) aspen; and 10) high elevation sagebrush-grass.

METHODOLOGY

Vegetation types on the mining permit area and adjacent areas were identified and mapped (Figure 1) by field reconnaissance and the use of aerial photographs. The acreages of the vegetation types and their percentages of the total permit area acreage (Table 1) were determined from Figure 1. The acreages of each vegetation type found in disturbed areas and areas of new disturbance, and their percentages of the total acreage of each vegetation type in the permit area (Table 2) were determined from Figures 1-7. Vegetation existing within the disturbed areas prior to mining was inferred from vegetation on adjacent, undisturbed areas.

Table 1. Acreages of each vegetation type and their percentages of the total permit area acreage.

Vegetation type	Acreage	% of permit area
Aspen	2,386	12.4
Barren Land	52	0.2
Grassland	582	3.0
High Elevation Sagebrush-Grass	1,122	6.0
Mixed Conifer	7,743	40.3
Mixed Conifer-Aspen	2,516	13.1
Mountain Brush	1,862	9.7
Pinyon-Juniper Woodland	2,465	12.8
Riparian	212	1.1
Sagebrush	266	6.0
	19,206	100.0

Table 2. Acreages of each vegetation type found in disturbed areas (and areas of new disturbance) and their percentages of the total acreage of each type in the permit area.

Vegetation type	Acreage	% of vegetation type
	Disturbed (New disturbance)	Disturbed (New disturbance)
Mixed Conifer	8.5 (53.1)	0.1 (0.7)
Mountain Brush	4.0 (3.8)	0.2 (0.2)
Pinyon-Juniper	260.0 (17.5)	10.5 (0.7)
Riparian	1.0 (1.7)	0.5 (0.8)
Sagebrush	(24.3)	(9.1)

Total Disturbance = 373.9 acres.

Reference areas and areas of new disturbance were sampled for aerial cover, species composition, productivity, tree density, and distribution of tree size-classes (diameter at breast height). Each 45,000 ft² (4200 m²) sampling area was marked with four metal T-posts. Percent aerial cover, litter cover, rock, and bareground were determined by the step-point method (Evans and Love 1957). The starting point and direction of each 20 point transect were randomly selected for each sampling area. Species composition was determined by listing the species hit at points along the same transects. Productivity was determined by clipping grasses, forbs, and current year's shrub growth within a 1 m² frame randomly placed along the step-point transects. Clipped plant material was oven-dried at 120° F (49° C) for 48 hours and weighed on a Metler top-loading balance. Tree density was measured by the point-centered quarter method (Mueller-Dombois and Ellenberg 1974). Quarters were established by using the four corners of the 1 m² productivity frame. Tree size classes were determined by measuring the circumference at breast height of the nearest tree in each quarter. Due to the branching habit of Rocky Mountain juniper, Utah juniper, and pinyon pine, it was necessary to take basal circumference readings. For trees smaller than 4 feet (1.2 m) in height, circumference was also measured at the base of the tree. All circumference measurements were converted to diameter measurements.

Sample adequacy for the representative cover and productivity parameters was determined by using the following equation:

$$m = \frac{t^2 s^2}{D^2} \quad (\text{Snedecor and Cochran 1967})$$

where: m = the minimum number of observations needed,
 t = t distribution value for a given level of confidence,
 s^2 = the variance estimate from preliminary vegetation
sampling, and
 D = the level of accuracy desired for the estimate of
the mean.

Sample adequacy for aerial cover estimates was determined after completing 10 step-point transects at each area. Sample adequacy for productivity measurements was determined after clipping and weighing plant material from 25 plots at each area. A 90 percent confidence level with a 10 percent error of the mean was used to calculate the proper sample size for aerial cover estimates. An 85 percent confidence level with a 15 percent error of the mean was used to calculate the proper sample size for productivity measurements. Additional sampling was performed at those areas where preliminary sample sizes were inadequate.

Preliminary data were collected between August 21 and 27, 1980, and supplementary data were collected October 7, 1980. Preliminary data were analyzed between September 17 and 23, 1980, and supplementary data were analyzed October 9, 1980.

The following persons (all employed by BIO/WEST, Inc., Logan, Utah 84321) were involved in the collection of the data:

Chris Call

Jerry Barker

Jim Albee

Alan Tye

Mike Madany

Haile Tamrat

The following persons (employed by BIO/WEST, Inc., Logan, Utah 84321) analyzed the data:

Chris Call

Jerry Barker

Persons consulted in preparation of this vegetation report:

Larry Dalton
Wildlife Biologist
Division of Wildlife Resources
Price, Utah 84501

Ron Dickemore
Range Conservationist
U.S. Forest Service
Manti LaSal National Forest District
Price, Utah 84501

Bob Graves
Range Wildlife Specialist
U.S. Forest Service
Manti LaSal National Forest District
Price, Utah 84501

Steve Spencer
Range Conservationist
U.S. Forest Service
Manti LaSal National Forest District
Price, Utah 84501

Gary Sey
District Forest Ranger
U.S. Forest Service
Manti LaSal National Forest District
Price, Utah 84501

Bob Eccli
Mining Engineer
U.S. Fuel Company
Hiawatha, Utah 84527

Disturbed Areas

Four vegetation types (mixed conifer, mountain brush, pinyon-juniper woodland, and riparian) were disturbed by past mining activities. More than one of these vegetation types was disturbed at several of the existing mines. Even with variations in slope, exposure and elevation between the disturbed areas, the visually dominant overstory and understory species remained fairly constant.

Mixed Conifer Vegetation Type

The portal area in the Right Fork of Miller Creek (elevation 8,400 feet), and portions of the King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek (elevation 8,300 feet), the King 6 Mine (King Mine) in the Left Fork of Miller Creek (elevation 8,200 feet), the Blackhawk Mine southwest of the town of Hiawatha (elevation 8,200 feet), and the Mohrland Mine in Mohrland Canyon (elevation 7,800 feet) are in this mixed conifer type (Figure 1). The dominant tree species were Douglas fir, white fir, quaking aspen, and Rocky Mountain maple. The dominant understory species were Saskatoon serviceberry, mallow ninebark, mountain snowberry, creeping barberry, myrtle pachistima, common juniper, mountain mahogany, aster, salina wildrye, and fringed brome.

Mountain Brush Vegetation Type

Portions of the King 4 and King 5 mines (Hiawatha Mine) and the Blackhawk Mine are in this mountain brush type (Figure 1). The dominant overstory species were Saskatoon serviceberry, Gambel oak, mountain mahogany, mountain snowberry, and big sagebrush. Dominant understory species were green ephedra, eriogonum (including the endangered species Eriogonum corymbosum var. dauidsei), salina wildrye, and Indian ricegrass.

Pinyon-Juniper Woodland Vegetation Type

Portions of the King 6 Mine (King Mine) and the Mohrland Mine, and all of the coal preparation plant-waste disposal complex next to the town of Hiawatha are in this pinyon-juniper woodland type (Figure 1). The dominant trees were Utah juniper and pinyon pine. The dominant understory species were big sagebrush, black sagebrush, pricklypear cactus, Saskatoon serviceberry, mountain mahogany, mountain snowberry, hoary aster, Salina wildrye, and Indian ricegrass.

Riparian Vegetation Type

Small portions of the King 4 and King 5 mines (Hiawatha Mine), the King 6 Mine (King Mine), and the Mohrland Mine are in this riparian type (Figure 1). The dominant tree species were narrowleaf cottonwood, sandbar willow, Douglas fir, and quaking aspen. The dominant understory species were big sagebrush, rubber rabbitbrush, Wood's rose, mountain snowberry, western virginsbower, horsetail, sweetclover, sedge, and American bullrush.

Several other species in each vegetation type were assumed to have been present prior to disturbance at each mine site (Tables 3-8).

Areas of New Disturbance

Four vegetation types (mixed conifer, pinyon-juniper woodland, riparian, and sagebrush) will be disturbed by proposed mining activities. As with previously disturbed areas, more than one vegetation type will be disturbed at the proposed mines and associated facilities.

Mixed Conifer Vegetation Type

The King 7 and King 8 mines and associated yard areas in Mohrland Canyon (elevation 7,300 to 8,100 feet), and a portion of the conveyor system (elevation 7,900 to 8,100 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in the town of Hiawatha will be in this mixed conifer type (Figures 1-7). The dominant trees are white fir, Douglas fir, Rocky Mountain maple, and quaking aspen. Dominant shrubs include Saskatoon serviceberry, creeping barberry, mountain mahogany, mallow ninebark, myrtle pachistima, and mountain snowberry. Dominant forbs and grasses include blueleaf aster, Wyoming painted-cup, goldenrod, Salina wildrye, needle-and-thread grass, and Indian ricegrass. All of the mixed conifer areas are in good condition. Weedy species are low in frequency and cover, open areas have good stands of desirable forbs and perennial grasses, and trees are not showing signs of widespread insect and disease damage. However, due to fire suppression, the fuel load (fallen trees and branches) has

Table 3. Major plant species assumed to have been present prior to disturbance at the portal site in the Right Fork of Miller Creek.

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
Forb	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Arnica cordifolia</u>	Heartleaf arnica
	<u>Lupinus</u> sp.	Lupine
Grass	<u>Swertia perennis</u>	Alpinebog swertia
	<u>Elymus salina</u>	Salina wildrye
	<u>Bromus ciliatus</u>	Fringed brome

Table 4. Major plant species assumed to have been present prior to disturbance at the King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek.

Life form	Botanical name	Common name
<u>Vegetation Type: Mountain Brush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Quercus gambellii</u>	Gambel oak
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Cirsium sp.</u>	Thistle
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Machaeranthera linearis</u>	Hoary aster
Grass	<u>Solidago sp.</u>	Goldenrod
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass

Table 4. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amalanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Ribes cereum</u>	Wax currant
	<u>Shepherdia canadensis</u>	Russet buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Astragalus</u> sp.	Locoweed
	<u>Lupinus</u> sp.	Lupine
	<u>Osmorhiza</u> sp.	Sweetroot
	<u>Swertia perennis</u>	Alpinebog swertia
	<u>Viola</u> sp.	Violet
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Bromus ciliatus</u>	Fringed brome

Table 4. Continued

Life form	Botanical Name	Common name
<u>Vegetation Type: Riparian</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>E. hyemale</u>	Western scouring rush
	<u>Lupinus sp.</u>	Lupine
	<u>Melilotus officinalis</u>	Yellow sweetclover
	<u>Solidago sp.</u>	Goldenrod

Table 4. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian (Continued)</u>		
Grass (Grasslike)	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex</u> sp.	Sedge
	<u>Juncus</u> sp.	Rush
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Scirpus americanus</u>	American bullrush
	<u>Stipa cominata</u>	Needle-and-thread grass

Table 5. Major plant species assumed to have been present prior to disturbance at the King 6 Mine (King Mine) in the Left Fork of Miller Creek.

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Packistima myrsinites</u>	Myrtle packistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Lupinus</u> sp.	Lupine
	<u>Machaeranthera canescens</u>	Hoary aster

Table 5. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie junegrass
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah fir
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Symphicarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
<u>Yucca harrimaniae</u>	Harriman yucca	

Table 5. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland (Continued)</u>		
Forb	<u>Arabis</u> sp.	Rockcress
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys
	<u>Machaeranthera linearis</u>	Hoary aster
	<u>Solidago</u> sp.	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass
<u>Vegetation Type: Riparian</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Rhus trilobata</u>	Skunk bush sumac
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed

Table 5. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian (Continued)</u>		
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum</u> sp.	Horsetail
	<u>Isomopsis aggregata</u>	Wyoming painted-cup
	<u>Melilotus officianalis</u>	Yellow sweetclover
Grass (Grasslike)	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex</u> sp.	Sedge
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa commata</u>	Needle-and-thread grass

Table 6. Major plant species assumed to have been present prior to disturbance at the coal preparation plant and waste material disposal site near the town of Hiawatha.

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Pinus edulis</u>	Pinyon pine
	<u>Juniperus osteosperma</u>	Utah juniper
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Opuntia</u> sp.	Prickly pear cactus
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Talinum parviflorum</u>	Fameflower
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Sporobolus airaides</u>	Alkali sacaton
	<u>Stipa comata</u>	Needle-and-thread grass

Table 7. Major plant species assumed to have been present prior to disturbance at the Blackhawk Mine.

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
Forb	<u>Symphoricarpos creophilus</u>	Mountain snowberry
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
Grass	<u>Solidago</u> sp.	Goldenrod
	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Vegetation Type: Mountain Brush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper

Table 7. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mountain Brush (Continued)</u>		
<u>Tree (Continued)</u>		
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Eriogonum sp.</u>	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 8. Major plant species assumed to have been present prior to disturbance at the Mohrland Mine in Mohrland Canyon.

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia</u> sp.	Pricklypear
Forb	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Astragalus</u> sp.	Locoweed
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum</u> sp.	Eriogonum
Grass	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir

Table 8. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
<u>Tree (Continued)</u>		
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>P. ponderosa</u>	Ponderosa pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Clematis ligustifolia</u>	Western Virginsbower
	<u>Eriogonum</u> sp.	Eriogonum

Table 8. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
Forb (Continued)		
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago canadensis</u>	Canada goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie junegrass
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Vegetation Type: Riparian</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ribes aureum</u>	Wax currant

Table 8. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian (Continued)</u>		
<u>Shrub (Continued)</u>		
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>Grindelia squarrosa</u>	Curlycup gumweed
	<u>Ipomopsis aggregata</u>	Wyoming painted-cup
	<u>Lupinus</u> sp.	Lupine
	<u>Melilotus officinalis</u>	Yellow sweetclover
Grass (Grasslike)	<u>Agropyron</u> sp.	Wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex</u> sp.	Sedge
	<u>Juncus</u> sp.	Rush
	<u>Scirpus americanus</u>	American bullrush

built up significantly in several areas. Relatively young stands of conifers occur in the areas of proposed disturbance (Table 9). White fir is the only tree species with individuals distributed in larger size classes. Absolute tree densities range from 483 to 538 trees per acre.

Pinyon-Juniper Woodland Vegetation Type

The conveyor system, coal storage area and loading area below the King 6 Mine (King Mine) in the Left Fork of Miller Creek (elevation 7,800 to 8,100 feet), a portion of the conveyor system (elevation 7,400 to 7,600 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha, and a portion of the conveyor system and King 7 and King 8 mine facilities in Mohrland Canyon (elevation 7,100 to 7,800 feet) will be in this pinyon-juniper woodland type (Figures 1-7). The dominant tree species are Utah juniper and pinyon pine. The dominant understory species are saskatoon serviceberry, big sagebrush, mountain mahogany, low rabbitbrush, yucca, goldenrod, Salina wildrye, western wheatgrass and Indian ricegrass. The endangered plant species Eriogonum corymbosum var. dauidsei is found in most of the areas of proposed disturbance, but it is not as prevalent as in the mountain brush vegetation type at higher elevations. Several of the sampling sites had cliffs and cutcrops with very little plant cover. Understory cover is also limited directly beneath the juniper and pinyon trees. Pinyon pine was more evenly distributed among the size classes compared to Utah juniper whose population was comprised mainly of seedlings and

Table 9. Tree composition by size class for the mixed conifer vegetation type within the proposed King 7 and King 8 mine areas in Mohrland Canyon.

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Sampling site 6 (alternative site for upper seam portal above old Mohrland Mine)						
<u>Abies concolor</u>	20	22	10	10	15	84
<u>Pseudotsuga menziesii</u>	3	7	1	0	1	15
<u>Populus tremuloides</u>	0	1	0	0	0	1

% of total	29	38	14	8	11	100
Absolute Density = 538 trees/acre						
B. Sampling site 7 (alternative seam portals and possible yard areas near old Mohrland Mine)						
<u>Abies concolor</u>	27	9	1	2	1	54
<u>Pinus edulis</u>	3	4	3	4	3	22
<u>Psuedotsuga menziesii</u>	7	5	2	1	1	21

Table 9. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
B. Sampling site 7 (continued)						
<u>Juniperus scopulorum</u>	2	0	0	0	0	2
<u>J. osteosperma</u>	1	0	0	0	0	1

% of total	53	24	8	9	6	100
Absolute Density = 483 trees/acre						

young trees (Table 10). Absolute tree densities range from 199 to 318 trees per acre.

Riparian Vegetation Type

A portion of the conveyor system (elevation 7,200 to 7,400 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha, and a portion of the King 7 and King 8 mine facilities in Mohrland Canyon (elevation 7,300 to 7,400 feet) will be in this riparian type (Figures 1-7). The dominant tree species are narrowleaf cottonwood, sandbar willow, river birch and quaking aspen. Dominant understory species include saskatoon serviceberry, rabbitbrush, silver buffaloberry, Wood's rose, mountain snowberry, aster, western virginsbower, horsetail, yellow sweetclover, sedge, Indian ricegrass, and needle-and-thread grass. Shrubs such as low and rubber rabbitbrush are spreading into the streambank areas from disturbed areas along roadsides, and these root-sprouting shrubs are crowding out desirable forbs and perennial grasses. Narrowleaf cottonwood has some individuals in larger size classes, but the remaining tree species are mainly comprised of seedlings and young trees (Table 11). Absolute tree density is approximately 617 trees per acre.

Sagebrush Vegetation Type

Portions of the conveyor system (elevation 7,150 to 7,300 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha, and portions of the King 7 and King 8 mine

Table 10. Tree composition by size class for the pinyon-juniper woodland type within proposed disturbance areas.

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Sampling site 4 (conveyor system, coal storage and loading areas below King 6 mine (King Mine) in the Left Fork of Miller Creek)						
<u>Pinus edulis</u>	24	13	6	7	5	68
<u>Juniperus osteosperma</u>	6	1	1	2	1	18
<u>Abies concolor</u>	3	1	1	0	0	6
<u>Juniperus scopulorum</u>	1	3	0	0	1	6
<u>Psuedotsuga menziesii</u>	0	1	0	0	1	2

% of total	42	24	10	14	10	100
Absolute Density = 199 trees/acre						
B. Sampling site 8 (conveyor system and loading area in King 7 and King 8 mine area in Mohrland Canyon)						
<u>Pinus edulis</u>	30	10	7	5	1	66

Table 10. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
B. Sampling site 8 (continued)						
<u>Juniperus osteosperma</u>	12	6	3	1	5	34

% of total	54	20	12	7	7	100
Absolute Density = 302 trees/acre						
C. Sampling site 11 (mine facilities, loading and transportation areas in King 7 and King 8 mine area in Mohrland Canyon)						
<u>Pinus edulis</u>	36	11	9	11	7	95
<u>Juniperus osteosperma</u>	1	1	2	0	0	5

% of total	46	15	14	14	11	100
Absolute Density = 318 trees/acre						

Table 11. Tree composition by size class for the riparian vegetation type within the proposed King 7 and King 8 mine areas in Mohrland Canyon, sampling site 9 (possible yard area, transportation area).

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Populus angustifolia</u>	22	9	7	6	5	62
<u>Acer glabrum</u>	9	1	0	0	0	13
<u>Juniperus osteosperma</u>	2	3	1	1	0	9
<u>Abies concolor</u>	3	3	0	0	0	8
<u>Juniperus scopulorum</u>	1	2	0	0	0	3
<u>Betula occidentalis</u>	2	0	0	0	0	2
<u>Pinus edulis</u>	2	0	0	0	0	2
<u>Pseudotsuga menziesii</u>	0	0	0	0	1	1

% of total	51	22	10	9	8	100

Absolute Density = 617 trees/acre

facilities in Mohrland Canyon (elevation 7,000 to 7,150 feet) will be in this sagebrush type (Figures 1-7). The dominant overstory is comprised almost exclusively of big sagebrush. Dominant understory species include rubber rabbitbrush, pricklypear cactus, rose, broom snakeweed, hoary aster, western virginsbower and Indian ricegrass. All areas of proposed disturbance are old townsites (circa 1900 to 1915), and many still have building foundations remaining. This prior disturbance has led to the development of overgrown sagebrush stands with relatively little understory cover. Density measurements were not taken for this type.

Several other species in each vegetation type were present in the areas of proposed disturbance (Tables 12 to 19).

Other perturbations such as fire, grazing, plowing, spraying, and seeding have occurred primarily on high elevation Forest Service land near the western boundary of the permit area. This Forest Service land comprises less than 5 percent of the Gentry Allotment which supports 4,800 AUM's (cattle) during the grazing season. All areas of new disturbance will be below this Forest Service land.

The permit area provides summer and winter range for portions of Deer Herd Unit 33 (1060 total AUM's), Deer Herd Unit 34 (3756 total AUM's), an elk herd (1918 total AUM's), and a limited moose population (320 total AUM's). The exact number of AUM's for each wildlife species on the permit area is not known.

Table 12. Major species within proposed King 7 and King 8 mine areas in Mohrland Canyon, sampling site 6 (alternative site for upper seam portal above old Mohrland Mine).

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Pinus flexilis</u>	Limber pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix</u> sp.	Willow
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Ribes cereum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Shepherdia canadensis</u>	Russet buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Astragalus</u> sp.	Locoweed
	<u>Fragaria</u> sp.	Strawberry

Table 12. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
Forb (Continued)		
	<u>Solidago canadensis</u>	Canada goldenrod
	<u>Viola</u> sp.	Violet
Grass	<u>Agropyron trachycalum</u>	Slender wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 13. Major species within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 7 (alternative seam portal sites and possible yard areas near old Mohrland Mine).

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>P. ponderosa</u>	Ponderosa pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Symphoricarpos oreophilus</u>	Mountain serviceberry
<u>Xanthocephalum sarothrae</u>	Broom snakeweed	
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Eriogonum sp.</u>	Eriogonum
	<u>Linum lewisii</u>	Lewis flax

Table 13. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
Forb (Continued)		
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago canescens</u>	Canada goldenrod
Grass (Grasslike)	<u>Agropyron sp.</u>	Wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex sp.</u>	Sedge
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie june grass

Table 14. Major species present within proposed disturbance below King 6 Mine (King Mine) in the Left Fork of Miller Creek, sampling site 4 (conveyor system, coal storage and loading areas).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer grandidentatum</u>	Big-tooth maple
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>P. ponderosa</u>	Ponderosa pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
<u>Yucca harrimaniae</u>	Harriman yucca	

Table 14. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland (Continued)</u>		
Forb	<u>Arabis</u> sp.	Rockcress
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys
	<u>Solidago</u> sp.	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Sitanion hysterix</u>	Bottlebrush squirrel-tail
	<u>Stipa commata</u>	Needle-and-thread grass

Table 15. Major species present with proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 8 (conveyor system and loading area).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Echinocereus triglochidiatus</u>	Echinocereus
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia</u> sp.	Pricklypear
	<u>Sclerocactus whipplei</u>	Sclerocactus
Forb	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Arenaria</u> sp.	Sandwort
	<u>Astragalus</u> sp.	Locoweed
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum</u> sp.	Eriogonum
Grass	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 16. Major species present within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 11 (mine facilities, loading and transportation areas).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia barkleyana</u>	Pricklypear
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Yucca harrimaniae</u>	Harriman yucca
	<u>Erigeron sp.</u>	Fleabane
	<u>Machaeranthera linearis</u>	Hoary aster
Grass	<u>Penstemon sp.</u>	Penstemon
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass

Table 17. Major species present within proposed King 7 and King 8 mine area in Mohrland Canyon, sampling site 9 (possible yard area, transportation area).

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. fremontii</u>	Fremont cottonwood
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>C. viscidiflorus</u>	Low rabbitbrush
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Opuntia sp.</u>	Pricklypear
	<u>Rhus trilobata</u>	Skunkbush sumac
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sherpherdia argenta</u>	Silver buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
<u>Xanthocephalum sarothrae</u>	Broom snakeweed	

Table 17. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian (Continued)</u>		
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>E. hyemale</u>	Western scouring-rush
	<u>Habenaria</u> sp.	Rain orchid
	<u>Hedesarum boreale</u>	Utah sweetvetch
	<u>Lupinus</u> sp.	Lupine
	<u>Melilotus alba</u>	White sweetclover
	<u>M. officinales</u>	Yellow sweetclover
	<u>Solidago canadensis</u>	Canada goldenrod
Grass (Grasslike)	<u>Agrostis</u> sp.	Bentgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>B. tectorum</u>	Cheatgrass brome
	<u>Calamagrostis</u> sp.	Reedgrass
	<u>Carex aurea</u>	Golden sedge
	<u>C. nebraskensis</u>	Nebraska sedge
	<u>Juncus</u> sp.	Rush
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa commata</u>	Needle-and-thread grass

Table 18. Major species present within proposed conveyor system route from King 4 and King 5 mines in the Middle Fork of Miller Creek to the coal preparation plant at Hiawatha, sampling site 3.

Life form	Botanical name	Common name
<u>Vegetation Type: Sagebrush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia</u> sp.	Pricklypear
	<u>Rosa</u> sp.	Rose
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis lugusticifolia</u>	Western Virginsbower
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Salsola kali</u>	Russian thistle
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa commata</u>	Needle-and-thread grass

Table 19. Major species present within proposed King 7 and King 8 mine area, sampling site 10 (mine facilities, loading and transportation areas).

Life form	Botanical name	Common name
<u>Vegetation Type: Sagebrush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia</u> sp.	Pricklypear
	<u>Rhus trilobata</u>	Skunk bush sumac
	<u>Rosa</u> sp.	Rose
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Lappula</u> sp.	Stickweed
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Sphaeralcea grossulariaefolia</u>	Gooseberryleaf globemallow
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Reference Areas

Eleven reference areas were selected in the five vegetation types which had existing disturbed areas and areas of proposed disturbance. All reference areas were located as close as possible to disturbed areas and areas of proposed disturbance without interfering with present and future mining activities (Figure 1). Species lists were developed for each reference area within the various vegetation types (Tables 20 to 30). Similarities between species composition, total aerial cover, productivity, geology, soils, slope and aspect were shown for reference areas, disturbed areas and areas of proposed disturbance (Tables 31 to 41). Tree density and size class were measured in reference areas in the mixed conifer, pinyon-juniper woodland, and riparian vegetation types (Tables 42 to 44).

Table 20. Major species present within reference area 1 (above King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek).

Life form	Botanical name	Common name
<u>Vegetation Type: Mountain Brush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>A. utahensis</u>	Utah serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Quercus gambellii</u>	Gambel oak
Forb	<u>Symphoricarpos creophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Cirsium</u> sp.	Thistle
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Machaeranthera linearis</u>	Hoary aster
	<u>Solidago</u> sp.	Goldenrod
<u>Viguiera multiflora</u>	Goldeneye	

Table 20. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mountain Brush (Continued)</u>		
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass

Table 21. Major species present within reference area 2 (above King 4 and King 5 mines [Hiawatha Mine] in the Middle Fork of Miller Creek).

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvoceus</u>	Mallow ninebark
	<u>Prunus virginiana</u>	Common chokecherry
	<u>Shepherdia canadensis</u>	Russet buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Arnica sp.</u>	Arnica
	<u>Astrogalus sp.</u>	Locoweed
	<u>Lupinus sp.</u>	Lupine
	<u>Osmorhiza sp.</u>	Osmorhiza
	<u>Swertia perennis</u>	Alpinebog swertia
	<u>Viola sp.</u>	Violet
Grass	<u>Elymus salina</u>	Salina wildrye

Table 22. Major species present within reference area 3 (along side lower portion of proposed conveyor system from King 4 and King 5 mines [Hiawatha Mine] to the coal preparation plant in Hiawatha).

Life form	Botanical name	Common name
<u>Vegetation Type: Sagebrush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia</u> sp.	Pricklypear
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Salsola kali</u>	Russian thistle
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 23. Major species present within reference area 4 (near proposed conveyor system and coal storage and loading area below King 6 Mine [King Mine] in the Left Fork of Miller Creek).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Yucca harrimaniae</u>	Harriman yucca
	Forb	<u>Artemisia ludoviciana</u>
<u>Eriogonum corymbosum</u>		Corymbed eriogonum
<u>Hymenoxys acaulis</u>		Stemless hymenoxys
<u>Machaeranthera linearis</u>		Hoary aster
<u>Solidago sp.</u>		Goldenrod

Table 23. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland (Continued)</u>		
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa commata</u>	Needle-and-thread grass

Table 24. Major species present within reference area 5 (near perimeter of waste disposal area near town of Hiawatha).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Opuntia</u> sp.	Pricklypear
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Talinum parviflorum</u>	Prairie flameflower
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Sporobolus airoides</u>	Alkali sacaton
	<u>Stipa commata</u>	Needle-and-thread grass

Table 25. Major species present within reference area 6 (next to proposed, alternative upper seam portal site above old Mohrland Mine in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix cascadiensis</u>	Cascades willow
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Low rabbitbrush
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Ribes cereum</u>	Wax currant
<u>Rosa woodsii</u>	Wood's rose	
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Fragaria</u> sp.	Strawberry
	<u>Lathyrus</u> sp.	Peavine

Table 25. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer (Continued)</u>		
<u>Forb (Continued)</u>		
	<u>Osmorhiza</u> sp.	Osmorhiza
	<u>Penstemon</u> sp.	Penstemon
	<u>Stellaria</u> sp.	Starwort
Grass	<u>Agropyron</u> sp.	Wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex</u> sp.	Sedge
	<u>Elymus salina</u>	Salina wildrye

Table 26. Major species present within reference area 7 (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Mixed Conifer</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Prunus virginiana</u>	Common chokecherry
	<u>Ribes aureum</u>	Golden currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sambucus curulea</u>	Blueberry elder
<u>Symphoricarpos oreophilus</u>	Mountain snowberry	

Table 26. Continued

Life form	Botanical name	Common name
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Chenopodium fremontii</u>	Fremont goosefoot
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Penstemon</u> sp.	Penstemon
	<u>Solidago canadensis</u>	Canada goldenrod
Grass	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie junegrass
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa fendleriana</u>	Mutton bluegrass

Table 27. Major species present within reference area 8 (near proposed conveyor system and loading area of King 7 and King 8 mine area in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia</u> sp.	Pricklypear
	<u>Rhus trilobata</u>	Skunk bush sumac
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Arabis</u> sp.	Rockcress
	<u>Astragalus</u> sp.	Locoweed
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Ipomopsis aggregata</u>	Skyrocket gilia
	<u>Lithospermum</u> sp.	Gromwell
Grass	<u>Bouteloua gracilis</u>	Blue grama
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 28. Major species present within reference area 9 (near proposed yard and transportation areas of King 7 and King 8 mine area in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Rhus trilobata</u>	Skunk bush sumac
	<u>Ribes aureum</u>	Golden currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle

Table 28. Continued

Life form	Botanical name	Common name
<u>Vegetation Type: Riparian (Continued)</u>		
<u>Forb (Continued)</u>		
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Conyza canadensis</u>	Canadian horseweed
	<u>Equisetum arvense</u>	Field horsetail
	<u>E. laevigatum</u>	Smooth horsetail
	<u>Erigeron sp.</u>	Fleabane
	<u>Grindelia squarrosa</u>	Curlycup gumweed
	<u>Ipomopsis aggregata</u>	Skyrocket gilia
	<u>Lupinus sp.</u>	Lupine
	<u>Melilotus alba</u>	White sweetclover
	<u>M. officianalis</u>	Yellow sweetclover
	<u>Solidago sparsiflora</u>	Goldenrod
Grass (Grasslike)	<u>Agropyron albicans</u>	Montana wheatgrass
	<u>Carex sp.</u>	Sedge
	<u>Hordeum jubatum</u>	Foxtail barley
	<u>Juncus balticus</u>	Baltic rush
	<u>Muhlenbergia asperifolia</u>	Alkali muhly
	<u>Scirpus americanus</u>	American bullrush

Table 29. Major species present within reference area 10 (near proposed mine facilities and loading and transportation areas of King 7 and King 8 mine area in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Sagebrush</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Rosa sp.</u>	Rose
Forb	<u>Chenopodium sp.</u>	Goosefoot
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Salsola kali</u>	Russian thistle
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 30. Major species present within reference area 11 (near proposed mine facilities and loading and transportation areas of King 7 and King 8 mine area in Mohrland Canyon).

Life form	Botanical name	Common name
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia sp.</u>	Pricklypear
	<u>Yucca harrimaniae</u>	Harriman yucca
Forb	<u>Ipomopsis aggregata</u>	Skyrocket gilia
	<u>Senecio sp.</u>	Groundsel
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 31. Similarities between reference area 1 and disturbed areas at the King 4 and King 5 mines (Hiawatha Mine) and the Blackhawk Mine.

Item	Reference Area 1	King 4 and 5 mines	Blackhawk Mine
<u>Vegetation Type: Mountain Brush</u>			
Species composition	25	19	14
Total aerial cover (%)	76	70-80	60-70
Productivity (g/m ²)	-	-	-
Geology	Blackhawk Formation	Blackhawk Formation	Blackhawk Formation
Soils			
Slope (degrees)	32°	25-35°	20-25°
Aspect	SSE	SSE	NNE

Table 32. Similarities between reference area 2 and disturbed areas at the portal in the Right Fork of Miller Creek, the King 4 and King 5 mines (Hiawatha Mine), the King 6 Mine (King Mine), and the Blackhawk Mine.

Item	Reference Area 2	Portal Area	King 4 and 5 mines	King 6 Mine	Blackhawk Mine
<u>Vegetation Type: Mixed Conifer</u>					
Species composition	22	17	21	25	18
Total aerial cover (%)	84	75-90	75-90	75-90	70-80
Productivity (g/m ²)	-	-	-	-	-
Geology	Blackhawk Formation				
<u>Soils</u>					
Slope (degrees)	31°	20-25°	30-35°	30-35°	20-25°
Aspect	NNW	NE	NNW	NNE	NNE

Table 33. Similarities between reference area 3 and the proposed conveyor system from King 4 and 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek to the coal preparation point near Hiawatha.

Item	Reference Area 3	Proposed conveyor System
<u>Vegetation Type: Sagebrush</u>		
Species composition	10	13
Total aerial cover (%)	54	39
Productivity (g/m ²)	67.14	59.22
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	4°	5°
Aspect	SSE	SSE

Table 34. Similarities between reference area 4 and the disturbed area at the King 6 Mine (King Mine), the proposed conveyor system from King 4 and King 5 mines (Hiawatha Mine) in the Middle Fork of Miller Creek to the coal preparation plant near Hiawatha, and the proposed conveyor system and coal storage and loading area below the King 6 Mine (King Mine).

Item	Reference Area 3	King 6 Mine	King 4 and 5 Mine Proposed Conveyor	King 6 Mine Proposed Conveyor
<u>Vegetation Type: Pinyon-Juniper Woodland</u>				
Species composition	26	25	24	32
Total aerial cover (%)	59	45-60	55.5	58.5
Productivity (g/m ²)	21.08	-	-	33.68
Geology	Masuk Shale	Blackhawk Formation	Masuk Shale	Masuk Shale
Soils				
Slope (degrees)	22°	20-25°	20°	20°
Aspect	SSE	SSE	S	SSE

Table 35. Similarities between reference area 5 and the disturbed waste disposal area near the town of Hiawatha.

Item	Disposal area	Reference Area 5
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Species composition	12	12
Total aerial cover (%)	46	45-60
Productivity (g/m ²)	-	-
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	3-4°	2-10°
Aspect	E	E

Table 36. Similarities between reference area 6 and proposed alternative upper seam portal site above old Mohrland Mine in Mohrland Canyon.

Item	Reference Area 6	Proposed portal site
<u>Vegetation Type: Mixed Conifer</u>		
Species composition	28	27
Total aerial cover (%)	89	75
Productivity (g/m ²)	26.15	13.81
Geology	Blackhawk Formation	Blackhawk Formation
Soils		
Slope (degrees)	32°	30°
Aspect	NNE	NNE

Table 37. Similarities between reference area 7 and proposed King 7 and King 8 mine alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon.

Item	Reference Area 7	Proposed portal sites and yard areas
<u>Vegetation Type: Mixed Conifer</u>		
Species composition	33	28
Total aerial cover (%)	71	78
Productivity (g/m ²)	22.85	25.78
Geology	Blackhawk Formation	Blackhawk Formation
Soils		
Slope (degrees)	38°	35°
Aspect	NNE	NNE

Table 38. Similarities between reference area 8 and proposed King 7 and King 8 mine conveyor system and loading area in Mohrland Canyon.

Item	Reference Area 8	Proposed conveyor system and loading area
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Species composition	21	19
Total aerial cover (%)	57	36
Productivity (g/m ²)	18.38	13.84
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	17°	15°
Aspect	SSE	SSE

Table 39. Similarities between reference area 9 and proposed King 7 and King 8 mine yard and transportation areas in Mohrland Canyon.

Item	Reference Area 4	Proposed yard and transportation areas
<u>Vegetation Type: Riparian</u>		
Species composition	38	42
Total aerial cover (%)	89.5	71.5
Productivity (g/m ²)	46.65	36.32
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	3-4°	3-4°
Aspect	ENE	E, ENE

Table 40. Similarities between reference area 10 and proposed King 7 and King 8 mine facilities and loading and transportation areas in Mohrland Canyon.

Item	Reference Area 9	Proposed loading and transportation areas
<u>Vegetation Type: Sagebrush</u>		
Species composition	9	14
Total aerial cover (%)	57	39
Productivity (g/m ²)	70.45	60.45
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	3°	3°
Aspect	NE	NE

Table 41. Similarities between reference area 11 and proposed King 7 and King 8 mine facilities and loading and transportation areas in Mohrland Canyon.

Item	Reference Area 10	Proposed loading and transportation areas
<u>Vegetation Type: Pinyon-Juniper Woodland</u>		
Species composition	12	17
Total aerial cover (%)	45	62
Productivity (g/m ²)	3.33	29.50
Geology	Masuk Shale	Masuk Shale
Soils		
Slope (degrees)	9°	7°
Aspect	NE	NE

Table 42. Tree composition by size class for reference areas within the mixed conifer vegetation type.

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Reference area 2 (above King 4 and King 5 mines [Hiawatha Mine] in the Middle Fork of Miller Creek)						
<u>Abies concolor</u>	45	3	1	0	1	62
<u>Pseudotsuga menziesii</u>	10	0	1	0	1	15
<u>Populus tremuloides</u>	10	1	0	0	0	14
<u>Acer glabrum</u>	5	1	0	0	0	8
<u>Picea pungens</u>	0	1	0	0	0	1

% of total	87	1	0	0	0	1

Absolute Density = 3,556 trees/acre

Table 42. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
B. Reference area 6 (next to proposed alternative upper seam portal site above old Mohrland Mine in Mohrland Canyon)						
<u>Abies concolor</u>	31	9	5	7	4	73
<u>Picea pungens</u>	7	1	0	0	1	10
<u>Pseudotsuga menziesii</u>	8	1	0	0	0	10
<u>Juniperus scopulorum</u>	3	2	0	0	0	6
<u>Pinus edulis</u>	1	0	0	0	0	1

% of total	63	16	6	9	6	100
Absolute Density = 1,440 trees/acre						
C. Reference area 7 (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon)						
<u>Abies concolor</u>	30	5	3	2	2	51
<u>Pseudotsuga menziesii</u>	9	6	2	0	7	31

Table 42. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
C. Reference area 7 (continued)						
<u>Pinus edulis</u>	3	1	3	1	1	11
<u>Juniperus scopulorum</u>	4	0	1	0	0	6
<u>J. osteosperma</u>	1	0	0	0	0	1

% of total	58	15	11	4	12	100
Absolute Density = 380 trees/acre						

Table 42. Tree composition by size class for reference areas within the pinyon-juniper woodland vegetation type.

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Reference area 4 (near proposed conveyor system and coal storage and loading area below King 6 Mine [King Mine] in the Left Fork of Miller Creek)						
<u>Pinus edulis</u>	25	10	5	4	11	55
<u>Juniperus osteosperma</u>	23	9	7	0	5	44
<u>Pseudotsuga menziesii</u>	1	0	0	0	0	1

% of total	49	19	12	4	16	100
Absolute Density = 185 trees/acre						
B. Reference area 5 (near perimeter of waste disposal area near town of Hiawatha)						
<u>Juniperus osteosperma</u>	26	8	3	0	1	68

Table 42. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
B. Reference area 5 (continued)						
<u>Pinus edulis</u>	12	1	2	3	0	32

% of total	68	16	9	5	2	100
Absolute Density = 73 trees/acre						
C. Reference area 8 (near proposed conveyor system and loading area of King 7 and King 8 mine areas in Mohrland Canyon)						
<u>Pinus edulis</u>	28	9	5	8	1	64
<u>Juniperus osteosperma</u>	14	3	3	0	9	36

% of total	55	15	10	10	10	100
Absolute Density = 354 trees/acre						

Table 42. Continued

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
D. Reference area 11 (near proposed mine facilities, and loading and transportation areas of King 7 and King 8 mine areas in Mohrland Canyon)						
<u>Pinus edulis</u>	39	6	10	6	1	77
<u>Juniperus osteosperma</u>	15	2	1	0	0	23

% of total	68	10	14	7	1	100
Absolute Density = 563 trees/acre						

Table 43. Tree composition by size class for the reference area in the riparian vegetation type.

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Populus angustifolia</u>	43	3	3	0	3	67
<u>Abies concolor</u>	4	2	2	0	0	10
<u>Juniperus scopulorum</u>	3	2	1	0	0	9
<u>Betula accidentalis</u>	4	0	0	0	0	5
<u>Pinus edulis</u>	3	1	0	0	0	5
<u>Acer glabrum</u>	2	0	0	0	0	4

% of total	74	10	9	0	7	100

Absolute Density = 204 trees/acre

LITERATURE CITED

- Evans, R. A. and R. M. Love. 1957. The step-point method of sampling: A practical tool in range research. *Journal of Range Management* 10:208-212.
- Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York.
- Snedecor, G. W. and W. G. Cochran. 1967. Statistical methods. Iowa State University Press.

APPENDIX III-2

VEGETATION OF THE U.S. FUEL COMPANY PROPERTY,
HIAWATHA, UTAH: A CONSOLIDATION OF DATA
COLLECTED DURING THE 1980 AND 1981 FIELD SEASON

Bio/West, Inc.
July 12, 1983

VEGETATION OF THE U.S. FUEL COMPANY PROPERTY,
HIAWATHA, UTAH: A CONSOLIDATION OF DATA
COLLECTED DURING THE 1980 AND 1981 FIELD SEASON

Submitted to

U.S. Fuel Company
P. O. Box A
Hiawatha, UT 84527

Prepared by

John A. Rice, Ph.D.

Submitted by

BIO/WEST, Inc.
P. O. Box 3226
Logan, UT 84321

July 12, 1983

TABLE OF CONTENTS

	Page
Scope	i
Introduction.....	1
Methodology.....	3
1980 Field Season.....	3
1981 Field Season.....	5
Existing Resources.....	7
Disturbed Areas.....	8
Mixed Conifer Vegetation.....	8
Mountain Brush Vegetation.....	9
Pinyon-Juniper Woodland Vegetation Type.....	9
Riparian Vegetation Type.....	9
Areas of Proposed Disturbance.....	10
Mixed Conifer Vegetation Type.....	10
Pinyon-Juniper Woodland Vegetation Type.....	11
Riparian Vegetation Type.....	12
Sagebrush Vegetation Type.....	13
Reference Areas.....	14
Range Condition of Reference Areas.....	14

Tables 1 - 61

Appendix A

Appendix B

LIST OF TABLES

Table	Description
1	Acreages of each vegetation type and their percentages of the total permit area acreage
2	Acreages of each vegetation type found in previously disturbed areas and areas of proposed disturbance, and their percentages of the total acreage of each type in the permit area
3	Correlation of SCS ecological sites to vegetation types of the permit area
4	Disturbed areas and areas of proposed disturbance in each vegetation type, and their respective reference area
5	Major plant species assumed to have been present in the mixed conifer vegetation type prior to disturbance
6	Major plant species assumed to have been present in the mountain brush vegetation type prior to disturbance
7	Major plant species assumed to have been present in the pinyon-juniper woodland vegetation type prior to disturbance
8	Major plant species assumed to have been present in the riparian vegetation type prior to disturbance
9	Major plant species in the mixed conifer vegetation type within proposed disturbance areas (1980 field season)
10	Summary of cover data for the combined mixed conifer sampling sites MCA6 and MCA7 (1981 field season)
11	Average woody plant density for the combined mixed-conifer sampling sites MCA6 and MCA7 (1981 field season)
12	Tree composition by size-class for mixed conifer sampling sites MCA 6 and MCA 7 (1980 field season)

LIST OF TABLES - Continued

Table	Description
13	Major plant species in the pinyon-juniper woodland present within proposed disturbance areas (1980 field season)
14	Summary of cover data for the pinyon-juniper sampling sites (1981 field season)
15	Average woody plant density for the pinyon-juniper sampling sites (1981 field season)
16	Tree composition by size-class for the pinyon-juniper woodland type within proposed disturbance areas (1980 field season)
17	Major plant species in the riparian vegetation types within the proposed disturbance area in Mohrland Canyon, sampling site RA9 (1980 field season)
18	Summary of cover data for the riparian sampling sites (1981 field season)
19	Average woody plant density for the riparian sampling sites (1981 field season)
20	Tree composition by size-class for the riparian vegetation type within the proposed disturbance areas in Mohrland Canyon, sampling site RA9 (1980 field season)
21	Major plant species in the sagebrush vegetation type within the proposed disturbance areas (1980 field season)
22	Summary of cover data for the sagebrush sampling sites (1981 field season)
23	Average woody plant density for the sagebrush sampling sites (1981 field season)

LIST OF TABLES - Continued

Table	Description
24	Major species present within reference area MBR1 (above King 4 and King 5 mines, Hiawatha Mine, in the Middle Fork of Miller Creek)
25	Major species present within reference area MCR2 (above King 4 and King 5 Mines, Hiawatha Mines, in the Middle Fork of Miller Creek)
26	Tree composition by size-class for reference area MCR2 mixed conifer vegetation type (above King 4 and 5 Mines, Hiawathia Mine, in the Middle Fork of Miller Creek) (1980 field season)
27	Major species present within reference area SBR3 (along lower portion of proposed conveyor system from King 4 and King 5 Mines, Hiawatha Mine, to the coal preparation plant in Hiawatha)
28	Relative percent plant cover for sagebrush reference area SBR3
29	Average woody plant density (number of plants per 2.0 m ²) for sagebrush reference area SBR3
30	Major species present within reference area PJR4 (near proposed conveyor system and coal storage and load-out area below King 6 Mine, King Mine, in the Left Fork of Miller Creek)
31	Relative percent cover for plants, litter and rock for pinyon-juniper reference area PJR4
32	Average woody plant density (number of plants per 2.0 m ²) for pinyon-juniper reference area PJR4
33	Tree composition by size-class for reference area PJR4, pinyon-juniper woodland vegetation type (near proposed conveyor system and coal storage and load-out area below King 6 Mine, King Mine, in the Left Fork of Miller Creek) (1980 field season)
34	Major species present within reference area PJR5 (near perimeter of waste disposal area near town of Hiawatha)

LIST OF TABLES - Continued

Table	Description
35	Tree composition by size-class for reference area PJR5, pinyon-juniper woodland vegetation type (near perimeter of waste disposal area near town of Hiawatha) (1980 field season)
36	Major species present within mixed conifer reference area MCR7 (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon)
37	Relative percent plant cover for the mixed-conifer reference area MCR7 (1981 field season)
38	Average woody plant density (number of plants per 2.0 m ²) for mixed-conifer reference area MCR7 (1981 field season)
39	Tree composition by size-class for reference area MCR7, mixed-conifer vegetation type (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon) (1980 field season)
40	Major species present within riparian reference area RR9 (near proposed yard and transportation areas for King 7 and King 8 Mines in Mohrland Canyon) (1980 field season)
41	Relative percent plant cover for the riparian reference area RR9 (1981 field season)
42	Average woody plant density (number of plants per 2.0 m ²) for the riparian reference area RR9 (1981 field season)

LIST OF TABLES - Continued

Tables	Description
43	Tree composition by size-class for reference area RR9, riparian vegetation type (near proposed yard transportation areas of King 7 and 8 Mines in Mohrland Canyon) (1980 field season)
44	Major species present within pinyon-juniper reference area PJR11 (near proposed mine facilities, load-out, and transportation areas for King 7 and King 8 Mines in Mohrland Canyon) (1980 field season)
45	Relative percent cover of plants, litter and rock for pinyon-juniper reference PJR11 (1981 field season)
46	Average woody plant density (number of plants per 2.0 m ²) for pinyon-juniper reference area PJR11 (1981 field season)
47	Tree composition by size-class for reference area PJR11, pinyon-juniper woodland vegetation type (near proposed mine facilities, and load-out and transportation areas of King 7 and King 8 Mines in Mohrland Canyon) (1980 field season)
48	Major species present within sagebrush reference area SBR12 (King 6 Mine topsoil stockpile and burrow area in the Left Fork of Miller Creek) (1981 field season)
49	Relative percent cover of plants, litter and rock for sagebrush reference area SBR12 (1981 field season)
50	Average woody plant density (number of plants per 2.0 m ²) for sagebrush reference area SBR12

LISTS OF TABLES - Continued

Tables	Description
51	Similarities between mountain brush reference area MBR1 and disturbed areas at the King 4 and King 5 Mines and the Blackhawk Mine (1980 field season)
52	Similarities between mixed conifer reference area MCR2 and disturbed areas at the portal in the Right Fork of Miller Creek, King 4 and King 5 Mines, the King 6 Mine (King Mine), and the Blackhawk Mine (1980 field season)
53	Similarities between sagebrush reference area SBR3 and proposed disturbance areas SBA3 and SBA10 (1981 field season)
54	Similarities between pinyon-juniper reference area PJR4 and proposed disturbance areas PJA4, PJA8, and PJA14 (1981 field season)
55	Similarities between the pinyon-juniper woodland reference area PJR5 and the disturbed waste disposal area near the town of Hiawatha (1980 field season)
56	Similarities between mixed-conifer reference area MCR7 and proposed disturbance areas MCA6 and MCA7 combined (1981 field season)
57	Similarities between riparian reference area RR9 and proposed disturbance areas RA9 and RA13 (1981 field season)
58	Similarities between pinyon-juniper reference area PJR11 and proposed disturbance area PJA11 (1981 field season)
59	Similarities between sagebrush reference area SBR12 and proposed disturbance area SBA12 (1981 field season)
60	t-test comparing plant cover for reference and proposed disturbance areas (1981 field season)
61	t-test comparing woody plant density for reference and proposed disturbance areas (1981 field season)

Scope

On July 23, 1980, BIO/WEST, Inc., was contracted by U.S. Fuel Company to perform a vegetation survey of U.S. Fuel Company property near Hiawatha, Utah. Preliminary data were collected between August 21 and 27, 1980, and supplementary data were collected October 7, 1980. The following persons (all employed by BIO/WEST, Inc.) were involved in the collection of data: Chris Call, Jerry Barker, Jim Albee, Alan Taye, Mike Madany, and Haile Tamrat. The data were analyzed by Chris Call and Jerry Barker. The following were consulted regarding the vegetation survey:

Larry Dalton
Wildlife Biologist
Division of Wildlife Resources
Price, UT 84501

Ron Dickemore
Range Conservationist
U.S. Forest Service
Manti LaSal National Forest District
Price, UT 84501

Bob Eccli
Mining Engineer
U.S. Fuel Company
Hiawatha, UT 84527

Bob Grover
Range Wildlife Specialist
U.S. Forest Service
Manti LaSal National Forest District
Price, UT 84501

Steve Spencer
Range Conservationist
U.S. Forest Service
Manti LaSal National Forest District
Price, UT 84501

Gary Sey
District Forest Ranger
U.S. Forest Service
Manti LaSal National Forest District
Price, UT 84501

INTRODUCTION

Ten vegetation types were identified (and mapped) within the permit area: 1) Barren land, 2) pinyon-juniper woodland, 3) riparian, 4) sagebrush, 5) mountain brush, 6) grassland, 7) mixed conifer, 8) mixed conifer-aspen, 9) aspen, and 10) high elevation sagebrush-grass. Eleven reference areas were established in five vegetation types, and the vegetation sampled for cover, productivity, tree density, distribution of tree size-classes (diameter at breast height), and species composition. The reference areas were chosen to be representative of the area disturbed or proposed to be disturbed with respect to vegetation, soils, aspect, climate, and elevation. Within the areas of proposed disturbance, "sample sites" were established and sampled in the same manner as the reference areas. The results of this survey were reported in "Vegetation Survey of U.S. Fuel Company Property, Hiawatha, Utah" (PR-41-1). This report was submitted to U.S. Fuel Company, and included as an appendix to the Vegetation Information section of the mining and reclamation plan.

Following Apparent Completeness Review of the mining and reclamation plan and Technical Environmental Assessment of the proposed conveyor belt in the Left Fork of Miller Creek, additional baseline vegetation data was requested.

In a telephone conversation, July 6, 1981, Mr. James Rutzloft, Office of Surface Mining, outlined the data requirements. Written confirmation of data requirements from the Division of Oil, Gas, and Mining was received August 4, 1981 (Appendix A). Subsequent to the conversation with Mr. Rutzloft, the additional data were collected between

July 28 and 30, 1981, and analyzed by Mr. Christopher Call and Mr. Jerry Barker. The results of cover and woody plant density sampling in reference area 4 (PJR4) and "affected area" 4 (PJA4), and a new reference area (SBR12) and "affected area" (SBA12) were reported in PR-41-2, "Vegetation Survey for the South Fork Area, Sharon Steel Company Property, Hiawatha, Utah." This report was submitted to U.S. Fuel Company who subsequently submitted the report to the Division of Oil, Gas, and Mining.

The objective of this report is to consolidate report PR-41-1, report PR-41-2, and heretofore unreported data (collected between July 28 and 30, 1981) into a single, organized report of all vegetation information collected by BIO/WEST, Inc.

METHODOLOGY

1980 Field Season

Vegetation types of the permit area and adjacent areas were identified and mapped (Figures 1-6) by field reconnaissance and the use of aerial photography. The acreages of the vegetation types and their percentages of the total permit area (Table 1) were determined from Figure 1. The acreages of the vegetation types found in previously disturbed areas and areas of proposed disturbance, and their percentages of the total acreage of each vegetation type in the permit area (Table 2) were determined from Figures 2-6. Vegetation types within previously disturbed areas were inferred from vegetation on adjacent, undisturbed areas.

Reference areas and sampling sites within areas of proposed disturbance were sampled for aerial cover, species composition, productivity, tree density, and distribution of tree size-classes (diameter at breast height). Each 45,000 ft² (4200 m²) sampling site and reference area was marked with four metal T-posts. Percent aerial cover of vegetation, litter, rock, and bare ground were estimated by the step-point method (Evans and Love 1957). The starting point and direction of each 20-point transect were randomly selected. Species composition was determined by listing the species along the transects. Productivity was determined by clipping grasses, forbs, and current year's shrub growth within a 1 m² frame randomly placed along the step-point transects. Clipped plant material was oven-dried at 120 F (49 C) for 48 hours and

weighed on a Metler top-loading balance. Tree density was measured by the point-centered quarter method (Mueller-Dombois and Ellenberg 1974). Quarters were established by using the four corners of the 1 m² productivity frame. Tree size classes were determined by measuring the circumference at breast height of the nearest tree in each quarter. Due to the branching habit of Rocky Mountain juniper, Utah juniper, and pinyon pine, it was necessary to take basal circumference readings. For trees smaller than 4 feet (1.2 m) in height, circumference was also measured at the base of the tree. All circumference measurements were converted to diameter measurements.

Sample adequacy for the representative cover and productivity parameters was determined by using the following equation:

$$m = \frac{t^2 s^2}{D^2} \text{ (Snedecor and Cochran 1967)}$$

where: m = the minimum number of observations needed,

t = t distribution value for a given level of confidence,

s^2 = the variance estimate from preliminary vegetation sampling, and

D = the level of accuracy desired for the estimate of the mean.

Sample adequacy for aerial cover estimates was determined after completing 10 step-point transects at each area. Sample adequacy for productivity measurements was determined after clipping and weighing

plant material from 25 plots at each area. A 90 percent confidence level with a 10 percent error of the mean was used to calculate the proper sample size for aerial cover estimates. An 85 percent confidence level with a 15 percent error of the mean was used to calculate the proper sample size for productivity measurements. Additional sampling was performed at those areas where preliminary sample sizes were inadequate.

*Note: Since an improper confidence level and error of the mean were used to calculate sample adequacy for productivity data it was suggested (Appendix A) that productivity be developed from Soil Conservation Service descriptions. Therefore, productivity data will not be reported in this document.

1981 Field Season

Reference areas and sampling sites within areas of proposed disturbance were sampled for plant cover, woody plant density, and species composition. Each 45,000 ft² (4,200 m²) reference area was marked with four metal T-posts. Percent cover of vegetation, litter, rock and bare ground were estimated using a 0.5 m² (0.5 x 1.0 m) quadrat. Percent cover was estimated only for individual plants that were rooted within the limits of the quadrat. Plant density was determined for woody species only. A 2.0 m² (1 x 2 m) quadrat was used for this purpose. Only woody plants that were rooted within the quadrat were counted. Species composition for reference areas and sampling sites was based on observations during cover sampling.

An estimate of plant productivity was developed from the Soil Conservation Service descriptions of range sites (see Chapter VII of the mining and reclamation plan).

The Jaccard Community Coefficient Equation was used to quantify community similarity between the reference areas and sampling sites. The coefficient is:

$$cc_j = \frac{c}{S_1 + S_2 - c}$$

where: cc_j = community coefficient,
 S_1, S_2 = number of species in each community, and
 c = number of species in common between the two communities.

The value of cc_j can vary from 0 to 1.0 (or 0 to 100 percent) with 0 showing the most dissimilarity and 1.0 showing the greatest similarity.

Statistical analyses included adequate sample size and student t-tests. All data plots were randomly selected using a random number table. Plots were located in the reference areas and sampling sites using a grid system.

Sampling adequacy for percent plant cover and plant density was determined by the same equation used in 1980. Sample adequacy for plant cover and density was determined after completing 20 sampling plots. An 80 percent confidence level with a 10 percent error of the mean was used to calculate the proper sample size. Additional sampling was performed in those areas where preliminary sample sizes were inadequate.

Student t-tests were performed to test for differences in plant cover and density between the reference and affected sites for each vegetation type. Significance was determined at the 90 percent level.

EXISTING RESOURCES

A diversity of vegetation types occurs within the boundaries of the U.S. Fuel Company permit area. This diversity is due primarily to differences in elevation, moisture, temperature, topography, aspect, and soils. During the 1980 field season, ten vegetation types (distinguished by the visually dominant species) were identified and mapped (Figures 1 through 7) within the permit area: 1) aspen, 2) barren land, 3) grassland, 4) mixed conifer, 5) mixed conifer-aspen, 6) mountain brush, 7) pinyon-juniper woodland, 8) riparian, 9) sagebrush, and 10) high elevation sagebrush-grass.

During 1980, the Soil Conservation Service (SCS) conducted a vegetation survey of the U.S. Fuel Company property in conjunction with a soil survey. This survey is included in Chapter VII. Table 3 correlates the ecological sites of the SCS survey to the vegetation types of BIO/WEST's survey.

Disturbed Areas

Four vegetation types (mixed conifer, mountain brush, pinyon-juniper woodland, and riparian) were disturbed by past mining activities. More than one of these vegetation types was disturbed at several of the existing mines. Table 4 lists the disturbed areas and their respective vegetation types and reference areas. Even with variations in slope, exposure, and elevation, the visually dominant overstory and understory species remained fairly constant.

Mixed Conifer Vegetation Type

The portal area in the Right Fork of Miller Creek elevation (8,400 feet), the portions of the King 4 and King 5 mines in the Middle Fork of Miller Creek (elevation 8,300 feet), the King 6 Mine in the Left Fork of Miller Creek (elevation 8,200 feet), the Blackhawk Mine southwest of the town of Hiawatha (elevation 8,200 feet), and the Mohrland Mine in Mohrland Canyon (elevation 7,800 feet) are in this mixed conifer type (Figure 1). Table 5 lists the major plant species assumed to have been present prior to disturbance at these sites. The dominant tree species were Douglas fir, white fir, quaking aspen, and Rocky Mountain maple. The dominant understory species were Saskatoon serviceberry, mallow ninebark, mountain snowberry, creeping barberry, myrtle pachistima, common juniper, mountain mahogany, aster, salina wildrye, and fringed brame.

Mountain Brush Vegetation Type

Portions of the King 4 and King 5 mines (Hiawatha Mine) and the Blackhawk Mine are in this mountain brush type (Figure 1). Table 6 lists the major plant species assumed to have been present prior to disturbance at these sites. The dominant overstory species were Saskatoon serviceberry, Gambel oak, mountain mahogany, mountain snowberry, and big sagebrush. Dominant understory species were green ephedra, eriogonum, salina wildrye, and Indian ricegrass.

Pinyon-Juniper Woodland Vegetation Type

Portions of the King 6 Mine (King Mine), the Mohrland Mine, and the coal preparation plant-waste disposal complex next to the town of Hiawatha are in this pinyon-juniper woodland type (Figure 1). Table 7 lists the major plant species assumed to have been present prior to disturbances at these sites. The dominant trees were Utah juniper and pinyon pine. The dominant understory species were big sagebrush, black sagebrush, pricklypear cactus, Saskatoon serviceberry, mountain mahogany, mountain snowberry, hoary aster, Salina wildrye, and Indian ricegrass.

Riparian Vegetation Type

Small portions of the King 4 and King 5 mines (Hiawatha Mine), the King 6 Mine (King Mine), and the Mohrland Mine are in this riparian type

(Figure 1). Table 8 lists the major plant species assumed to have been present prior to disturbances at these sites. The dominant tree species were narrowleaf cottonwood, sandbar willow, Douglas fir, and quaking aspen. The dominant understory species were big sagebrush, rubber rabbitbrush, Wood's rose, mountain snowberry, western virginsbower, horsetail, sweetclover, sedge, and American bullrush.

Areas of Proposed Disturbance

Four vegetation types (mixed conifer, pinyon-juniper woodland, riparian, and sagebrush) will be disturbed by proposed mining activities. As with previously disturbed areas, more than one vegetation type will be disturbed at the proposed mines and associated facilities. Table 4 lists the areas of proposed disturbance and their respective vegetation types and reference areas.

Mixed Conifer Vegetation Type

The King 7 and King 8 mines and associated yard areas in Mohrland Canyon (MCA6 and MCA7: elevation 7,300 to 8,100 feet) will be in this mixed conifer type (Figures 1-7). Tables 9, 10, 11, and 12 summarize the species composition, cover, woody plant density, and tree size-class distribution data, respectively. Sampling adequacy is demonstrated in Appendix B. The dominant trees are white fir, Douglas fir, Rocky Mountain maple, and quaking aspen. Dominant shrubs include Saskatoon serviceberry, creeping barberry, mountain mahogany, mallow ninebark,

myrtle pachistima, and mountain snowberry. Dominant forbs and grasses include blueleaf aster, Wyoming painted-cup, goldenrod, Salina wildrye, needle-and-thread grass, and Indian ricegrass. All of the mixed conifer areas are in good condition. Weedy species are low in frequency and cover, open areas have good stands of desirable forbs and perennial grasses, and trees are not showing signs of widespread insect and disease damage. However, due to fire suppression, the fuel load (fallen trees and branches) has built up significantly in several areas. Relatively young stands of conifers occur in the areas of proposed disturbance. White fir is the only tree species with individuals distributed in larger size classes.

Pinyon-Juniper Woodland Vegetation Type

The conveyor system, coal storage area and load-out area below the King 6 Mine (King Mine) in the Left Fork of Miller Creek (PJA4: elevation 7,800 to 8,100 feet); a portion of the conveyor system (elevation 7,400 to 7,600 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha (PJA14); and a portion of the conveyor system (PJA8) and King 7 and King 8 mine facilities in Mohrland Canyon (PJA11: elevation 7,100 to 7,800 feet) will be in this pinyon-juniper woodland type (Figures 1-7). Tables 13, 14, 15, and 16 summarize the species composition, cover, woody plant density, and tree size-class distribution data, respectively. Sample adequacy is demonstrated in Appendix B. The dominant tree species are Utah juniper and pinyon pine. The dominant understory species are Saskatoon serviceberry, big sagebrush, mountain mahogany, low rabbitbrush, yucca,

goldenrod, Salina wildrye, western wheatgrass, and Indian ricegrass. Several of the sampling sites had cliffs and outcrops with very little plant cover. Understory cover is also limited directly beneath the juniper and pinyon trees. Pinyon pine was more evenly distributed among the size classes compared to Utah juniper whose population was comprised mainly of seedlings and young trees.

Riparian Vegetation Type

A portion of the conveyor system (elevation 7,200 to 7,400 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha (RA13), and a portion of the King 7 and King 8 mine facilities in Mohrland Canyon (RA9: elevation 7,300 to 7,400 feet) will be in this riparian type (Figures 1-7). Tables 17, 18, 19, and 20 summarize the species composition, cover, woody plant density, and tree size-class distribution data, respectively. Sample adequacy is demonstrated in Appendix B. The dominant tree species are narrowleaf cottonwood, sandbar willow, river birch and quaking aspen. Dominant understory species include Saskatoon serviceberry, rabbitbrush, silver buffaloberry, Wood's rose, mountain snowberry, aster, western virgins-bower, horsetail, yellow sweetclover, sedge, Indian ricegrass, and needle-and-thread grass. Shrubs such as low and rubber rabbitbrush are spreading into the streambank areas from disturbed areas along roadsides, and these root-sprouting shrubs are crowding out desirable forbs and perennial grasses. Narrowleaf cottonwood has some individuals in larger size-classes, but the remaining tree species are mainly comprised of seedlings and young trees (Table 20).

Sagebrush Vegetation Type

Portions of the conveyor system (elevation 7,150 to 7,300 feet) from the King 4 and King 5 mines (Hiawatha Mine) to the coal preparation plant in Hiawatha (SBA3); portions of the King 7 and King 8 mine facilities in Mohrland Canyon (SBA10: elevation 7,000 to 7,150 feet); and the topsoil stockpile and borrow areas below the King 6 Mine (King Mine) in the Left Fork of Miller Creek (SBA12) will be in this sagebrush type (Figures 1-7). Tables 21, 22, and 23 summarize the species composition, cover, and woody plant density data, respectively. Sample adequacy is demonstrated in Appendix B. The dominant overstory is comprised almost exclusively of big sagebrush. Dominant understory species include rubber rabbitbrush, pricklypear cactus, rose, broom snakeweed, hoary aster, western virginsbower and Indian ricegrass. Most areas of proposed disturbance are old townsites (circa 1900 to 1915), and many still have building foundations remaining. This prior disturbance has led to the development of overgrown sagebrush stands with relatively little understory cover.

Other perturbations such as fire, grazing, plowing, spraying, and seeding have occurred primarily on high elevation Forest Service land near the western boundary of the permit area. This Forest Service land comprises less than 5 percent of the Gentry Allotment which supports 4,800 AUM's (cattle) during the grazing season. All areas of new disturbance will be below this Forest Service land.

Reference Areas

Nine reference areas were selected in the five vegetation types which had existing disturbed areas and areas of proposed disturbance. All reference areas were located as close as possible to disturbed areas and areas of proposed disturbance without interfering with present and future mining activities (Figure 1). Table 4 lists the disturbed areas and areas of proposed disturbance, with their respective reference area. Species lists were developed for each reference area within the various vegetation types. Tables 24 through 50 summarize species composition, cover, woody plant density, and tree composition by size class data. The similarity between disturbed areas and areas of proposed disturbance, and reference areas is demonstrated in Tables 51 through 61. Sample adequacy is demonstrated in Appendix B.

Range Condition of Reference Areas

The Vegetation Survey conducted by the Soil Conservation Services in 1981 (see Chapter VIII of the Mining and Reclamation Plan) indicated that all ecological sites were in poor to fair range condition with the exception of the following sites in good condition: Upland Loam (P-J), Mountain Shallow Loam (Shrub), Mountain Shallow Loam (Curl-leaf mountain mahogany), and Wet Meadow. Since none of the reference areas are in the good condition ecological sites, it is assumed that they are in poor to fair condition. Though it would appear that fencing of reference areas is in order, since the area is presently used only for short periods during the spring and fall for trailing cattle to and from summer and winter ranges, fencing should not be necessary.

Table 1. Acreages of each vegetation type and their percentages of the total permit area acreage.

Vegetation Type	Acreage	% of Permit Area
Aspen	2,386	12.4
Barren Land	52	0.2
Grassland	582	3.0
High Elevation Sagebrush-Grass	1,122	6.0
Mixed Conifer	7,743	40.3
Mixed Conifer-Aspen	2,516	13.1
Mountain Brush	1,862	9.7
Pinyon-Juniper Woodland	2,465	12.8
Riparian	212	1.1
Sagebrush	<u>266</u>	<u>6.0</u>
	19,206	100.0

Table 2. Acreages of each vegetation type found in previously disturbed areas and areas of proposed disturbance, and their percentages of the total acreage of each type in the permit area.

Vegetation Type	<u>Acreage</u> <u>Previously Disturbed</u> <u>(Proposed Disturbance)</u>	<u>% of Vegetation Type</u> <u>Previously Disturbed</u> <u>(Proposed Disturbance)</u>
Mixed Conifer	8.5 (53.1)	0.1 (0.7)
Mountain Brush	4.0 (3.8)	0.2 (0.2)
Pinyon-Juniper	260.0 (17.5)	10.5 (0.7)
Riparian	1.0 (1.7)	0.5 (0.8)
Sagebrush	(24.3)	(9.1)

Total Disturbance = 373.9 acres.

Table 3. Correlation of SCS ecological sites to vegetation types of the permit area.

<u>Vegetation Type</u>	<u>SCS Ecological Site^a</u>
Aspen	Woodland
Barren Land	Badland Soil (not placed in an ecological site)
Grassland	Mountain Loam Mountain Stony Loam Upland Stony Loam
Mixed Conifer	Disturbed Site Semi-wet Stream Bottom Woodland
Mixed Conifer-Aspen	Semi-wet Stream Bottom Woodland
Mountain Brush	Disturbed Site Mountain Shallow Loam Mountain Shallow Loam (Curl-leaf Mountain Mahogany) Mountain Stony Loam
Pinyon-Juniper Woodland	Disturbed Site Mountain Shallow Loam Upland Loam (P-J) Upland Shallow Loam Upland Stony Loam
Riparian	Disturbed Site Semiwet Streambottom
Sagebrush	Disturbed Site Mountain Loam Upland Loam
High Elevation Sagebrush-Grass	Intermixed with Woodland

^aSource: Vegetation Survey, Soil Survey and Interpretations for U.S. Fuel Co. Mine Area, Soil Conservation Service, February, 1981.

Table 4. Disturbed areas and areas of proposed disturbance in each vegetation type, and their respective reference area.

Vegetation Type	Disturbed Area or Area of Proposed Disturbance	Reference Area
Mountain Brush	Disturbed area at the King 4 & 5 Mines, and the Blackhawk Mine.	MBR1
Mixed Conifer	Disturbed area at the portal in the Right Fork of Miller Creek, the King 4 & 5 Mines, the King 6 Mine, and the Blackhawk Mine.	MCR2
	Proposed disturbance for the alternative upper seam portal site above the Mohrland Mine (MCA6), and King 7 & 8 alternative seam portal site and yard areas near the Mohrland Mine (MCA7).	MCR7
Sagebrush	Proposed disturbance for the conveyor system from King 4 & 5 Mines to the coal preparation plant near Hiawatha (SBA3); and King 7 & 8 Mine facilities, load-out, and transportation areas (SBA10).	SBR3
	Proposed disturbance for the topsoil stockpile and borrow area below the King 6 Mine (SBA12)	SBR12
Pinyon-Juniper Woodland	Disturbed area at the King 6 Mine.	PJR4
	Proposed disturbance for the conveyor system from King 4 & 5 Mines to the coal preparation plant near Hiawatha (SBA14), the load-out area below the King 6 Mine (PJA4), and the conveyor system and load-out area at the King 7 & 8 Mines (PJA8).	
	Disturbed area at the coal preparation plant-waste disposal complex area near Hiawatha.	PJR5
	Proposed disturbance for the King 7 and 8 Mine facilities, load-out, and transportation areas (PJA11)	PJR11
Riparian	Proposed disturbance for the mine yard and transportation areas at the King 7 & 8 Mines (RA9), and the conveyor system from King 4 & 5 Mines to the coal preparation plant near Hiawatha (RA13).	RR9

Table 5. Major plant species assumed to have been present in the mixed conifer vegetation type prior to disturbance.

Life Form	Botanical Name	Common Name
<u>Portal Site in the Right Fork of Miller Creek</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Arnica cordifolia</u>	Heartleaf arnica
	<u>Lupinus sp.</u>	Lupine
	<u>Swertia perennis</u>	Alpinebog swertia
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Bromus ciliatus</u>	Fringed brome
<u>King 4 and King 5 Mines</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Ribes cereum</u>	Wax currant
	<u>Shepherdia canadensis</u>	Russet buffaloberry
<u>Symphoricarpos oreophilus</u>	Mountain snowberry	
Forb	<u>Astragalus sp.</u>	Locoweed
	<u>Lupinus sp.</u>	Lupine
	<u>Osmorhiza sp.</u>	Sweetroot
	<u>Swertia perennis</u>	Alpinebog swertia
	<u>Viola sp.</u>	Violet
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Bromus ciliatus</u>	Fringed brome

Table 5. Continued

Life Form	Botanical Name	Common Name
<u>King 6 Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Lupinus</u> sp.	Lupine
	<u>Machaeranthera canescens</u>	Hoary aster
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie junegrass
<u>Blackhawk Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry

Table 5. Continued

Life Form	Botanical Name	Common Name	
<u>Blackhawk Mine - Continued</u>			
Forb	<u>Aster glaucodes</u>	Blueleaf aster	
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup	
	<u>Eriogonum sp.</u>	Eriogonum	
	<u>Machaeranthera canescens</u>	Hoary aster	
	<u>Salidago sp.</u>	Goldenrod	
Grass	<u>Agropyron smithii</u>	Western wheatgrass	
	<u>Elymus salina</u>	Salina wildrye	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	
<u>Mohrland Mine</u>			
Tree	<u>Abies concolor</u>	White fir	
	<u>Acer glabrum</u>	Rocky Mountain maple	
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	
	<u>Pinus edulis</u>	Pinyon pine	
	<u>P. ponderosa</u>	Ponderosa pine	
	<u>Pseudotsuga menziesii</u>	Douglas fir	
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	
	<u>Artemisia nova</u>	Black sagebrush	
	<u>Artemisia tridentata</u>	Big sagebrush	
	<u>Berberis repens</u>	Creeping barberry	
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany	
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush	
	<u>Juniperus communis</u>	Common juniper	
	<u>Packistima myrsinites</u>	Myrtle packistima	
	<u>Physocarpus malvaceus</u>	Mallow ninebark	
	<u>Sambucus cerulea</u>	Blueberry elder	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	
	Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
		<u>Aster glaucodes</u>	Blueleaf aster
		<u>Castilleja linariaefolia</u>	Wyoming painted-cup
<u>Clematis ligustifolia</u>		Western Virginsbower	
<u>Eriogonum sp.</u>		Eriogonum	
<u>Machaeranthera canescens</u>		Hoary aster	
<u>Solidago canadensis</u>		Canada goldenrod	
Grass	<u>Agropyron smithii</u>	Western wheatgrass	
	<u>Bromus ciliatus</u>	Fringed brome	
	<u>Elymus salina</u>	Salina wildrye	
	<u>Koeleria cristata</u>	Prairie junegrass	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	

Table 6. Major plant species assumed to have been present in the mountain brush vegetation type prior to disturbance.

Life Form	Botanical Name	Common Name
<u>King 5 and King 6 Mines</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Quercus gambellii</u>	Gambel oak
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
<u>Xanthocephalum sarothrae</u>	Broom snakeweed	
Forb	<u>Cirsium sp.</u>	Thistle
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass
<u>Blackhawk Mine</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Eriogonum sp.</u>	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian Ricegrass

Table 7. Major plant species assumed to have been present in the pinyon-juniper woodland vegetation type prior to disturbance.

Life Form	Botanical Name	Common Name
<u>King 6 Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah fir
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
<u>Yucca harrimaniae</u>	Harriman yucca	
Forb	<u>Arabis sp.</u>	Rockcress
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Eriogonum sp.</u>	Eriogonum
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass
<u>Mohrland Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany

Table 7. Continued

Life Form	Botanical Name	Common Name
<u>Mohrland Mine - Continued</u>		
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia sp.</u>	Pricklypear
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Astragalus sp.</u>	Locoweed
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum sp.</u>	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Coal Preparation Plant-Waste Disposal Complex</u>		
Tree	<u>Pinus edulis</u>	Pinyon pine
	<u>Juniperus osteosperma</u>	Utah juniper
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>C. montanus</u>	True mountain mahogany
	<u>Opuntia sp.</u>	Pricklypear cactus
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Talinum parviflorum</u>	Fameflower
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Sporobolus aeroides</u>	Alkali sacaton
	<u>Stipa comata</u>	Needle-and-thread grass

Table 8. Major plant species assumed to have been present in the riparian vegetation type prior to disturbance.

Life Form	Botanical Name	Common Name
<u>King 4 and King 5 Mines</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>E. hyemale</u>	Western scouring rush
	<u>Lupinus sp.</u>	Lupine
	<u>Melilotus officinalis</u>	Yellow sweetclover
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex sp.</u>	Sedge
	<u>Juncus sp.</u>	Rush
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Scirpus americanus</u>	American bullrush
	<u>Stipa comata</u>	Needle-and-thread grass
<u>King 6 Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Rhus trilobata</u>	Skunk bush sumac

Table 8. Continued

Life Form	Botanical Name	Common Name
<u>King 6 Mine - Continued</u>		
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum sp.</u>	Horsetail
	<u>Isomopsis aggregata</u>	Wyoming painted-cup
	<u>Melilotus officinalis</u>	Yellow sweetclover
Grass	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex sp.</u>	Sedge
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass
<u>Mohrland Mine</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>Grindelia squarrosa</u>	Curlycup gumweed

Table 8. Continued

Life Form	Botanical Name	Common Name
<u>Mohrland Mine - Continued</u>		
	<u>Ipomopsis aggregata</u>	Scarlet gilia
	<u>Lupinus sp.</u>	Lupine
	<u>Melilotus officinalis</u>	Yellow sweetclover
Grass	<u>Agropyron sp.</u>	Wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex sp.</u>	Sedge
	<u>Juncus sp.</u>	Rush
	<u>Scirpus americanus</u>	American bullrush

Table 9. Major plant species in the mixed conifer vegetation type within proposed disturbance areas (1980 field season)

Life Form	Botanical Name	Common Name
<u>Sampling Site MCA6: Alternative Site for Upper Seam Portal</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Pinus flexilis</u>	Limber pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix sp.</u>	Willow
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Juniperus communis</u>	Common juniper
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Shepherdia canadensis</u>	Russet buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	Forb	<u>Aster glaucodes</u>
<u>Astragalus sp.</u>		Locoweed
<u>Fragaria sp.</u>		Strawberry
<u>Solidago canadensis</u>		Canada goldenrod
<u>Viola sp.</u>		Violet
Grass	<u>Agropyron trachycaulum</u>	Slender wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Sampling Site MCA7: Alternative Seam Portal Site and Yard Areas</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>P. ponderosa</u>	Ponderosa pine
	<u>Pseudotsuga menziesii</u>	Douglas fir

Table 9. Continued

Life Form	Botanical Name	Common Name
<u>Sampling Site MCA7: Alternative Seam Portal Site and Yard Areas</u>		
<u>- Continued</u>		
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	Forb	<u>Aster glaucodes</u>
<u>Castilleja linariaefolia</u>		Wyoming painted-cup
<u>Eriogonum sp.</u>		Eriogonum
<u>Linum lewisii</u>		Lewis flax
<u>Machaeranthera canescens</u>		Hoary aster
<u>Solidago canescens</u>		Canada goldenrod
Grass	<u>Agropyron sp.</u>	Wheatgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>Carex sp.</u>	Sedge
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie june grass

Table 10. Summary of cover data for the combined mixed-conifer sampling sites MCA6 and MCA7 (1981 field season).

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Elymus salina</u>	Salina wildrye	51.8	53.6
	<u>Poa</u> sp.	Bluegrass	1.8	
Forbs	<u>Aster foliaceus</u>	Leafy aster	3.2	11.2
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys	2.7	
	<u>Solidago</u> sp.	Goldenrod	2.2	
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush	1.5	
	<u>Cryptantha</u> sp.	Cryptantha	1.0	
	<u>Castilleja</u> sp.	Indian paintbrush	0.4	
	<u>Ipomopsis aggregata</u>	Scarlet gilia	0.2	
Shrubs	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	17.2	32.9
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	9.2	
	<u>Pachistima myrsinites</u>	Myrtle pachistima	5.0	
	<u>Berberis repens</u>	Creeping barberry	1.5	
Trees	<u>Pinus edulis</u>	Pinyon pine	1.3	2.3
	<u>Abies concolor</u>	White fir	0.5	
	<u>Juniperis scopulorum</u>	Rocky Mountain juniper	0.5	
	Plant		13.4	
	Litter		26.1	
	Rock		15.1	
	Bare ground		45.4	

Table 11. Average woody plant density (number of plants per 2.0 m²) for the combined mixed-conifer sampling sites MCA6 and MCA7 (1981 field season).

Life form	Species	Common name	Density
Shrubs	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.83
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.42
	<u>Pachistima myrsinites</u>	Myrtle pachistima	0.20
	<u>Artemisia tridentata</u>	Big sagebrush	0.18
	<u>Berberis repens</u>	Creeping barberry	0.17
	<u>Sambucus cerulea</u>	Blueberry elder	0.02
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	<u>0.02</u>
Total			1.84
Trees	<u>Abies concolor</u>	White fir	0.08
	<u>Juniperus osteosperma</u>	Utah juniper	0.08
	<u>Pseudotsuga menziesii</u>	Douglas fir	0.08
	<u>Pinus edulis</u>	Pinyon pine	<u>0.07</u>
Total			0.31

Table 12. Tree composition by size class for the mixed conifer sampling sites MCA6 and MCA 7 (1980 field season).

	Diameter breast height (in.)					% of Total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Sampling site MCA6 (alternative site for upper seam portal above old Mohrland Mine)						
<u>Abies concolor</u>	20	22	10	10	15	84
<u>Pseudotsuga menziesii</u>	3	7	1	0	1	15
<u>Populus tremuloides</u>	0	1	0	0	0	1

% of total	29	38	14	8	11	100
Absolute Density = 538 trees/acre						
B. Sampling site MCA7 (alternative seam portals and possible yard areas near old Mohrland Mine)						
<u>Abies concolor</u>	27	9	1	2	1	54
<u>Pinus edulis</u>	3	4	3	4	3	22
<u>Pseudotsuga menziesii</u>	7	5	2	1	1	21
<u>Juniperus scopulorum</u>	2	0	0	0	0	2
<u>J. osteosperma</u>	1	0	0	0	0	1

% of total	53	24	8	9	6	100
Absolute Density = 483 trees/acre						

Table 13. Major plant species in the pinyon-juniper woodland present within proposed disturbance areas (1980 field season).

Life Form	Botanical Name	Common Name
<u>King 6 Mine Conveyor System, Coal Storage, and Load-Out Areas (PJA4)</u>		
Tree	<u>Abies concolor</u>	White fir
	<u>Acer grandidentatum</u>	Big-tooth maple
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>P. ponderosa</u>	Ponderosa pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Yucca harrimaniae</u>	Harriman yucca
Forb	<u>Arabis sp.</u>	Rockcress
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys
	<u>Solidago sp.</u>	Goldenrod
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Sitanion hystrix</u>	Bottlebrush squirreltail
	<u>Stipa comata</u>	Needle-and-thread grass

Table 13. Continued

Life Form	Botanical Name	Common Name
<u>King 7 and 8 Mines, Conveyor System, and Load-Out Areas (PJA8)</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Echinocereus triglochidiatus</u>	Echinocereus
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia</u> sp.	Pricklypear
	<u>Sclerocactus whipplei</u>	Sclerocactus
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Arenaria</u> sp.	Sandwort
	<u>Astragalus</u> sp.	Locoweed
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (PJA 11)</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia barkleyana</u>	Pricklypear
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Yucca harrimaniae</u>	Harriman yucca
Forb	<u>Eriogeron</u> sp.	Fleabane
	<u>Machaeranthera linearis</u>	Hoary aster
	<u>Penstemon</u> sp.	Penstemon
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass

Table 14. Summary of cover data for the pinyon-juniper sampling sites (1981 field season).

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 6 Mine Conveyor System, Coal Storage, and Load-Out Areas (PJA4)</u>				
Grasses	<u>Elymus salina</u>	Salina wildrye	6.4	55.4
	<u>Agropyron smithii</u>	Bluebunch wheatgrass	8.1	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	18.8	
	<u>Bouteloua gracilis</u>	Blue grama	7.7	
	<u>Stipa camata</u>	Needle-and-thread grass	13.6	
	<u>Poa pratensis</u>	Kentucky bluegrass	0.8	
Forbs	<u>Ipomopsis aggregata</u>	Scarlet gilia	0.8	4.7
	<u>Grindelia squarrosa</u>	Curlycup gumweed	0.6	
	<u>Eriogonum sp.</u>	Eriogonum	0.9	
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys	0.5	
	<u>Cryptantha sp.</u>	Cryptantha	1.0	
	<u>Machaeranthera linearis</u>	Hoary aster	0.9	
Shrub	<u>Ephedra viridis</u>	Green ephedra	1.9	35.1
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	1.5	
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	1.7	
	<u>Cercocarpus montanus</u>	True mountain mahogany	5.2	
	<u>Berberis repens</u>	Creeping barberry	6.1	
	<u>Artemisia nova</u>	Black sagebrush	6.8	
	<u>Sambucus cerulea</u>	Blueberry elder	1.2	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	1.5	
	<u>Yucca harrimaniae</u>	Harriman yucca	2.0	
	<u>Opuntia sp.</u>	Prickly pear	0.8	

Table 14. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 6 Mine Conveyor System, Coal Storage, and Load-Out Areas (PJA4) - Continued</u>				
Shrub - Continued				
	<u>Tetrademia canescens</u>	Gray horsebrush	0.8	
	<u>Artemisia tridentata</u>	Big sagebrush	5.6	
	<u>Juniperus osteosperma</u>	Utah juniper	1.5	4.8
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	1.2	
	<u>Pinus edulis</u>	Pinyon pine	2.1	
	Plant		10.7	
	Litter		23.6	
	Rock		18.2	
	Bare ground		47.5	

<u>King 7 and 8 Mines Conveyor System and Load-Out Areas (PJA8)</u>				
Grasses	<u>Agropyron smithii</u>	Western wheatgrass	20.2	40.0
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	15.7	
	<u>Bouteloua gracilis</u>	Blue grama	1.7	
	<u>Stipa comata</u>	Needle-and-thread grass	1.4	

Table 14. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 7 and 8 Mines Conveyor System and Load-Out Areas (PJA8) - Continued</u>				
Forbs	<u>Eriogonum</u> sp.	Eriogonum	2.7	8.7
	<u>Cryptantha</u> sp.	Cryptantha	2.2	
	<u>Hedysarum boreale</u>	Sweetvetch	1.8	
	<u>Ipomopsis aggregata</u>	Scarlet gilia	1.3	
	<u>Machaeranthera linearis</u>	Hoary aster	0.3	
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush	0.4	
Shrub	<u>Cercocarpus montanus</u>	True mountain mahogany	9.4	
	<u>Artemisia tridentata</u>	Big sagebrush	9.1	
	<u>Artemisia nova</u>	Black sagebrush	7.6	
	<u>Ephedra viridis</u>	Green ephedra	7.0	
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	1.8	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	1.4	
	<u>Yucca harrimaniae</u>	Harriman yucca	1.3	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	1.2	
	<u>Opuntia</u> sp.	Pricklypear	1.0	
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush	0.6	
Trees	<u>Juniperus osteosperma</u>	Utah juniper	8.5	11.9
	<u>Pinus edulis</u>	Pinyon pine	3.4	
	Plant		10.4	
	Litter		14.2	
	Rock		17.6	
	Bare ground		57.5	

Table 14. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (PJA11)</u>				
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass	9.7	14.5
	<u>Elymus salina</u>	Salina wildrye	2.3	
	<u>Bouteloua gracilis</u>	Blue grama	2.1	
	<u>Poa pratensis</u>	Kentucky bluegrass	0.4	
Forbs	<u>Eriogonum sp.</u>	Eriogonum	6.2	12.3
	<u>Cryptantha sp.</u>	Cryptantha	4.0	
	<u>Machaeranthera linearis</u>	Hoary aster	1.1	
	<u>Ipomopsis aggregata</u>	Scarlet gilia	1.0	
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	23.2	59.2
	<u>Yucca harrimaniae</u>	Harriman yucca	11.0	
	<u>Cercocarpus montanus</u>	True mountain mahogany	7.2	
	<u>Opuntia sp.</u>	Pricklypear	6.1	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	5.1	
	<u>Artemisia tridentata</u>	Big sagebrush	2.8	
	<u>Ephedra viridis</u>	Green ephedra	2.3	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	1.5	
Trees	<u>Pinus edulis</u>	Pinyon pine	11.4	14.0
	<u>Juniperus osteosperma</u>	Utah juniper	2.6	
	Plant		7.4	
	Litter		18.0	
	Rock		16.4	
	Bare ground		58.1	

Table 14. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (PJA14)</u>				
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass	19.7	29.2
	<u>Stipa comata</u>	Needle-and-thread grass	6.6	
	<u>Bouteloua gracilis</u>	Blue grama	1.8	
	<u>Agropyron smithii</u>	Western wheatgrass	1.1	
Forbs	<u>Cryptantha sp.</u>	Cryptantha	2.9	11.9
	<u>Cirsium vulgare</u>	Common thistle	2.0	
	<u>Eriogonum sp.</u>	Eriogonum	1.8	
	<u>Sphaeralcea sp.</u>	Globemallow	1.3	
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush	1.1	
	<u>Machaeranthera linearis</u>	Hoary aster	1.1	
	<u>Aster foliaceus</u>	Leafy aster	0.9	
	<u>Hedysarum boreale</u>	Sweetvetch	0.6	
	<u>Ipomopsis aggregata</u>	Scarlet gilia	0.2	
Shrub	<u>Cercocarpus montanus</u>	True mountain mahogany	15.4	51.2
	<u>Artemisia tridentata</u>	Big sagebrush	8.0	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	6.0	
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	4.7	
	<u>Ephedra viridis</u>	Green ephedra	3.4	
	<u>Artemisia nova</u>	Black sagebrush	2.7	
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush	2.0	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	2.0	
	<u>Opuntia sp.</u>	Pricklypear	1.8	

Table 14. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (PJA14) - Continued</u>				
Shrub - Continued				
	<u>Sambucus cerulea</u>	Blueberry elder	1.8	
	<u>Berberis repens</u>	Creeping barberry	1.4	
	<u>Tetrademia canescens</u>	Gray horsebrush	1.3	
	<u>Yucca harrimaniae</u>	Harriman yucca	0.7	
Trees	<u>Pinus edulis</u>	Pinyon pine	7.3	7.7
	<u>Juniperus osteosperma</u>	Utah juniper	0.4	
	Plant		10.5	
	Litter		8.3	
	Rock		15.3	
	Bare ground		66.0	

Table 15. Average woody plant density (number of plants per 2.0 m²) for the pinyon-juniper sampling sites (1981 field season).

Life form	Species	Common name	Density
<u>King 6 Mine Conveyor System, Coal Storage, and Load-Out Areas (PJA4)</u>			
Shrubs	<u>Berberis repens</u>	Creeping barberry	0.93
	<u>Cercocarpus montanus</u>	True mountain mahogany	0.44
	<u>Artemisia tridentata</u>	Big sagebrush	0.23
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.16
	<u>Artemisia nova</u>	Black sagebrush	0.13
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	0.10
	<u>Ephedra viridus</u>	Mormon tea	0.08
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.07
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.03
	<u>Chrysthamnus nauseosus</u>	Rubber rabbitbrush	0.02
		Total	2.19
Trees	<u>Pinus edulis</u>	Pinyon pine	0.05
	<u>Juniperus osteosperma</u>	Utah juniper	0.08
	<u>J. scopulorum</u>	Rocky Mountain juniper	0.01
	<u>Abies concolor</u>	White fir	0.01
	<u>Pseudotsuga menziesii</u>	Douglas-fir	0.01
		Total	0.19
<u>King 7 and 8 Mines Conveyor System and Load-Out Areas (PJA8)</u>			
Shrubs	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	0.26
	<u>Ephedra viridus</u>	Mormon tea	0.23
	<u>Artemisia nova</u>	Black sagebrush	0.16
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.13
	<u>Berberis repens</u>	Creeping barberry	0.12
	<u>Cercocarpus montanus</u>	True mountain mahogany	0.09
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.08
	<u>Artemisia tridentata</u>	Big sagebrush	0.07
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.01
		Total	1.15
Trees	<u>Pinus edulis</u>	Pinyon pine	0.19
	<u>Juniperus osteosperma</u>	Utah juniper	0.10
		Total	0.29

Table 15. Continued

Life form	Species	Common name	Density	
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (PJA11)</u>				
Shrubs	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.46	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.17	
	<u>Artemisia tridentata</u>	Big sagebrush	0.12	
	<u>Berberis repens</u>	Creeping barberry	0.11	
	<u>Cercocarpus montanus</u>	True mountain mahogany	0.09	
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	0.08	
	<u>Ephedra viridus</u>	Mormon tea	0.05	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.03	
	Total		1.11	
Trees	<u>Pinus edulis</u>	Pinyon pine	0.28	
	<u>Juniperus osteosperma</u>	Utah juniper	0.11	
		Total	0.39	
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (PJA14)</u>				
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	0.37	
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	0.10	
	<u>C. montanus</u>	True mountain mahogany	0.10	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.10	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.08	
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.07	
	<u>Ephedra viridus</u>	Mormon tea	0.07	
	<u>Berberis repens</u>	Creeping barberry	0.07	
	<u>Artemisia nova</u>	Black sagebrush	0.06	
	<u>Tetrademia canescens</u>	Gray horsebrush	0.04	
	<u>Chrysothamnus</u> <u>viscidiflorus</u>	Little rabbitbrush	0.01	
	<u>C. nauseosus</u>	Rubber rabbitbrush	0.01	
		Total		1.08
	Trees	<u>Pinus edulis</u>	Pinyon pine	0.30
<u>Juniperus osteosperma</u>		Utah juniper	0.05	
		Total	0.35	

Table 16. Tree composition by size class for the pinyon-juniper woodland type within proposed disturbance areas (1980 field season).

Life Form	Diameter breast height (in.)					% of Total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
A. Sampling site PJA4 (conveyor system, coal storage and load-out areas below King 6 mine (King Mine) in the Left Fork of Miller Creek)						
<u>Pinus edulis</u>	24	13	6	7	5	68
<u>Juniperus osteosperma</u>	6	1	1	2	1	18
<u>Abies concolor</u>	3	1	1	0	0	6
<u>Juniperus scopulorum</u>	1	3	0	0	1	6
<u>Pseudotsuga menziesii</u>	0	1	0	0	1	2

% of total	42	24	10	14	10	100
Absolute Density = 199 trees/acre						
B. Sampling site PJA8 (conveyor system and load-out area in King 7 and King 8 mine area in Mohrland Canyon)						
<u>Pinus edulis</u>	30	10	7	5	1	66
<u>Juniperus scopulorum</u>	12	6	3	1	5	34

% of total	54	20	12	7	7	100
Absolute Density = 302 trees/acre						
C. Sampling site PJA11 (mine facilities, load-out and transportation areas in King 7 and King 8 mine area in Mohrland Canyon)						
<u>Pinus edulis</u>	36	11	9	11	7	95
<u>Juniperus osteosperma</u>	1	1	2	0	0	5

% of total	46	15	14	14	11	100
Absolute Density = 318 trees/acre						

Table 17. Major plant species in the riparian vegetation type within the proposed disturbance area in Mohrland Canyon, sampling site RA9 (possible yard area, transportation area). (1980 Field season)

Life Form	Botanical Name	Common Name
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. fremontii</u>	Fremont cottonwood
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>C. viscidiflorus</u>	Low rabbitbrush
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Opuntia sp.</u>	Pricklypear
	<u>Rhus trilobata</u>	Skunkbush sumac
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sherpherdia argenta</u>	Silver buffaloberry
<u>Symphoricarpos oreophilus</u>	Mountain snowberry	
<u>Xanthocephalum sarothrae</u>	Broom snakeweed	
Forb	<u>Arabis sp.</u>	Rockcress
	<u>Cirsium vulgare</u>	Bull thistle
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Equisetum arvense</u>	Field horsetail
	<u>E. hyemale</u>	Western scouring-rush
	<u>Habeneria sp.</u>	Rain orchid
	<u>Hedysarum boreale</u>	Utah sweetvetch
	<u>Lupinus sp.</u>	Lupine
	<u>Melilotus alba</u>	White sweetclover
	<u>M. officinales</u>	Yellow sweetclover
<u>Solidago canadensis</u>	Canada goldenrod	
Grass	<u>Agrostis sp.</u>	Bentgrass
	<u>Bromus ciliatus</u>	Fringed brome
	<u>B. tectorum</u>	Cheatgrass brome
	<u>Calamagrostis sp.</u>	Reedgrass
	<u>Carex aurea</u>	Golden sedge
	<u>C. nebraskensis</u>	Nebraska sedge
	<u>Juncus sp.</u>	Rush
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
<u>Stipa comata</u>	Needle-and-thread grass	

Table 18. Summary of cover data for the riparian sampling sites (1981 field season).

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 7 and 8 Mines Yard and Transportation Areas (RA9)</u>				
Grasses	<u>Poa pratensis</u>	Kentucky bluegrass	6.6	13.4
	<u>Panicum spp.</u>	Switchgrass	3.8	
	<u>Bromus tectorum</u>	Cheatgrass	2.6	
	<u>Agropyron smithii</u>	Western wheatgrass	0.4	
Forbs	<u>Clematis ligusticifolia</u>	White clematis	40.0	59.8
	<u>Aster foliaceus</u>	Leafy aster	9.5	
	<u>Cirsium vulgare</u>	Common thistle	6.6	
	<u>Machaeranthera linearis</u>	Hoary aster	0.9	
	<u>Melilotus officianales</u>	Sweetclover	0.9	
	<u>Solidago sp.</u>	Goldenrod	0.9	
	<u>Arnica cordifolia</u>	Heartleaf arnica	0.6	
	<u>Hedysarum boreale</u>	Sweetvetch	0.4	
Shrub	<u>Rosa woodsii</u>	Wild rose	11.2	12.1
	<u>Artemisia tridentata</u>	Big sagebrush	0.6	
	<u>Ribes aureum</u>	Wax currant	0.3	
Trees	<u>Salix exigua</u>	Sandbar willow	5.8	15.7
	<u>Populus angustifolia</u>	Narrowleaf cottonwood	3.8	
	<u>Pseudotsuga menziesii</u>	Douglas fir	2.9	
	<u>Abies concolor</u>	White fir	1.2	
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	2.0	
	Plant		19.8	
	Litter		51.3	
	Rock		3.2	
	Bare ground		25.8	

Table 18. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (RA13)</u>				
Grasses	<u>Carex sp.</u>	Sedge	41.3	72.8
	<u>Poa sp.</u>	Bluegrass	26.4	
	<u>Scirpus americanus</u>	American bullrush	3.1	
	<u>Hordeum jubatum</u>	Foxtail barley	2.0	
Forbs	<u>Equisetum arvense</u>	Field horsetail	5.6	16.9
	<u>Equisetum laevigatum</u>	Smooth horsetail	5.5	
	<u>Cirsium vulgare</u>	Common thistle	2.6	
	<u>Agoseris glauca</u>	False dandelion	1.8	
	<u>Cynoglossum officinale</u>	Houndstongue	0.8	
	<u>Aster foliaceus</u>	Leafy aster	0.5	
	<u>Rumex crispus</u>	Curlydock	0.1	
Shrub	<u>Rosa woodsii</u>	Wild rose	2.7	6.7
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	2.2	
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	1.2	
	<u>Artemisia tridentata</u>	Big sagebrush	0.6	
Trees	<u>Salix exigua</u>	Sandbar willow	3.6	3.6
	Plant		32.6	
	Litter		45.6	
	Rock		1.2	
	Bare ground		21.8	

Table 19. Average woody plant density (number of plants per 2.0 m²) for the riparian sampling sites (1981 field season).

Life form	Species	Common name	Density
<u>King 7 and 8 Mines Yard and Transportation Areas (RA9)</u>			
Shrubs	<u>Rosa woodsii</u>	Wood's rose	0.90
	<u>Shepherdia argentea</u>	Buffaloberry	0.12
	<u>Ribes aureum</u>	Wax currant	0.10
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.04
	<u>Artemisia tridentata</u>	Big sagebrush	0.04
	<u>Rhus trilobata</u>	Skunk bush	<u>0.02</u>
Total			1.22
Trees	<u>Salix exigua</u>	Sandbar willow	0.32
	<u>Populus angustifolia</u>	Narrowleaf cottonwood	0.20
	<u>Abies concolor</u>	White fir	0.10
	<u>Juniperus osteosperma</u>	Utah juniper	0.08
	<u>Pseudotsuga menziesii</u>	Douglas fir	<u>0.02</u>
	Total		
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (RA13)</u>			
Shrubs	<u>Rosa woodsii</u>	Wood's rose	0.27
	<u>Artemisia tridentata</u>	Big sagebrush	0.14
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.12
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	<u>0.07</u>
Total			0.60
Trees	<u>Salix exigua</u>	Sandbar willow	0.55
	<u>Pseudotsuga menziesii</u>	Douglas fir	0.04
	<u>Populus tremuloides</u>	Quaking aspen	<u>0.02</u>
Total			0.61

Table 20. Tree composition by size class for the riparian vegetation type within the proposed disturbance area in Mohrland Canyon, sampling site RA9 (possible yard area, transportation area) (1980 field season).

Life Form	Diameter breast height (in.)					% of Total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Populus angustifolia</u>	22	9	7	6	5	62
<u>Acer glabrum</u>	9	1	0	0	0	13
<u>Juniperus osteosperma</u>	2	3	1	1	0	9
<u>Abies concolor</u>	3	3	0	0	0	8
<u>Juniperus scopulorum</u>	1	2	0	0	0	3
<u>Betula occidentalis</u>	2	0	0	0	0	2
<u>Pinus edulis</u>	2	0	0	0	0	2
<u>Pseudotsuga menziesii</u>	0	0	0	0	1	1

% of total	51	22	10	9	8	100
Absolute Density = 617 trees/acre						

Table 21. Major plant species in the sagebrush vegetation type within the proposed disturbance areas (1980 field season).

Life Form	Botanical Name	Common Name
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (SBA3)</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia sp.</u>	Pricklypear
	<u>Rosa sp.</u>	Rose
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Salsola kali</u>	Russian thistle
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (SBA10)</u>		
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia sp.</u>	Pricklypear
	<u>Rhus trilobata</u>	Skunkbush sumac
	<u>Rosa sp.</u>	Rose
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Lappula sp.</u>	Stickweed
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Sphaeralcea grossulariaefolia</u>	Gooseberryleaf globemallow
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 22. Summary of cover data for the sagebrush sampling sites (1981 field season).

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (SBA3)</u>				
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass	5.8	8.3
	<u>Bromus tectorum</u>	Cheatgrass	2.1	
	<u>Sitanion hystrix</u>	Squirrel-tail grass	0.4	
Forbs	<u>Grindelia squarrosa</u>	Gumweed	0.4	0.8
	<u>Astragalus sp.</u>	Locoweed	0.3	
	<u>Salsola kali</u>	Russian thistle	0.1	
Shrub	<u>Artemisia tridentata</u>	Big sagebrush	85.4	90.9
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	3.8	
	<u>Yucca harrimaniae</u>	Harriman yucca	0.8	
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.6	
	<u>Ceratoides lanata</u>	Winterfat	0.2	
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.1	
Trees			0	0
	Plant		27.1	
	Litter		18.1	
	Rock		0.2	
	Bare ground		54.6	

Table 22. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (SBA10)</u>				
Grasses			0	0
Forbs			0	0
Shrub	<u>Artemisia tridentata</u>	Big sagebrush	93.5	100
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	6.5	
Trees			0	0
	Plant		24.5	
	Litter		35.6	
	Rock		1.7	
	Bare ground		38.2	

<u>King 6 Mine Topsoil Stockpile and Borrow Areas (SBA12)</u>				
Grasses	<u>Stipa comata</u>	Needle-and-thread grass	41.0	42.8
	<u>Bouteloua gracilis</u>	Blue grama	1.0	
	<u>Agropyron smithii</u>	Western wheatgrass	0.4	

Table 23. Average woody plant density (number of plants per 2.0 m²) for the sagebrush sampling sites (1981 field season).

Life form	Species	Common name	Density
<u>King 4 and 5 Mines Conveyor System to Coal Preparation Plant (SBA3)</u>			
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	2.60
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.20
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	<u>0.03</u>
	Total		2.83
Trees			0
<u>King 7 and 8 Mine Facilities, Load-Out and Transportation Areas (SBA10)</u>			
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	2.55
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	<u>0.33</u>
	Total		2.88
Trees			0
<u>King 6 Mine Topsoil Stockpile and Borrow Areas (SBA12)</u>			
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	1.21
	<u>Artemisia nova</u>	Black sagebrush	0.44
	<u>Berberis repens</u>	Creeping barberry	0.18
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.11
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.09
	<u>Tetrademia canescens</u>	Gray horsebrush	0.07
	<u>Ceratoides lanata</u>	Winterfat	0.04
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	<u>0.02</u>
	Total		2.16
Trees	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	0.09
	<u>Pinus edulis</u>	Pinyon pine	<u>0.02</u>
	Total		0.11

Table 24. Major species present within reference area MBR1 (above King 4 and King 5 mines, Hiawatha Mine, in the Middle Fork of Miller Creek).

Life form	Botanical name	Common name
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain Juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>A. utahensis</u>	Utah serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Quercus gambellii</u>	Gambel oak
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Cirsium</u> sp.	Thistle
	<u>Eriogonum corymbosum</u>	Corymbed eriogonum
	<u>Eriogonum</u> sp.	Eriogonum
	<u>Machaeranthera linearis</u>	Hoary aster
	<u>Solidago</u> sp	Goldenrod
	<u>Viguiera multiflora</u>	Goldeneye

Table 24. continued

Life form	Botanical name	Common name
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa pratensis</u>	Kentucky bluegrass

Table 25. Major species present within reference area MCR2 (above King 4 and King 5 mines, Hiawatha Mines, in the Middle Fork of Miller Creek).

Life form	Botanical name	Common name
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Picea pungens</u>	Colorado blue spruce
	<u>Populus tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Berberis repens</u>	Creeping barberry
	<u>Holodiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvoceus</u>	Mallow ninebark
	<u>Prunus virginiana</u>	Common chokecherry
	<u>Shepherdia canadensis</u>	Russet buffaloberry
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
Forb	<u>Arnica</u> sp.	Arnica
	<u>Astragalus</u> sp.	Locoweed
	<u>Lupinus</u> sp.	Lupine
	<u>Osmorhiza</u> sp.	Osmorhiza
	<u>Swertia perennis</u>	Alpinebog swertia
	<u>Viola</u> sp.	Violet
Grass	<u>Elymus salina</u>	Salina wildrye

Table 26. Tree composition by size-class for reference area MCR2 mixed conifer vegetation type (above King 4 and 5 Mines, Hiawathia Mine, in the Middle Fork of Miller Creek). (1980 field season)

<u>Species</u>	<u>Diameter breast height (in.)</u>					<u>% of total</u>
	<u>0-2.99</u>	<u>3.0-5.99</u>	<u>6.0-8.99</u>	<u>9.0-12.0</u>	<u>>12.0</u>	
<u>Abies concolor</u>	60		1	0	1	62
<u>Pseudotsuga canadensis</u>			1	0	1	15
<u>Populus tremuloides</u>	10	1	0	0	0	14
<u>Acer glabrum</u>	5	1	0	0	0	8
<u>Picea pungens</u>	0	1	0	0	0	1
<u>% of total</u>	<u>88</u>	<u>8</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>100</u>

Absolute Density = 3,556 trees/acre

Table 27. Major species present within reference area SBR3 (along lower portion of proposed conveyor system from King 4 and King 5 mines, Hiawatha Mine, to the coal preparation plant in Hiawatha).

Life form		Common name
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Opuntia</u> sp.	Pricklypear
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Salsola kali</u>	Russian thistle
Grass	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 28. Relative percent plant cover for sagebrush reference area SBR3.

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass	8.8	9.6
	<u>Sitanion hystrix</u>	Squirrel-tail grass	0.8	
Forbs	<u>Astragalus</u> sp.	Locoweed	1.3	1.3
Shrub	<u>Artemesia tridentata</u>	Big sagebrush	86.2	89.1
	<u>Ceratoides lanata</u>	Winterfat	1.2	
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.5	
Trees			0	0
	Plant		30.6	
	Litter		17.1	
	Rock		0.4	
	Bare ground		51.9	

Table 29. Average woody plant density (number of plants per 2.0 m²) for sagebrush reference area SBR3.

Life form	Species	Common name	Density
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	2.22
	<u>Ceratoides lanata</u>	Winterfat	0.11
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	<u>0.04</u>
Total			2.37
Trees			0

Table 30. Major species present within reference area PJR4 (near proposed conveyor system and coal storage and load-out area below King 6 Mine, King Mine, in the Left Fork of Miller Creek).

Life form	Botanical name	Common name
Tree	<u>Abies concolor</u>	White fir
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>C. montanus</u>	True mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Ephedra viridis</u>	Green ephedra
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Tetrademia canescens</u>	Gray horsebrush
	<u>Yucca harrimaniae</u>	Harriman yucca
	Forb	<u>Artemisia ludoviciana</u>
<u>Eriogonum corymbosum</u>		Corymbed eriogonum
<u>Hymenoxys acaulis</u>		Stemless hymenoxys
<u>Machaeranthera linearis</u>		Hoary aster
<u>Solidago sp.</u>		Goldenrod

Table 30. Continued

Life form	Botanical name	Common name
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass

Table 31. Relative percent cover for plants, litter and rock for pinyon-juniper reference area PJR4.

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Stipa comata</u>	Needle-and-thread grass	33.9	54.3
	<u>Bouteloua gracilis</u>	Blue grama	11.0	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	6.8	
	<u>Bromus tectorum</u>	Cheatgrass	1.1	
	<u>Elymus salina</u>	Salina wildrye	0.6	
	<u>Agropyron smithii</u>	Bluebunch wheatgrass	0.9	
Forbs	<u>Eriogonum</u> sp.	Eriogonum	1.5	8.6
	<u>Cryptantha</u> sp.	Cryptantha	1.9	
	<u>Ipomopsis aggregata</u>	Scarlet gilia	2.0	
	<u>Grindelia squarrosa</u>	Curlycup gumweed	0.8	
	<u>Machaeranthera linearis</u>	Hoary aster	0.6	
	<u>Shaeralcea</u> sp.	Globemallow	0.2	
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush	1.6	
Shrub	<u>Cerococarpus montanus</u>	True mountain mahogany	6.8	30.7
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	3.9	

Table 31. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
Shrub (Continued)				
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	2.1	
	<u>Opuntia</u> sp.	Pricklypear	0.5	
	<u>Artemesia tridentata</u>	Big sagebrush	9.7	
	<u>Tetrademia canescens</u>	Gray horsebrush	1.4	
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	2.7	
	<u>Fero</u> sp.	Fero cactus	0.9	
	<u>Berberis repens</u>	Creeping barberry	1.5	
	<u>Artemisia nova</u>	Black sagebrush	1.2	
Trees	<u>Pinus edulis</u>	Pinyon pine	5.0	6.4
	<u>Juniperus osteosperma</u>	Utah juniper	1.4	

	Plant		15.4	
	Litter		19.4	
	Rock		16.8	
	Bare ground		48.6	

Table 32. Average woody plant density (number of plants per 2.0 m²) for pinyon-juniper reference area PJR4.

Life form	Species	Common name	Density
Shrubs	<u>Cercocarpus montanus</u>	True mountain mahogany	0.37
	<u>Artemisia tridentata</u>	Big sagebrush	0.28
	<u>Berberis repens</u>	Creeping barberry	0.19
	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.16
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	0.12
	<u>Ephedra viridus</u>	Mormon tea	0.05
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.04
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.04
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	<u>0.03</u>
	Total		1.28
Trees	<u>Pinus edulis</u>	Pinyon pine	0.15
	<u>Juniperus osteosperma</u>	Utah juniper	0.11
	<u>Abies concolor</u>	White fir	<u>0.01</u>
		Total	

Table 33. Tree composition by size-class for reference area PJR4, pinyon-juniper woodland vegetation type (near proposed conveyor system and coal storage and load-out area below King 6 Mine, King Mine, in the Left Fork of Miller Creek) (1980 field season).

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Pinus edulis</u>	25	10	5	4	11	55
<u>Juniperus osteosperma</u>	23	9	7	0	5	44
<u>Pseudotsuga menziesii</u>	1	0	0	0	0	1
% of total	49	19	12	4	16	100

Absolute Density = 185 trees/acre

Table 34. Major species present within reference area PJR 5 (near perimeter of waste disposal area near town of Hiawatha).

Life form	Botanical name	Common name
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Artemisia nova</u>	Black sagebrush
	<u>A. tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Opuntia</u> sp.	Pricklypear
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Talinum parviflorum</u>	Prairie flameflower
Grass	<u>Agropyron smithii</u>	Western wheatgrass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Sporobolus aeroides</u>	Alkali sacaton
	<u>Stipa comata</u>	Needle-and-thread grass

Table 35. Tree composition by size-class for reference area PJR5, pinyon-juniper woodland vegetation type (near perimeter of waste disposal area near town of Hiawatha) (1980 field season).

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Pinus edulis</u>	12	1	2	3	0	32
<u>Juniperus osteosperma</u>	26	8	3	0	1	68
% of total	68	16	9	5	2	100

Absolute Density = 73 trees/acre

Table 36. Major species present within mixed conifer reference area MCR7 (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon).

Life form	Botanical name	Common name
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Juniperus scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Pseudotsuga menziesii</u>	Douglas fir
Shrub	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia nova</u>	Black sagebrush
	<u>Berberis repens</u>	Creeping barberry
	<u>Cercocarpus ledifolius</u>	Curly-leaf mountain mahogany
	<u>Chrysothamnus viscidiflorus</u>	Low rabbitbrush
	<u>Holdiscus dumosus</u>	Bush ocean-spray
	<u>Juniperus communis</u>	Common juniper
	<u>Pachistima myrsinites</u>	Myrtle pachistima
	<u>Physocarpus malvaceus</u>	Mallow ninebark
	<u>Prunus virginiana</u>	Common chokecherry
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Sambucus cerulea</u>	Blueberry elder
	<u>Symphoricarpos oreophiuls</u>	Mountain snowberry

Table 36. Continued

Life form	Botanical name	Common name
Forb	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Castilleja linariaefolia</u>	Wyoming painted-cup
	<u>Chenopodium fremontii</u>	Fremont goosefoot
	<u>Clematis ligusticifolia</u>	Western virginsbower
	<u>Eriogonum sp.</u>	Eriogonum
	<u>Machaeranthera canescens</u>	Hoary aster
	<u>Penstemon sp.</u>	Penstemon
	<u>Solidago canadensis</u>	Canada goldenrod
Grass	<u>Bromus ciliatus</u>	Fringed brome
	<u>Elymus salina</u>	Salina wildrye
	<u>Koeleria cristata</u>	Prairie junegrass
	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Poa fendleriana</u>	Mutton bluegrass

Table 37. Relative percent plant cover the mixed-conifer reference area MCR7
(1981 field season)

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Elymus salina</u>	Salina wildrye	39.8	46.8
	<u>Bouteloua gracilis</u>	Blue grama	2.6	
	<u>Poa</u> sp.	Bluegrass	2.6	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	1.8	
Forbs	<u>Solidago</u> sp.	Goldenrod	4.4	11.8
	<u>Aster foliaceus</u>	Leafy aster	4.1	
	<u>Artemisia ludoviciana</u>	Louisiana sagebrush	2.1	
	<u>Arnica cordifolia</u>	Heartleaf arnica	0.5	
	<u>Machaeranthera lineris</u>	Hoary aster	0.5	
	<u>Castillej</u> sp.	Indian paintbrush	0.2	
Shrubs	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	15.7	34.8
	<u>Physocarpus malvaceus</u>	Mallow ninebark	6.5	
	<u>Pachistima myrsinites</u>	Mountain lover	3.5	
	<u>Sambucus cerulea</u>	Blueberry elder	3.5	
	<u>Berberis repens</u>	Creeping barberry	2.6	

Table 37. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
Shrubs (continued)				
	<u>Juniperus communis</u>	Common juniper	1.8	
	<u>Artemesia tridentata</u>	Big sagebrush	1.2	
Trees	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	2.8	6.6
	<u>Abies concolor</u>	White fir	2.0	
	<u>Pseudotsuga menziesii</u>	Douglas fir	1.0	
	<u>Pinus edulis</u>	Pinyon pine	0.8	
	Plant		15.6	
	Litter		33.3	
	Rock		12.8	
	Bare ground		38.3	

Table 38. Average woody plant density (number of plants per 2.0 m²) for mixed-conifer reference area MCR7. (1981 field season)

Life Form	Species	Common name	Density
Shrubs	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.73
	<u>Berberis repens</u>	Creeping barberry	0.31
	<u>Artemisia tridentata</u>	Big sagebrush	0.20
	<u>Pachistima myrsinites</u>	Myrtle pachistima	0.20
	<u>Physocarpus malvaceus</u>	Mallow ninebark	0.13
	<u>Sambucus cerulea</u>	Blueberry elder	0.08
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany	<u>0.01</u>
	Total		1.66
Trees	<u>Abies concolor</u>	White fir	0.15
	<u>Pinus edulis</u>	Pinyon pine	0.05
	<u>Juniperus osteosperma</u>	Utah juniper	0.05
	<u>Pseudotsuga menziesii</u>	Douglas fir	<u>0.03</u>
	Total		0.28

Table 39. Tree composition by size class for reference area MCR7, mixed conifer vegetation type (near proposed alternative seam portal sites and yard areas near old Mohrland Mine in Mohrland Canyon). (1980 field season)

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	>12.0	
<u>Abies concolor</u>	30	5	3	2	2	41
<u>Pseudotsuga menziesii</u>	9	6	2	0	7	24
<u>Pinus edulis</u>	3	1	3	1	11	
<u>Juniperus scopulorum</u>	4	0	1	0	6	
<u>J. osteosperma</u>	1	0	0	0	1	
% of total	48	2	3	3	28	100

Absolute Density = 380 trees/acre

Table 40. Major species present within riparian reference area RR9 (near proposed yard and transportation areas for King 7 and King 8 Mines in Mohrland Canyon) (1980 field season).

Life form	Botanical name	Common name
Tree	<u>Abies concolor</u>	White fir
	<u>Acer glabrum</u>	Rocky Mountain maple
	<u>Betula occidentalis</u>	River birch
	<u>Juniperus osteosperma</u>	Utah juniper
	<u>J. scopulorum</u>	Rocky Mountain juniper
	<u>Pinus edulis</u>	Pinyon pine
	<u>Populus angustifolia</u>	Narrowleaf cottonwood
	<u>P. tremuloides</u>	Quaking aspen
	<u>Pseudotsuga menziesii</u>	Douglas fir
	<u>Salix exigua</u>	Sandbar willow
Shrub	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus ledifolius</u>	Curl-leaf mountain mahogany
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Rhus trilobata</u>	Skunkbush sumac
	<u>Ribes aureum</u>	Wax currant
	<u>Rosa woodsii</u>	Wood's rose
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
Forb	<u>Artemisia ludoviciana</u>	Louisiana sagebrush
	<u>Aster glaucodes</u>	Blueleaf aster
	<u>Cirsium vulgare</u>	Bull thistle

Table 40. Continued

Life form	Botanical name	Common name	
Forb (continued)	<u>Clematis ligusticifolia</u>	Western virginsbower	
	<u>Conyza canadensis</u>	Canadian horseweed	
	<u>Equisetum arvense</u>	Field horsetail	
	<u>E. laevigatum</u>	Smooth horsetail	
	<u>Erigeron</u> sp.	Fleabane	
	<u>Grindelia squarrosa</u>	Curlycup gumweed	
	<u>Impomopsis aggregata</u>	Scarlet gilia	
	<u>Lupinus</u> sp.	Lupine	
	<u>Melilotus alba</u>	White sweetclover	
	<u>M. officinalis</u>	Yellow sweetclover	
	<u>Solidago sparsiflora</u>	Goldenrod	
	Grass (Grasslike)	<u>Agropyron albicans</u>	Mountain wheatgrass
		<u>Carex</u> sp.	Sedge
		<u>Hordeum jubatum</u>	Foxtail barley
<u>Juncus balticus</u>		Baltic rush	
<u>Muhlenbergia asperifolia</u>		Alkali muhly	
<u>Scirpus americanus</u>		American bullrush	

Table 41. Relative percent plant cover for the riparian reference area RR9.
(1981 field season)

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Carex</u> sp.	Sedge	22.6	38.7
	<u>Poa</u> sp.	Bluegrass	6.8	
	<u>Panicum</u> sp.	Switchgrass	4.1	
	<u>Bromus tectorum</u>	Cheatgrass	2.5	
	<u>Agropyron smithii</u>	Western wheatgrass	1.0	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	0.9	
	<u>Scirpus americanus</u>	American bullrush	0.6	
	<u>Agropyron albicans</u>	Montana wheatgrass	0.2	
Forbs	<u>Clematis ligusticifolia</u>	White clematis	11.3	25.4
	<u>Melilotus officianales</u>	Sweetclover	3.1	
	<u>Melilotus alba</u>	White sweetclover	2.2	
	<u>Cirsium vulgare</u>	Common thistle	1.6	
	<u>Grindelia squarrosa</u>	Gumweed	1.5	
	<u>Arnica cordifolia</u>	Heartleaf arnica	1.3	
	<u>Equisetum laevigatum</u>	Smooth horsetail	1.3	

Table 41. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
Forbs (Continued)				
	<u>Aster foliaceus</u>	Leafy aster	1.2	
	<u>Equisetum arvense</u>	Field horsetail	1.2	
	<u>Verbascum thapsus</u>	Mullein	0.4	
	<u>Tragopogon dubious</u>	Goatsbeard	0.3	
Shrub	<u>Artemisia tridentata</u>	Big sagebrush	5.6	14.3
	<u>Shepherdia argentea</u>	Silver buffaloberry	5.2	
	<u>Rosa woodsii</u>	Wild rose	1.9	
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	1.6	
Trees	<u>Salix exigua</u>	Sandbar willow	20.7	21.6
	<u>Abies concolor</u>	White fir	0.9	
	Plant		28.8	
	Litter		25.6	
	Rock		1.7	
	Bare ground		43.9	

Table 42. Average woody plant density (number of plants per 2.0 m²) for the riparian reference area RR9 (1981 field season).

Life form	Species	Common name	Density
Shrubs	<u>Shepherdia argentia</u>	Buffaloberry	0.25
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.24
	<u>Artemisia tridentata</u>	Big sagebrush	0.20
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.09
	<u>Ribes aurem</u>	Wax currant	0.05
	<u>Chrysothamnus linifolius</u>	Spreading rabbitbrush	<u>0.04</u>
Total			0.87
Trees	<u>Salix exigua</u>	Sandbar willow	1.20
	<u>Populus angustifolia</u>	Narrowleaf cottonwood	0.20
	<u>Juniperus osteosperma</u>	Utah juniper	0.05
	<u>Abies concolor</u>	White fir	0.04
	<u>Pseudotsuga menziesii</u>	Douglas fir	0.04
	<u>Pinus edulis</u>	Pinyon pine	<u>0.02</u>
Total			1.55

Table 43. Tree composition by size-class for reference area RR9, riparian vegetation type (near proposed yard transportation areas of King 7 and 8 Mines area in Mohrland Canyon). (1980 field season).

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	> 12.0	
<u>Populus angustifolia</u>	43	3	3	0	3	67
<u>Abies concolor</u>	4	2	2	0	0	10
<u>Juniperus scopulorum</u>	3	2	1	0	0	9
<u>Betula occidentalis</u>	4	0	0	0	0	5
<u>Pinus edulis</u>	3	1	0	0	0	5
<u>Acer glabrum</u>	2	0	0	0	0	4
% of total	74	10	9	0	7	100

Absolute Density = 204 trees/acre

Table 44. Major species present within pinyon-juniper reference area PJR11 (near proposed mine facilities, load-out, and transportation areas for King 7 and King 8 Mines in Mohrland Canyon) (1980 field season).

Life form	Botanical name	Common name
Tree	<u>Juniperus osteosperma</u>	Utah juniper
	<u>Pinus edulis</u>	Pinyon pine
Shrub	<u>Amerlanchier alnifolia</u>	Saskatoon serviceberry
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Cercocarpus montanus</u>	True mountain mahogany
	<u>Ephedra viridis</u>	Green ephedra
	<u>Opuntia</u> sp.	Pricklypear
	<u>Yucca harrimaniae</u>	Harriman yucca
Forb	<u>Ipomopsis aggregata</u>	Scarlet gilia
	<u>Senecio</u> sp.	Groundsel
Grass	<u>Elymus salina</u>	Salina wildrye
	<u>Oryzopsis hymenoides</u>	Indian ricegrass

Table 45. Relative percent cover of plants, litter and rock pinyon-juniper reference area PJR11 (1981 field season)

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Elymus salina</u>	Salina wildrye	6.4	55.4
	<u>Agropyron smithii</u>	Bluebunch wheatgrass	8.1	
	<u>Oryzopsis hymenoides</u>	Indian ricegrass	18.8	
	<u>Bouteloua gracilis</u>	Blue grama	7.7	
	<u>Stipa comata</u>	Needle-and-thread grass	13.6	
	<u>Poa pratensis</u>	Kentucky bluegrass	0.8	
Forbs	<u>Ipomopsis aggregata</u>	Scarlet gilia	0.8	4.7
	<u>Grindelia squarrosa</u>	Curlycup gumweed	0.6	
	<u>Eriogonum</u> sp.	Eriogonum	0.9	
	<u>Hymenoxys acaulis</u>	Stemless hymenoxys	0.5	
	<u>Cryptantha</u> sp.	Cryptantha	1.0	
	<u>Machaeranthera linearis</u>	Hoary aster	0.9	
Shrub	<u>Ephedra viridis</u>	Green ephedra	1.9	35.1
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	1.5	

Table 45. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
Shrub continued				
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	1.7	
	<u>Cercocarpus montanus</u>	True mountain mahogany	5.2	
Trees	<u>Pinus edulis</u>	Pinyon pine	5.5	10.3
	<u>Juniperus osteosperma</u>	Utah juniper	4.8	
	Plant		6.9	
	Litter		16.2	
	Rock		26.9	
	Bare ground		50.0	

Table 46. Average woody plant density (number of plants per 2.0 m²) for pinyon-juniper reference area PJR11 (1981 field season).

Life form	Species	Common name	Density
Shrubs	<u>Amelanchier alnifolia</u>	Saskatoon serviceberry	0.34
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	0.21
	<u>Ephedra viridis</u>	Green ephedra	0.17
	<u>Cercocarpus montanus</u>	True mountain mahogany	0.13
	<u>Artemisia tridentata</u>	Big sagebrush	0.11
	<u>Berberis repens</u>	Creeping barberry	0.10
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	<u>0.04</u>
Total			1.10
Trees	<u>Juniperus osteosperma</u>	Utah juniper	0.15
	<u>Pinus edulis</u>	Pinyon pine	<u>0.15</u>
Total			0.30

Table 47. Tree composition by size-class for reference area PJR11, pinyon-juniper woodland vegetation type (near proposed mine facilities, and load-out and transportation areas of King 7 and King 8 Mines in Mohrland Canyon). (1980 field season).

Species	Diameter breast height (in.)					% of total
	0-2.99	3.0-5.99	6.0-8.99	9.0-12.0	> 12.0	
<u>Pinus edulis</u>	39	6	10	6	1	77
<u>Juniperus osteosperma</u>	15	2	1	0	0	23
% of total	68	10	14	7	1	100

Absolute Density = 563 trees/acre

Table 48. Major species present within sagebrush reference area SBR12 (King 6 Mine top soil stockpile and borrow area in the Left Fork of Miller Creek) (1981 field season).

Life form	Botanical name	Common name
Trees	<u>Juniperus scopulorum</u>	Rocky Mountain Juniper
	<u>Juniperus osteosperma</u>	Utah juniper
Shrub	<u>Artemisia nova</u>	Black sagebrush
	<u>Artemisia tridentata</u>	Big sagebrush
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed
	<u>Ceratoides lanata</u>	Winterfat
Forb	<u>Eriogonum sp.</u>	Eriogonum
	<u>Melilotus alba</u>	White sweetclover
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass
	<u>Stipa comata</u>	Needle-and-thread grass
	<u>Bouteloua gracilis</u>	Blue grama
	<u>Sitanion hystrix</u>	Squirrel-tail grass

Table 49. Relative percent cover of plants, litter and rock for sagebrush reference area
SBR12 (1981 field season)

Life form	Species	Common name	% relative cover	% relative cover by life form
Grasses	<u>Oryzopsis hymenoides</u>	Indian ricegrass	25.8	41.1
	<u>Stipa comata</u>	Needle-and-thread grass	7.2	
	<u>Bouteloua gracilis</u>	Blue grama	4.6	
	<u>Sitanion hystrix</u>	Squirrel-tail grass	3.5	
Forbs	<u>Eriogonum</u> sp.	Eriogonum	5.7	7.5
	<u>Melilotus alba</u>	White sweetclover	1.8	
Shrub	<u>Artemisia nova</u>	Black sagebrush	19.2	51.0
	<u>Artemisia tridentata</u>	Big sagebrush	17.3	
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	6.4	
	<u>Xanthocephalum sarathrae</u>	Broom snakeweed	3.7	
	<u>Ceratoides lanata</u>	Winterfat	1.2	

Table 49. Continued

Life form	Species	Common name	% relative cover	% relative cover by life form
Trees	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	3.0	3.6
	<u>Juniperus osteosperma</u>	Utah juniper	0.6	

	Plant		16.4	
	Litter		21.0	
	Rock		11.1	
	Bare ground		71.4	

Table 50. Average woody plant density (number of plants per 2.0 m²) for sagebrush reference area SBR12.

Life form	Species	Common name	Density
Shrubs	<u>Artemisia tridentata</u>	Big sagebrush	0.91
	<u>Artemisia nova</u>	Black sagebrush	0.66
	<u>Chrysothamnus nauseosus</u>	Rubber rabbitbrush	0.23
	<u>Ceratoides lanata</u>	Winterfat	0.14
	<u>Xanthocephalum sarothrae</u>	Broom snakeweed	0.09
	<u>Symphoricarpos oreophilus</u>	Mountain snowberry	<u>0.03</u>
	Total		2.06
Trees	<u>Juniperus scopulorum</u>	Rocky Mountain juniper	<u>0.03</u>
	Total		0.03

Table 51. Similarities between mountain brush reference area MBR1 and disturbed areas at the King 4 and King 5 Mines and the Blackhawk Mine (1980 field season).

Item	Reference Area MBR1	King 4 and 5 mines (MBA1)	Blackhawk Mine
Species number	25	19	14
Total aerial cover (%)	76	70-80	60-70
Productivity (lbs/A ¹)	1400	1400	1400
Geology	Blackhawk Formation	Blackhawk Formation	Blackhawk Formation
Soils ¹	Pachic Agriboroll	Pachic Agriboroll	Pachic Agriboroll
Slope (degrees)	32°	25-35°	20-25°
Aspect	SSE	SSE	NNE
Range Site ¹	Mountain Stony Loam	Mountain Stony Loam	Mountain Stony Loam

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February, 1981.

Table 52. Similarities between mixed conifer reference area MCR2 and disturbed areas at the portal in the Right Fork of Miller Creek, King 4 and King 5 Mines, the King 6 Mine (King Mine), and the Blackhawk Mine (1980 field season).

Item	Reference Area MCR2	King 4 and 5 Mines	Portal Area	King 6 Mine	Blackhawk Mine
Species number	22	21	17	25	18
Total aerial cover (%)	84	75-90	75-90	75-90	70-80
Productivity (lbs/A) ¹	2000	2000	2000	2000	2000
Geology	Blackhawk Formation				
Soils ¹	Mollic Cryoboralf				
Slope (degrees)	31°	30-35°	20-25°	30-35°	20-25°
Aspect	NNW	NNW	NE	NNE	NNE
Range Site ¹	Woodland	Woodland	Woodland	Woodland	Woodland

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February, 1981.

Table 53. Similarities between sagebrush reference area SBR3 and proposed disturbance areas SBA3 and SBA10. (1981 field season).

Item	SBR3	SBA3	SBA10
Species number	6	12	2
Total cover (%)	30.6	27.12	24.5
Productivity (lbs/A) ¹	1500	1500	1500
Density (2.0 m ²)			
Shrub	2.37	2.83	2.88
Trees	0	0	0
Geology	Masuk Shale	Masuk Shale	Masuk Shale
Soils ¹	Ustic Torrifuvent	Ustic Torrifuvent	Ustic Torrifuvent
Slope (degrees)	4°	5°	3°
Aspect	SSE	SSE	NE
Range Site ¹	Upland Loam	Upland Loam	Upland Loam
Jaccard's Community Coefficient	-	0.50	0.333

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area. Soil Conservation Service, February, 1981.

Table 54. Similarities between pinyon-juniper reference area PJR4 and proposed disturbance areas PJA4, PJA8, and PJA 14. (1981 field season).

Item	PJR4	PJA4	PJA8	PJA14
Species number	25	27	22	28
Total cover (%)	15.2	10.7	10.4	10.5
Productivity (lbs/A)	1200	1200	1200	1200
Density (2.0 m ²)				
Shrub	1.28	2.19	1.15	1.08
Trees	0.27	0.19	0.29	0.35
Geology	Masuk Shale	Masuk Shale	Masuk Shale	Masuk Sahle
Soils	Cumulic Haploboroll	Cumulic Haploboroll	Cumulic Haploboroll	Cumulic Haploboroll
Slope (degrees)	22°	20°	15°	23°
Aspect	SSE	SSE	SSE	SSE
Range Site	Upland Loam (P-J)	Upland Loam (P-J)	Upland Loam (P-J)	Upland Loam (P-J)
Jaccard's Community Coefficient	-	0.68	0.69	0.67

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February, 1981.

Table 55. Similarities between the pinyon-juniper woodland reference area PJR5 and the disturbed waste disposal area near the town of Hiawatha (PJA5). (1980 field season).

Item	PJR5	PJA5
Species number	12	12
Total aerial cover (%)	46	45-60
Productivity (lbs/A) ¹	300	300
Geology	Masuk Shale	Masuk Shale
Soils ¹	-	-
Slope (degrees)	3-4°	2-10°
Aspect	E	E
Range Site	Upland Shallow Shale	Upland Shallow Shale

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February 1981.

Table 56. Similarities between mixed-conifer reference area MCR7 and proposed disturbance areas MCA6 and MCA7 combined. (1981 field season).

Item	MCR7	MCA6/MCA7
Species number	21	16
Total cover (%)	15.6	13.4
Productivity (lbs/A) ¹	2000	2000
Density (2.0 m ²)		
Shrub	1.66	1.84
Trees	0.28	0.31
Geology	Blackhawk Formation	Blackhawk Formation
Soils ¹	Mollic Cryoboralf	Mollic Cryoboralf
Slope (degrees)	38°	38°
Aspect	NNE	NNE
Range Site ¹	Woodland Site	Woodland Site
Jaccard's Community Coefficient		0.682

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Services, Feb., 1981.

Table 57. Similarities between riparian reference area RR9 and proposed disturbance areas RA9 and RA13. (1981 field season)

Item	RR9	RA9	RA13
Species number	25	20	16
Total cover (%)	28.8	20.3	32.4
Productivity (lbs/A) ¹	3000	3000	3000
Density (2.0 m ²)			
Shrub	0.87	1.22	0.60
Trees	1.55	0.72	0.61
Geology	Masuk Shale	Masuk Shale	Masuk Shale
Soils ¹	Typic Ustorthent	Typic Ustorthent	Typic Ustorthent
Slope (degrees)	6-8°	6-8°	6-8°
Aspect	SW	SW	SW
Range Site ¹	Semi-wet Stream Bottom	Semi-wet Stream Bottom	Semi-wet Stream Bottom
Jaccard's Community Coefficient	-	0.364	0.414

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February 1981.

Table 58. Similarities between pinyon-juniper reference area PJR11 and proposed disturbance area PJA11 (1981 field season).

Item	PJR11	PJA11
Species number	16	18
Total cover (%)	6.9	7.4
Productivity (lbs/A) ¹	400	400
Density (2.0 m ²)		
Shrub	1.1	1.1
Trees	0.3	0.4
Geology	Masuk Shale	Masuk Shale
Soils ¹	Ustollic Calciorthid	Ustollic Calciorthid
Slope (degrees)	9°	7°
Aspect	NE	NE
Range Site ¹	Upland Stony Loam (P-J)	Upland Stony Loam (P-J)
Jaccard's Community Coefficient	0.888	

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February 1981.

Table 59. Similarities between sagebrush reference area SBR12 and proposed disturbance area SBA12 (1981 field season).

Item	SBR12	SBA12
Species number	13	15
Total cover (%)	16.4	24.0
Productivity (lbs/A) ¹	2000	2000
Density (2.0 m ²)		
Shrub	2.06	2.16
Trees	0.03	0.11
Geology	-	-
Soils	Cumulic Haploboroll	Cumulic Haploboroll
Slope (degrees)	6-8°	6-8°
Aspect	SW	SW
Range Site	Mountain loam	Mountain loam
Jaccard's Community Coefficient		0.56

¹Source: Vegetation Survey, Soil Survey and Interpretation for U.S. Fuel Co. Mine Area, Soil Conservation Service, February, 1981.

Table 60. t-test comparing plant cover for reference and proposed disturbance areas (1981 field season).

Areas		t-value		
Proposed	Disturbance	Reference	Critical	Observed
SBA3		SBR3	1.28	3.98
PJA4		PJR4	1.28	3.20
MCA6/MCA7		MCR7	1.28	5.14
PJA8		PJR4	1.29	8.21
RA9		RR9	1.29	17.14
SBA10		SBR3	1.29	8.24
PJA11		PJR11	1.28	3.63
SBA12		SBR12	1.30	8.65
RA13		RR9	1.29	3.74
PJA14		PJR4	1.29	14.83

Table 61. t-test comparing woody plant density for reference and proposed disturbance areas (1981 field season).

Areas		t-value	
Proposed Disturbance	Reference	Critical	Observed
SBA3	SBR3	1.29	6.91
PJA4	PJR4	1.25	4.16
MCA6/MCA7	MCR7	1.28	4.37
PJA8	PJR4	1.29	2.19
RA9	RR9	1.28	10.84
SBA10	SBR3	1.29	7.30
PJA11	PJR11	1.29	1.74
SBA12	SBR12	1.29	3.02
RA13	RR9	1.28	12.60
PJA14	PJR4	1.29	2.11

Appendix A

SCOTT M. MATHESON
Governor

TEMPLE A. REYNOLDS
Executive Director,
NATURAL RESOURCES

CLEON B. FEIGHT
Director



STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

OIL, GAS, AND MINING BOARD

CHARLES R. HENDERSON
Chairman

JOHN L. BELL
EDWARD T. BECK
E. STEELE McINTYRE
BOB NORMAN
MARGARET BIRD
HERM OLSEN

August 4, 1981

Mr. Christopher A. Call
Reclamation Specialist
Bid/West Inc.
P.O. Box 3226
Logan, Utah 84321

RE: Baseline Vegetation Data
U.S. Fuel Company
King Mines Complex
ACT/007/011
Carbon County, Utah

Dear Mr. Call:

In response to your telephone call to James Ratzloff of Office of Surface Mining on July 6, 1981, below is a delineation of the baseline vegetation data requirements for the King Mines Complex. The data requirements are summarized from the Technical Environmental Assessment for the proposed conveyor belt in the left fork of Miller Creek and the Apparent Completeness Review for the entire King Mines Complex.

The following is needed for the affected vegetation communities and the corresponding reference areas:

-cover, by species and total aerial cover below the tree canopy (not to exceed 100%)

-woody plant density (both trees and shrubs)

-production, according to SCS Range Site Description

-a comparison of similarity between affected area communities and reference areas, according to cover, shrub density, (by a t-test), slope, aspect, soils and species composition (by a similarity index)

Sampling adequacy should be met for woody plant cover and density at 80% confidence and 10% precision ($d = .1$) using a two tailed t value. The sampling plots should be laid-out at random in the affected area communities so that all vegetation has an equal chance of being sampled.

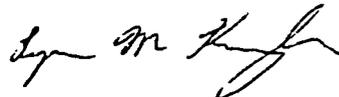
Mr. Christopher A. Call
August 4, 1981
Page Two

Cover should be sampled using the ocular estimation method or another approved method. Shrub density should be sampled using the point-centered quarter method or a quadrant method.

The reference areas chosen must be in fair or better range condition. Site specific production and species diversity data are not required until the bond-release period. A general indication of production for the affected communities and reference areas according to a Science Conservation Service range site description is necessary, however, range site data does not need to be statistically adequate.

If you have any questions, call me.

Sincerely,



LYNN M. KUNZLER
RECLAMATION BIOLOGIST

LMK/te

cc: James Ratzloff, OSM

Appendix B

Table 1B. Sample adequacy for plant cover (1981 field season).

Area	\bar{x}^a	s^2b	Minimum Sample Size	Observed Sample Size
<u>Proposed Disturbance</u>				
SBA3	27.1	108.07	26	50
PJA4	10.7	53.08	74	75
MCA6/MCA7	13.4	34.30	33	30
PJA8	10.4	45.43	69	70
RA9	20.3	71.60	32	35
SBA10	24.5	88.67	25	35
PJA11	7.4	21.94	67	75
SBA12	24.0	35.31	11	20
RA13	32.4	121.33	21	25
PJA14	10.5	33.58	51	55
<u>Reference</u>				
SBR3	30.6	118.96	22	40
PJR4	15.2	63.58	48	50
MCR7	15.6	46.36	33	35
RR9	28.8	98.25	21	32
PJR11	6.9	17.98	62	70
SBR12	16.4	32.48	19	20

^aMean percent plant cover

^bSample variance

Table 2B. Sample adequacy for woody plant density (1981 field season).

Area	\bar{x}^a	s^2b	Minimum Sample Size	Observed Sample Size
<u>Proposed Disturbance</u>				
SBA3	3.06	1.70	31	35
PJA4	2.38	1.94	89	90
MCA6/MCA7	2.15	1.24	44	60
PJA8	1.44	1.06	79	90
RA9	1.94	1.06	47	50
SBA10	2.88	1.00	21	40
PJA11	1.50	0.84	62	65
SBA12	2.27	1.42	43	45
RA13	1.21	0.86	83	85
PJA14	1.14	0.65	55	60
<u>Reference</u>				
SBR3	2.37	1.51	45	45
PJR4	1.55	1.22	75	75
MCR7	1.94	1.74	70	70
RR9	2.42	2.06	54	55
PJR11	1.46	0.66	51	70
SBR12	2.09	0.81	32	35

^aMean woody plant density

^bSample variance

Table 3B. Sample adequacy for tree density data (1980 field season).

Area	\bar{x}^a	s^2b	Minimum Sample Size	Observed Sample Size
<u>Proposed Disturbance</u>				
PJA4	14.79	34.6	28	20
PJA8	12.00	18.4	22	20
RA9	8.48	9.48	29	20
<u>Reference</u>				
PJR4	15.60	18.8	13	20
PJR8	11.06	16.4	23	20
PR9	14.60	105.1	86	20

^aMean plant density
^bSample variance

APPENDIX III-3
VERTEBRATE SPECIES OF SOUTHEASTERN UTAH
UTAH DIVISION OF WILDLIFE RESOURCES
1978

SPECIES LIST OF VERTEBRATE WILDLIFE
THAT INHABIT SOUTHEASTERN UTAH

Compiled by

Larry B. Dalton
C. Brent Farnsworth
Randall B. Smith
R. Craig Wallace
Roger B. Wilson
Samuel C. Winegardner

PUBLICATION NO. 78-16

UTAH STATE DIVISION OF WILDLIFE RESOURCES

Douglas F. Day, Director

Copyright © 1978 Division of Wildlife Resources

ACKNOWLEDGMENTS

Agencies and individuals that have contributed information on species distribution within the southeastern region are acknowledged. Bureau of Land Management and U.S. Forest Service biologists provided information concerning local sightings and distribution of wildlife species. Species lists obtained from Arches and Canyonlands National parks were also helpful. Within the Utah Division of Wildlife Resources, local conservation officers and wildlife biologists provided valuable information on species within their districts or areas of experience. Thanks go to other Division personnel who assisted with review of this document.

The status and population trend for individual species is a product of the experience of the authors and others who have professional experience with the wildlife resource in southeastern Utah.

Larry B. Dalton
C. Brent Farnsworth
Randall B. Smith
R. Craig Wallace
Roger B. Wilson
Samuel C. Winegardner

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SPECIES LIST	3
Fishes	3
Amphibians	6
Reptiles	8
Birds	14
Mammals	48
LITERATURE CITED	68

LIST OF TABLES

	Page
Table 1. List of Game Species and Region of Inhabitation within Utah	63
Big Game	63
Fishes	63
Furbearers	64
Migratory Game Birds	64
Small Game - Mammals	65
Small Game - Upland Birds	66
 Table 2. Classification of the 466 Species of Vertebrate Wildlife.	 67

SPECIES LIST OF VERTEBRATE WILDLIFE
THAT INHABIT SOUTHEASTERN UTAH

Utah is believed to be inhabited by 734 species of vertebrate wildlife. Four hundred forty-five of these species are protected: 2 amphibians, 2 reptiles, 26 mammals, 58 fish and 357 birds. One hundred of the protected species are game species: 10 species of big game; 20, fish; 10, furbearers; 43, migratory game birds; 5, small game mammals; and 12, upland, small game birds. Table 1 provides a comparison of inhabitation by game species between Utah Division of Wildlife Resource's five regions.

Southeastern Utah is inhabited by 466 species of vertebrate wildlife in six biogeographic areas (Table 2). Three hundred forty-three of these species are protected: 2 amphibians, 26 mammals, 38 fish and 277 birds. Seventy-nine of the protected species that inhabit southeastern Utah are game species: 9 species of big game; 13, game fish; 9, furbearers, 35, migratory game birds; 4, small game mammals; and 9, upland, small game birds.

Southeastern Utah has been divided into six biogeographic areas. Each area allows an overlap of wildlife species that inhabit contiguous low and high elevation areas. This procedure was utilized to reduce any controversy that would normally arise from a "sharp line" drawn on a map.

- A- Wasatch Plateau extending east from Skyline Drive to Highway 10 and bounded on the north by Highway 6 and on the south by Interstate 70.
- B- West Tavaputs Plateau including all drainages into the Price River drainage from Soldier's Summit east along Reservation Ridge and including the drainages into Argyle, Nine Mile and Minnie Maud creeks; bounded on the east by the Green River and south and west by Highway 6.
- C- East Tavaputs Plateau bounded on the east by the Colorado-Utah state line; on the south by Interstate 70; on the west by the Green River and on the north by Uintah-Ouray Indian Reservation and the Uintah-Grand county line.
- D- San Rafael Swell and San Rafael Desert bounded by Highway 6 on the north; Highway 10 on the west; the Green River on the east and the Emery-Wayne county line on the south.
- E- Henry Mountains and Burr Desert bounded on the north by Emery-Wayne county line; the Green and Colorado rivers on the east; Lake Powell on the south and Capitol Reef National Park and the Waterpocket Fold on the west.
- F- Mountains and deserts of Grand and San Juan counties south of Interstate Highway 70 and north of the San Juan River bounded on the east by the Utah-Colorado border and on the west by the Green and Colorado rivers and Lake Powell.

Each species is listed by common name followed by the generic and specific nomenclature. The status for each species was determined by the authors after evaluation and consultation from several sources. The listing for mammals was developed from Sparks (1974), Burt and Grossenheider (1976) and Durrant (1952). The primary sources consulted in compiling the bird list were Behle and Perry (1975) and Hayward et al. (1976) although, Peterson (1969), Robbins et al. (1966) and Udvardy and Rayfield (1977) were also used.

Holden (1973), Bailey et al. (1970), Eddy (1969) and Sigler and Miller (1963) were consulted for preparation of the list of fishes.

The status of reptiles and amphibians was determined through discussion with local herpetologists. The phylogenetic listing is after Stebbins (1966). Tanner (1975) was consulted for species inhabiting Utah.

The following code letters are given for each species to describe its status.

- K Status unknown - It is believed that these species are present, but little is known of their population dynamics.
- C Common - These species are widespread and abundant.
- U Uncommon - These species are widespread, but not abundant.
- R Rare - These species are seldom identified during any one year.
- O Occasional - These species are periodically identified during a long term period--10-50 years.
- A Accidental - Distribution for these species does not normally include this area. Sightings are as far between as 50 to 100 years.
- E Endangered - These species are endangered with extinction or extirpation from wildland in Utah.
- T Threatened - These species are threatened with becoming endangered in Utah.
- L Limited - These species are common but restricted to a particular use area or habitat type in Utah.
- X Extirpated - These species have disappeared from wildland habitats in Utah.
- P Protected - These species are protected by state or federal laws in Utah.
- N Nonprotected - These species are not protected by any laws in Utah.

The following terminology is used to describe the seasonal status for avian species.

Transient - These species pass through southeastern Utah twice a year during their migratory travels.

Resident - These species occur yearlong in southeastern Utah.

Summer Resident - These species breed in southeastern Utah and migrate elsewhere for the winter.

Winter Resident - These species breed elsewhere but winter in southeastern Utah.

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Species -- 38 species in southeastern Utah				
Family Clupeidae				
Threadfin Shad (<u>Dorosoma petenense</u>)	E,F	L-P	Stable	Lake-pelagic areas
Family Salmonidae				
Cutthroat Trout (<u>Salmo clarki</u>)	A,B,D,F	C-P	Stable	Lakes-rocky shores, deep pelagic water; river-pools, riffles, and overhanging banks
Rainbow Trout (<u>Salmo gairdneri</u>)	A,B,E,F,	C-P	Stable	Lake-littoral and pelagic areas rivers-pools, riffles, overhanging banks
Brown Trout (<u>Salmo trutta</u>)	A,B,E,F	C-P	Stable	Lake-pelagic and littoral areas rivers-pools, riffles, and overhanging banks
Brook Trout (<u>Salvelinus fontinalis</u>)	A,F	L-P	Stable	Lake-pelagic and littoral areas
Family Esocidae				
Northern Pike (<u>Esox lucius</u>)	E,F	L-P	Unknown	Lake-littoral areas with submerged trees and brush
Family Cyprinidae				
Longfin Dace (<u>Agosia chrysogaster</u>)	E,F	K-P	Unknown	Unknown
Carp (<u>Cyprinus carpio</u>)	A,B,C,D,E,F	C-P	Stable	Lakes-littoral areas; quiet water areas in rivers, ponds, sloughs, creeks, and irrigation ditches
Utah Chub (<u>Gila atraria</u>)	A,B	L-P	Abundant	Irrigation ditches, ponds, sloughs, creeks, rivers, and lakes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Fishes -- 38 species in southeastern Utah				
Family Clupeidae				
Threadfin Shad (<u>Dorosoma petenense</u>)	E,F	L-P	Stable	Lake-pelagic areas
Family Salmonidae				
Cutthroat Trout (<u>Salmo clarki</u>)	A,B,D,F	C-P	Stable	Lakes-rocky shores, deep pelagic water; river-pools, riffles, and overhanging banks
Rainbow Trout (<u>Salmo gairdneri</u>)	A,B,E,F,	C-P	Stable	Lake-littoral and pelagic areas rivers-pools, riffles, overhanging banks
Brown Trout (<u>Salmo trutta</u>)	A,B,E,F	C-P	Stable	Lake-pelagic and littoral areas rivers-pools, riffles, and overhanging banks
Brook Trout (<u>Salvelinus fontinalis</u>)	A,F	L-P	Stable	Lake-pelagic and littoral areas
Family Esocidae				
Northern Pike (<u>Esox lucius</u>)	E,F	L-P	Unknown	Lake-littoral areas with submerged trees and brush
Family Cyprinidae				
Longfin Dace (<u>Agosia chrysogaster</u>)	E,F	K-P	Unknown	Unknown
Carp (<u>Cyprinus carpio</u>)	A,B,C,D,E,F	C-P	Stable	Lakes-littoral areas; quiet water areas in rivers, ponds, sloughs, creeks, and irrigation ditches
Utah Chub (<u>Gila atraria</u>)	A,B	L-P	Abundant	Irrigation ditches, ponds, sloughs, creeks, rivers, and lakes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
* Leatherside Chub (<u>Gila copei</u>)	A,E	C-P	Stable	Pool and riffle areas
x Humpback Chub (<u>Gila cypha</u>)	B	E-P	Decreasing	Eddies and backwaters
x Bonetail Chub (<u>Gila elegans</u>)	B,C,F	E-P*	Decreasing	Main channels of large rivers
Roundtail Chub (<u>Gila robusta</u>)	B,C,D,E,F	C-P	Stable	Riffles and stagnant backwaters
Red Shiner (<u>Notropis lutrensis</u>)	B,C,D,E,F	C-P	Increasing	Riffles, pools, backwaters, and eddies
San Shiner (<u>Notropis stramineus</u>)	F	C-P	Increasing	Riffles, pools, backwaters, and eddies
Fathead Minnow (<u>Pimephales promelas</u>)	B,C,D,E,F	C-P	Stable	Pools and backwaters
x Colorado Squawfish (<u>Ptychocheilus lucius</u>)	B,C,D,E,F	E-P	Decreasing	Slow waters, eddies, backwaters, and large pools
x Longnose Dace (<u>Rhinichtys cataractae</u>)	A	U-P	Unknown	Pools and riffles
Speckled Dace (<u>Rhinichtys osculus</u>)	A,B,C,D,E,F	C-P	Stable	Pools and riffles
Redside Shiner (<u>Richardsonius balteatus</u>)	A,B,D	C-P	Stable	Lakes, creeks and rivers
Family Catostomidae				
White Sucker (<u>Catostomus commersoni</u>)	E,F	U-P	Unknown	Unknown
Bluehead Sucker (<u>Catostomus discobolus</u>)	A,B,C,D,E,F	C-P	Stable	Pools, riffles and lakes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Flannelmouth Sucker <u>(Catostomus latipinnis)</u>	B,C,D,E,F	C-P	Stable	Pools and riffles
Mountain Sucker <u>(Catostomus platyrhynchus)</u>	A	L-P	Stable	Pools and riffles
x Humpback Sucker <u>(Xyrauchen texanus)</u>	B,C,D,E,F	T-P*	Decreasing	Large rivers with strong currents
Family Ictaluridae				
x Black Bullhead <u>(Ictalurus melas)</u>	B,C,D,E,F	C-P	Stable	Pools, quiet water and lakes
x Yellow Bullhead <u>(Ictalurus natalis)</u>	E,F	R-P	Stable	Quiet water areas and lakes
x Channel Catfish <u>(Ictalurus punctatus)</u>	B,C,D,E,F	C-P	Stable	Pools, riffles, quiet water areas and lakes
Family Cyprinodontidae				
Plains Killifish <u>(Fundulus kansae)</u>	F	R-P	Stable	Quiet water areas
Family Poeciliidae				
Mosquito fish <u>(Gambusia affinis)</u>	F	R-P	Stable	Quiet water areas
Family Cottidae				
x Mottled Sculpin <u>(Cottus bairdi)</u>	A	C-P	Stable	Rocky riffles and pool areas
Family Percichtyidae				
x Striped Bass <u>(Morone saxatilis)</u>	E,F	C-P	Increasing	Lake-pelagic areas
Family Centrarchidae				
Green Sunfish <u>(Lepomis cyanellus)</u>	B,C,D,E,F	C-P	Stable	Quiet backwaters and lakes
x Bluegill <u>(Lepomis macrochirus)</u>	E,F	C-P	Stable	Lakes-littoral areas with rocky shores and submerged brush

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
x Largemouth Bass (<u>Micropterus salmoides</u>)	A,B,C,D,E,F	C-P	Stable	Rivers-quiet water areas; lakes-littoral rocky areas, with submerged brush
x Black Crappie (<u>Pomoxis nigromaculatus</u>)	E,F	C-P	Stable	Lake-littoral zone around submerged brush and trees, and pelagic areas
Family Percidae				
x Perch (<u>Perca flavescens</u>)	F	U-P	Unknown	Unknown
x Walleye (<u>Stizostedion vitreum</u>)	E,F	C-P	Stable	Lake-deep water around rocky bottoms

* It is believed that these species will be included on the Federal list of threatened and endangered species in the near future.

o

Amphibians -- 11 species in southeastern Utah

Family Ambystomatidae

! x Tiger Salamander (Ambystoma tigrinum)

A,B,C,D,E,F	C-P	Unknown	Quiet water of ponds, reservoirs, lakes, temporary rain pools and streams from arid sagebrush plains to rolling grasslands, mountain meadows and forests
-------------	-----	---------	---

Family Pelobatidae

! Great Basin Spadefoot Toad
(Scaphiopus intermontanus)

A,B,C,D,E,F	C-N	Unknown	Sagebrush flats, pinion- juniper woodlands to high elevations in spruce-fir communities
-------------	-----	---------	--

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Western Spadefoot Toad <u>(Scaphiopus hammondi)</u>	F	K-N	Unknown	Washes, alkali flats, foothills, mountain valleys, in open vegetation and shortgrass, where soil is sandy and/or gravelly
Family Bufonidae				
! Western Toad <u>(Bufo boreas)</u>	A	K-N	Unknown	Desert streams, springs, grasslands, woodlands, and mountain meadows
Red Spotted Toad <u>(Bufo punctatus)</u>	D,E,F,	C-N	Unknown	Open grassland and rocky canyons
! Woodhouse's Toad <u>(Bufo woodhousei)</u>	A,B,C,D,E,F	C-N	Unknown	Grassland, sagebrush flats, woods, desert streams, valleys, flood plains, farms, and city backyards
Great Plains Toad <u>(Bufo cognatus)</u>	C,D,E,F,	C-N	Unknown	Prairies, deserts, quiet water of streams, grasslands and sagebrush plains
Family Hylidae				
! Chorus Frog <u>(Pseudacris triseriata)</u>	A,B,C,D,F	C-N	Unknown	Grassy pools, lakes, and marshes of prairies or mountains

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Canyon Tree Frog (<u>Hyla arenicolor</u>)	E,F	L-N	Unknown	Intermittant or permanent streams with rocky pools in canyons with cottonwoods or other trees
Family Ranidae				
x Bullfrog (<u>Rana catesbeiana</u>)	F	L-P	Unknown	Colorado River-usually quiet water where there is thick growth of aquatic vegetation
! Leopard Frog (<u>Rana pipiens</u>)	A,B,C,D,E,F	C-N	Unknown	Springs, creeks, rivers, ponds, canals, reservoirs and wet meadows
Reptiles -- 36 species in southeastern Utah				
Family Iguanidae				
∞ x Chuckwalla (<u>Sauromalus obesus</u>)	E,F	L-N	Unknown	Rocky hillsides
! Collared Lizard (<u>Crotaphytus collaris</u>)	A,B,C,D,E,F	C-N	Unknown	Canyons, rocky gullies, mountain slopes and boulder strewn alluvial fans where vegetation is sparse
! Leopard Lizard (<u>Crotaphytus wislizenii</u>)	A,B,C,D,E,F	C-N	Unknown	Arid and semi-arid plains with bunchgrass, sagebrush or other low desert shrub communities; avoids dense vegetation
Lesser Earless Lizard (<u>Holbrookia maculata</u>)	F	K-N	Unknown	Washes, sandy stream banks and sand dunes on shortgrass prairie and farmlands

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Eastern Fence Lizard <u>(Sceloporus undulatus)</u>	A,B,C,D,E,F	C-N	Unknown	Forest, woodlands, prairie, brushy flatlands, sand dunes, rocky hillsides and farmlands
Desert Spiny Lizard <u>(Sceloporus magister)</u>	D,E,F	C-N	Unknown	Shadscale deserts, pinion-juniper woodland, willows and cottonwoods.
! Sagebrush Lizard <u>(Sceloporus graciosus)</u>	A,B,C,D,E,F	C-N	Unknown	Variety of habitat types; sagebrush, pinion-juniper, low desert shrub and rocklands
! Tree Lizard <u>(Urosaurus ornatus)</u>	A,B,C,D,E,F	C-N	Unknown	Trees and rocks
! Side-blotched Lizard <u>(Uta stansburiana)</u>	A,B,C,D,E,F	C-N	Unknown	Inhabits a variety of habitat types; sandy washes with scattered rocks and low growing shrubs
Desert Horned Lizard <u>(Phrynosoma platyrhinos)</u>	E	K-N	Unknown	Along washes at the edge of dunes in saltbrush and sagebrush areas
! Short-horned Lizard <u>(Phrynosoma douglassi)</u>	A,B,C,D,E,F	C-N	Unknown	Desert grassland, sagebrush, pinion-juniper, pine-spruce and spruce-fir associations, extending from desert shrub to mountain habitats

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Xantusiidae * Utah Night Lizard (<u>Xantusia vigilis</u>)	E,F	L-N	Unknown	Dead clumps of yucca plants and woodrat middens
Family Teiidae Plateau Whiptail (<u>Cnemidophorus velox</u>)	F	K-N	Unknown	Mountains in pinion-juniper woodland and lower edges of ponderosa pine forests
Western Whiptail (<u>Cnemidophorus tigris</u>)	A,B,C,D,E,F	C-N	Unknown	Desert shrub communities where plants are sparse and there are open areas for running
Family Scincidae Many-lined Skink (<u>Eumeces multivirgatus</u>)	E,F	K-N	Unknown	Shortgrass prairie that extends into the mountains; often vacant lots, city dumps and backyards
Western Skink (<u>Eumeces skiltonianus</u>)	C	K-N	Unknown	Grasslands, woodlands and forests in rocky habitat near streams with abundant cover
Family Boidae ! Rubber Boa (<u>Charina bottae</u>)	A	C-N	Unknown	Grasslands, woodlands, and forests with rotting logs; often found under rocks and under the bark of fallen or standing dead trees

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Colubridae				
Smooth Green Snake <u>(Opheodrys vernalis)</u>	F	K-N	Unknown	Damp grassy environment
! Striped Whipsnake <u>(Masticophis taeniatus)</u>	A,B,C,D,E,F	C-N	Unknown	Brushlands, grasslands, sagebrush flats, pinion-juniper woodlands and open pine forests
Coachwhip <u>(Masticophis flagellum)</u>	E,F	K-N	Unknown	Utilizes a variety of habitats but avoids dense vegetation; rodent burrows, rocks and branches are used
! Racer <u>(Coluber constrictor)</u>	A,B,C,D,E,F	C-N	Unknown	Meadows, sparse brush and forest openings with semi-arid and moist areas; grassy places near rocks and logs are preferred
Corn Snake <u>(Elaphe guttata)</u>	F	K-N	Unknown	Stream and river bottoms, rocky wooded hillsides, coniferous forests, and farmland with rodent burrows, rocks and logs
! Ringneck Snake <u>(Diadophis punctatus)</u>	A	K-N	Unknown	Moist habitats usually in the mountains or along stream and river bottoms

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Gopher Snake <u>(Pituophis melanoleucus)</u>	A,B,C,D,E,F	C-N	Unknown	Lowlands to high mountains including desert, coniferous forest and farmland types; grassland and open brushland are prescribed
! x Milk Snake <u>(Lampropeltis triangulum)</u>	A,B,C,F	K-N	Unknown	Variety of habitats from lowlands to mountains; rotten logs and stumps are preferred
Common Kingsnake <u>(Lampropeltis getulus)</u>	E,F	K-N	Unknown	Variety of habitats from lowlands to mountains with rock outcrops and clumps of vegetation under rotting logs or rocks
! x Sonora Mountain Kingsnake <u>(Lampropeltis pyromelana)</u>	A	K-N	Unknown	Mountains, pinion-juniper woodlands, mountain brush, coniferous forests with rocks, logs and dense clumps of vegetation
Long-nosed Snake <u>(Rhinocheilus lecontei)</u>	F	K-N	Unknown	Prairies, brushland and irrigated parts of deserts
! Western Terrestrial Garter Snake <u>(Thamnophis elegans)</u>	A,B,C,D,E,F	C-N	Unknown	Variety of terrestrial and aquatic habitats from lowlands to mountains
! Common Garter Snake <u>(Thamnophis sirtalis)</u>	A,F	K-N	Unknown	Variety of habitats, usually near water

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Black-necked Garter Snake <u>(Thamnophis cyrtopsis)</u>	F	K-N	Unknown	Desert and grasslands
Western Black-headed Snake <u>(Tantilla planiceps)</u>	E,F	K-N	Unknown	Grasslands, woodlands and deserts; often found under rocks and logs
! Night Snake (<u>Hypsiglena torquata</u>)	A,B,C,D,E,F	C-N	Unknown	Plains, sagebrush flats, desert and woodlands; often found under rocks and surface litter
Family Crotalidae				
Hopi Rattlesnake <u>(Crotalus viridis nuntius)</u>	E	U-N	Unknown	Prefers rock piles and rodent burrows on grasslands, brushlands, woodlands and forests; avoids sparsely vegetated deserts
Prairie Rattlesnake <u>(Crotalus viridis viridis)</u>	F	U-N	Unknown	Prefers rock piles and rodent burrows on grasslands, woodlands and forests; avoids sparsely vegetated deserts
! Midget Faded Rattlesnake <u>(Crotalus viridis concolor)</u>	A,B,C,D,E,F	C-N	Unknown	Prefers rock piles and rodent burrows on grasslands, brushlands, woodlands and forests; avoids sparsely vegetated deserts

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Birds -- 278 species in southeastern Utah				
Order Gaviiformes				
Family Gaviidae				
Common Loon (<u>Gavia immer</u>)	A,B,C,D,E,F	U-P transient and winter resident	Stable	Lakes of coniferous forests, open lakes, reservoirs and bays
Order Podicipediformes				
Family Podicipedidae				
Horned Grebe (<u>Podiceps auritus</u>)	A,B,C,D,E,F	R-P transient and summer resident	Stable	Lakes, ponds and reservoirs
Eared Grebe (<u>Podiceps nigricollis</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Lakes, bays and reservoirs
14 * Western Grebe (<u>Aechmophorus occidentalis</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Sloughs, bays and reservoirs and lakes with emergent vegetation for nesting
Pied-billed Grebe (<u>Podilymbus podiceps</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Ponds, lakes, streams and marshes
Order Pelecaniformes				
Family Pelecanidae				
* White Pelican (<u>Pelecanus erythrorhynchos</u>)	A,B,C,D,E,F	L-P transient and summer resident	Stable	Larger shallow bodies of water and large rivers
Family Phalacrocoracidae				
* Double-crested Cormorant (<u>Phalacrocorax auritus</u>)	A,B,C,D,E,F	U-P summer resident	Stable	Bays, lakes and rivers

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Ciconiiformes				
Family Ardeidae				
x Great Blue Heron (<u>Ardea herodias</u>)	A,B,C,D,E,F	C-P resident	Stable	Marshes, shallow reservoirs, rivers, streams, shores and irrigation ditches
Green Heron (<u>Butorides striatus</u>)	B,E,F	R-P transient	Unknown	Marshes, wooded streams, rivers, small ponds and lake margins
Cattle Egret (<u>Bubulcus ibis</u>)	E,F	O-P transient	Unknown	Marshes, lake margins, and irrigated lands
Snowy Egret (<u>Egretta thula</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Marshes, ponds, lake margins and irrigated land
SI Black-crowned Night Heron (<u>Nycticorax nycticorax</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Marshes, lake margins and shores
Least Bittern (<u>Ixobrychus exilis</u>)	D,E,F	U-P transient	Unknown	Densely vegetated marshes
American Bittern (<u>Botaurus lentiginosus</u>)	A,B,C,D,E,F	U-P summer resident	Stable	Densely vegetated marshes
Family Ciconiidae				
Wood Stork (<u>Mycteria americana</u>)	D,E,F	O-P transient	Unknown	Marshes, ponds and lake margins
Family Threskiornithidae				
x White-faced Ibis (<u>Plegadis chihi</u>)	A,B,C,D,E,F	C-P summer resident	Increasing	Marshes and irrigated land

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Anseriformes				
Family Anatidae				
x Whistling Swan (<u>Olor columbianus</u>)	A,B,C,D,E,F	O-P winter resident C-P transient	Stable	Lakes, large rivers and fields
x Trumpeter Swan (<u>Olor buccinator</u>)	B,C,D,E,F	R-P transient	Unknown	Lakes and large rivers
x Canada Goose (<u>Branta canadensis</u>)	A,B,C,D,E,F	C-P resident and transient	Increasing	Lakes, bays, marshes, rivers and grainfields
X White-fronted Goose (<u>Anser albifrons</u>)	A,B,C,D,E,F	R-P transient	Stable	Marshes, fields, lakes and bays
X Snow Goose (<u>Chen caerulescens</u>)	A,B,C,D,E,F	U-P transient	Stable	Marshes, grainfields, reservoir, ponds and bays
x Ross' Goose (<u>Chen rossii</u>)	A,B,C,D,E,F	O-P transient	Stable	Marshes, grainfields, prairies, ponds and bays
x Mallard (<u>Anas platyrhynchos</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, irrigated land, grainfields, ponds, river lakes, bays and reservoir extending from lowlands mountains
x Gadwall (<u>Anas strepera</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Lakes, ponds, rivers and marshes
x Pintail (<u>Anas acuta</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, grainfields, ponds, lakes and reservoirs

91

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
x Green-winged Teal (<u>Anas crecca</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, lakes, ponds, rivers and bays
x Blue-winged Teal (<u>Anas discors</u>)	A,B,C,D,E,F	U-P resident and transient	Stable	Ponds and marshes
x Cinnamon Teal (<u>Anas cyanoptera</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Stock ponds, rivers, marshes and lakes
x American Widgeon (<u>Anas americana</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, irrigated land, ponds, lakes and bays
17 x Northern Shoveler (<u>Anas clypeata</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, ponds and sloughs
x Wood Duck (<u>Aix sponsa</u>)	A,B,C,D,E,F	R-P transient	Stable	Wooded rivers and ponds
x Redhead (<u>Aythya americana</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes with some deep water, lakes and reservoirs
x Ring-necked Duck (<u>Aythya collaris</u>)	A,B,C,D,E,F	U-P transient	Stable	Coniferous lakes, wooded ponds, marshes and reservoirs
x Canvasback (<u>Aythya valisineria</u>)	A,B,C,D,E,F	C-P transient R-P summer resident	Stable	Marshes, lakes and reservoirs

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
X Greater Scaup (<u>Arthya marila</u>)	A,B,C,D,E,F	U-P transient	Stable	Lakes, rivers and ponds
X Lesser Scaup (<u>Arthya affinis</u>)	A,B,C,D,E,F	C-P transient	Stable	Marshes, ponds and lakes
X Common Goldeneye (<u>Bucephala clangula</u>)	A,B,C,D,E,F	U-P transient	Stable	Lakes and rivers
X Bufflehead (<u>Bucephala albeola</u>)	A,B,C,D,E,F	U-P transient	Stable	Lakes, ponds and rivers
X White-winged Scoter (<u>Melanitta deglandi</u>)	D	O-P transient	Stable	Large lakes and reservoirs. Recorded occurrence at Desert Lake WMA
X Ruddy Duck (<u>Oxyura jamaicensis</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Marshes, ponds, rivers and reservoirs
X Hooded Merganser (<u>Mergus cucullatus</u>)	A,B,C,D,E,F	R-P transient	Stable	Wooded lakes, ponds, rivers and reservoirs
X Common Merganser (<u>Mergus merganser</u>)	A,B,C,D,E,F	C-P transient U-P winter resident	Stable	Wooded lakes and rivers in summer; in winter, open rivers, lakes and ponds
X Red-breasted Merganser (<u>Mergus serrator</u>)	A,B,C,D,E,F	C-P transient	Stable	Lakes, reservoirs and rivers

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Falconiformes				
Family Cathartidae				
! x Turkey Vulture (<u>Cathartes aura</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Usually seen in sky or perched on dead trees, posts, carrion or on ground
! California Condor (<u>Gymnogyps californianus</u>)	A,B,C,D,E,F	X-P	Extirpated	Usually seen in sky or perched on dead trees, posts, carrion or on ground
Family Accipitridae				
! x Goshawk (<u>Accipiter gentilis</u>)	A,B,C,D,E,F	U-P resident	Stable	Mountain woodlands
! x Sharp-shinned Hawk (<u>Accipiter striatus</u>)	A,B,C,D,E,F	U-P resident and transient	Stable	Forests, thickets, scruboak, desert riparian, mountain woodlands and aspen
! x Cooper's Hawk (<u>Accipiter cooperii</u>)	A,B,C,D,E,F	C-P summer resident and transient R-P winter resident	Stable	Broken woodlands, dry wooded canyons, riparian areas, pinion-juniper and conifers
! x Red-tailed Hawk (<u>Buteo jamaicensis</u>)	A,B,C,D,E,F	C-P resident	Stable	Open country, woodlands, mountains and deserts
x Red-shouldered Hawk (<u>Buteo lineatus</u>)	C,F	A-P transient	Unknown	Broken woodlands, primarily along lowland rivers and often close to cultivated fields
! x Swainson's Hawk (<u>Buteo swainsoni</u>)	A,B,C,D,E,F	U-P summer resident	Stable	Dry plains and rangeland with hills; open forest or alpine meadows with sparse trees

19

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
x Rough-legged Hawk (<u>Buteo lagopus</u>)	A,B,C,D,E,F	C-P winter resident	Stable	Open country, woodlands, deserts and marshes
x Ferruginous Hawk (<u>Buteo regalis</u>)	A,B,C,D,E,F	U-P summer resident R-P winter resident	Stable	Open desert; infrequent marshes and farmlands are utilized
! x Golden Eagle (<u>Aquila chrysaetos</u>)	A,B,C,D,E,F	C-P resident	Stable	Open mountains, foothills, canyons and deserts
! x Bald Eagle (<u>Haliaeetus leucocephalus</u>)	A,B,C,D,E,F	E-P winter resident	Increasing	Lakes, rivers and marshes surrounded by open country with available perching sites
20 x Marsh Hawk (<u>Circus cyaneus</u>)	A,B,C,D,E,F	C-P resident	Stable	Marshes, fields and prairies
Family Pandionidae x Osprey (<u>Pandion haliaetus</u>)	A,B,C,D,E,F	U-P transient	Stable	Rivers, lakes and large bodies of water
Family Falconidae ! x Prairie Falcon (<u>Falco mexicanus</u>)	A,B,C,D,E,F	C-P resident	Stable	Canyons, open habitat in mountains, plains and deserts
! x Peregrine Falcon (<u>Falco peregrinus</u>)	A,B,C,D,E,F	E-P resident	Unknown	Canyons, high cliffs, rivers, marshlands and deserts
x Merlin (<u>Falco columbarius</u>)	A,B,C,D,E,F	C-P winter resident	Unknown	Open country and foothills; often associated with flocking passerines

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
!x American Kestrel (<u>Falco sparverius</u>)	A,B,C,D,E,F	C-P summer resident U-P winter resident	Stable	Open country, prairies, deserts, wooded streams, farmland and cities
Order Galliformes				
Family Tetraonidae				
!x Blue Grouse (<u>Dendragapus obscurus</u>)	A,B,C,D,E,F	C-P resident	Stable	Coniferous forests, aspen, mountain brush, open slash and burns
!x Ruffed Grouse (<u>Bonasa umbellus</u>)	A,B	C-P resident	Stable	Aspen and coniferous forests near stream courses
21 x Sage Grouse (<u>Centrocercus urophasianus</u>)	A,B,C,F	C-P resident	Stable	Sagebrush plains associated with pasture lands; sagebrush parks associated with wet meadows
Family Phasianidae				
x California Quail (<u>Lophortyx californicus</u>)	A,B,D,E,F	C-P resident	Stable	Mountain brush, woodland edges and farmlands near river bottoms
x Gambels Quail (<u>Lophortyx gambelii</u>)	D,E,F	C-P resident	Stable	Desert thickets, usually near water
!x Chukar (<u>Alectoris chukar</u>)	A,B,C,D,E,F	C-P resident	Stable	Rocky, grassy or brushy slopes in arid mountains and canyons
x Ring-necked Pheasant (<u>Phasianus colchicus</u>)	A,B,C,D,E,F	C-P resident	Decreasing	Irrigated cropland, pastureland, wetlands and desert washes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat U.S. Area
x White-winged Pheasant (<u>Phasianus colchicus</u>)	E,F	L-P resident	Decreasing	Irrigated cropland, pastureland and wetland; near Hanksville and Bluff, Utah
Family Meleagrididae				
x Merriam's Turkey (<u>Meleagris gallapavo</u>)	F	L-P resident	Stable	Mountainous regions with Ponderosa pine, mixed conifer and aspen wood- lands or mountain brush
Order Gruiformes				
Family Gruidae				
x Sandhill Crane (<u>Grus canadensis</u>)	A,B,C,D,E,F	R-P transient	Stable	In winter, prairies grainfields and marshes in summer, mountain meadows and marshes
Family Rallidae				
x Virginia Rail (<u>Rallus limicola</u>)	A,B,C,D,E,F	C-P resident	Stable	Marshes
x Sora Rail (<u>Porzana carolina</u>)	A,B,C,D,E,F	U-P resident	Stable	Marshes and wet meadows
x Common Gallinule (<u>Gallinula chloropus</u>)	A,D	R-P transient	Unknown	Marshes, wet meadows, lakes with bulrush or cattails and sedges
x American Coot (<u>Fulica americana</u>)	A,B,C,D,E,F	C-P resident and transient	Stable	Ponds, lakes, marshes, and agricultural lands adjacent to wetland habitats.
Order Charadriiformes				
Family Charadriidae				
Semipalmated Plover (<u>Charadrius semipalmatus</u>)	A,B,C,D,E,F	U-P transient	Stable	Shores of marshes, reservoirs and mudflats

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
* Snowy Plover <u>(Charadrius alexandrinus)</u>	A,B,C,D,E,F	U-P transient	Stable	Alkali and sand flats
Killdeer <u>(Charadrius vociferus)</u>	A,B,C,D,E,F	C-P summer resident and transient	Stable	Fields and pastures, lawns, riverbanks, irrigated land, shores, plowed fields, alkali flats and gravel roads
! Mountain Plover <u>(Charadrius montanus)</u>	A,B,C,F	R-P transient	Stable	Semi-arid grasslands, plains and plateaus
American Golden Plover <u>(Pluvialis dominica)</u>	A,B,C,D,E,F	U-P transient	Stable	Prairies, mudflats and shores
Black-bellied Plover <u>(Pluvialis squatarola)</u>	A,B,C,D,E,F	C-P transient	Stable	Mudflats, open marshes and shores
Family Scolopacidae				
* Common Snipe <u>(Capella gallinago)</u>	A,B,C,D,E,F	C-P resident	Stable	Marshes, irrigation ditches, stream sides, and wet meadows
* Long-billed Curlew <u>(Numenius americanus)</u>	A,B,C,D,E,F	U-P summer resident and transient	Declining	Meadows, pastures and wetlands
* Willet <u>(Catoptrophorus semipalmatus)</u>	A,B,C,D,E,F	U-P summer resident and transient	Stable	Marshes, wet meadows and muddy shores
Spotted Sandpiper <u>(Tringa macularia)</u>	A,B,C,D,E,F	C-P summer resident and transient	Stable	Pebbly lake shores, ponds and stream sides

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Solitary Sandpiper (<u>Tringa solitaria</u>)	A,B,C,D,E,F	U-P transient	Stable	Stream sides, ponds and marshes
Greater Yellowlegs (<u>Tringa melanoleuca</u>)	A,B,C,D,E,F	U-P transient	Stable	Open marshes, mudflats, streams and ponds
Lesser Yellowlegs (<u>Tringa flavipes</u>)	A,B,C,D,E,F	C-P transient	Stable	Marshes, mudflats, shores and pond edges
Pectoral Sandpiper (<u>Calidris melanotos</u>)	A,B,C,D,E,F	U-P transient	Stable	Prairie pools and marshy shores
Baird's Sandpiper (<u>Calidris bairdii</u>)	A,B,C,D,E,F	U-P transient	Stable	Rainpools, pond margins mudflats and shores
Least Sandpiper (<u>Calidris minutilla</u>)	A,B,C,D,E,F	C-P transient	Stable	Grassy marshes, rain- pools, shores and alkal mudflats
Western Sandpiper (<u>Calidris mauri</u>)	A,B,C,D,E,F	C-P transient	Stable	Shores, beaches, mud- flats and open marshes
Sanderling (<u>Calidris alba</u>)	A,B,C,D,E,F	U-P transient	Stable	Lake shores
Short-billed Dowitcher (<u>Limnodromus griseus</u>)	A,B,C,D,E,F	U-P summer resident and transient	Stable	Mudflats, open marshes and ponds
Long-billed Dowitcher (<u>Limnodromous scolopaceus</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Mudflats, shallow pools and wetlands

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Marbled Godwit (<u>Limosa fedoa</u>)	A,B,C,D,E,F	C-P transient	Stable	Grasslands and meadows near lakes and shallow lake margins
Family Recurvirostridae American Avocet (<u>Recurvirostra americana</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Marshes, mudflats, alkaline lakes, shallow ponds and sloughs
Black-necked Stilt (<u>Himantopus mexicanus</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Grassy marshes, alkali mudflats, pools and shallow lakes
Family Phalaropodidae Wilson's Phalarope (<u>Phalaropus tricolor</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Shallow lakes, marshes, pools, shores and mudflats
Northern Phalarope (<u>Phalaropus lobatus</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Lakes and ponds
Family Laridae Glaucous Gull (<u>Larus hyperboreus</u>)	D	R-P transient	Stable	Recorded using marshlands at Desert Lake WMA
Herring Gull (<u>Larus argentatus</u>)	A,B,C,D,E,F	U-P transient	Stable	Lakes, farmlands and dumps
California Gull (<u>Larus californicus</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Lakes, rivers, farmlands and dumps
Ring-billed Gull (<u>Larus delawarensis</u>)	A,B,C,D,E,F	C-P winter resident	Stable	Lakes, rivers, refuse dumps, fields and cities

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Franklin's Gull (<u>Larus pipixcan</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Prairies, marshes, lakes and plowed fields
Bonaparte's Gull (<u>Larus philidelphia</u>)	A,B,C,D,E,F	U-P transient	Stable	Rivers, lakes and open marshes
Forsters Tern (<u>Sterna forsteri</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Marshes, lakes and reservoirs
Common Tern (<u>Sterna hirundo</u>)	A,B,C,D,E,F	U-P transient	Stable	Lakes and reservoirs
Black Tern (<u>Chlidonias niger</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Marshes, lakes and reservoirs
Caspian Tern (<u>Hydroprogne caspia</u>)	A,B,C,D,E,F	U-P transient	Stable	Large lakes and reservoirs
Order Columbiformes Family Columbidae ! x Band-tailed pigeon (<u>Columba fasciata</u>)	A,E,F	U-P summer resident and transient	Stable	Forests, canyons and foothills near mountain brush (acorns) and agricultural lands
! Rock Dove (<u>Columba lavia</u>)	A,B,C,D,E,F	C-N resident	Stable	Cities, farms and cliffs
! x Mourning Dove (<u>Zenaidura macroura</u>)	A,B,C,D,E,F	C-P summer resident and transient	Stable	Farmlands, towns, open woods, grassland and deserts
White-winged Dove (<u>Zenaidura asiatica</u>)	E,F	A-P summer resident and transient	Unknown	Open woods and river bottoms

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Cuculiformes Family Cuculidae ! * Yellow-billed Cuckoo <u>(Coccyzus americanus)</u>	A,B,C,D,E,F	K-P summer resident	Unknown	River thickets and willows
Order Strigiformes Family Tytonidae ! * Barn Owl (<u>Tyto alba</u>)	A,B,C,D,E,F	K-P resident	Unknown	Woodlands, fields, farms, towns, canyons, cliffs and dirt banks
Family Strigidae ! * Screech Owl (<u>Otus asio</u>)	A,B,C,D,E,F	U-P resident	Stable	Riparian communities and wooded canyons
! * Flammulated Owl (<u>Otus flammeolus</u>)	A,B,C,D,E,F	K-P summer resident	Unknown	Open pine and fir forests in mountains
! * Great Horned Owl (<u>Bubo virginianus</u>)	A,B,C,D,E,F	C-P resident	Stable	Ubiquitous
! * Pygmy Owl (<u>Glaucidium gnoma</u>)	A,B,C,D,E,F	K-P resident	Unknown	Wooded canyons in open coniferous, mixed woodlands and pinion-juniper forests
* Burrowing Owl (<u>Speotyto cunicularia</u>)	A,B,C,D,E,F	L-P resident	Declining	Open grassland, prairies, dikes, desert, farms and prairie dog colonies

<u>Species</u>	<u>Biogeographic Area Inhabited</u>	<u>Status</u>	<u>Population Trend</u>	<u>Habitat Use Area</u>
✓ Spotted Owl (<u>Strix occidentalis</u>)	C,E	K-P Unknown	Unknown	Wooded canyons with narrow side canyons in the desert
! x Long-eared Owl (<u>Asio otus</u>)	A,B,C,D,E,F	C-P resident	Stable	River woodlands, pinion-juniper forests, willow thickets and Russian olive trees
x Short-eared Owl (<u>Asio flammeus</u>)	A,B,C,D,E,F	C-P resident	Stable	Marshes, prairies, irrigated land and open country with short vegetation
! x Saw-whet Owl (<u>Aegolius acadicus</u>)	A,B,C,D,E,F	K-P resident	Stable	Forest, conifers and groves
28				
Order Caprimulgiformes				
Family Caprimulgidae				
! Common Nighthawk (<u>Chordeiles minor</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Treeless plains to mountains with open pine woods; often seen in flight over country side or town
Lesser Nighthawk (<u>Chordeiles acutipennis</u>)	E	R-P summer resident	Unknown	Arid open scrub, dry grasslands, pastures and desert washes
! Poor-will (<u>Phalaenoptilus nuttallii</u>)	A,B,C,D,E,F	C-P summer resident	Stable	Arid uplands with open pinion-juniper and sparse brush; riparian areas at roadsides

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Apodiformes				
Family Apodidae				
! * Black Swift (<u>Cypseloides niger</u>)	A,B,C,D,E,F	U-P summer resident	Unknown	Open areas in mountain country
! White-throated Swift (<u>Aeronautes saxatalis</u>)	A,B,C,D,F	C-P summer resident	Unknown	Open areas; wide ranging and breeds mainly in dry mountain canyons
Family Trochilidae				
! Black-chinned Hummingbird (<u>Archilochus alexandri</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Semi-arid country near water; semi-wooded canyons and slopes, mountain brush and riparian woodlands
29 ! Broad-tailed Hummingbird (<u>Selasphorus platycercus</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Ubiquitous
! Rufous Hummingbird (<u>Selasphorus rufus</u>)	A,B,C,D,E,F	C-P summer resident and transient	Unknown	Forest edges, thickets in coniferous and deciduous forests, mountain brush and alpine meadows
! Calliope Hummingbird (<u>Stellula calliope</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	High mountains, canyons and forest openings
Rivoli's Hummingbird (<u>Eugenes fulgens</u>)	E,F	U-P summer resident	Unknown	High mountain forest openings, pine-oak forests and canyons

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Order Caraciformes Family Alcedinidae Belted Kingfisher <u>(Megasceryle alcyon)</u>	A,B,C,D,E,F	U-P resident	Stable	Rivers, ponds and lakes
Order Piciformes Family Picidae ! Common Flicker <u>(Colaptes auratus)</u>	A,B,C,D,E,F	C-P resident	Stable	Deciduous or mixed woodlands, open forest, farms towns, canyons and semi-open country
X Pileated Woodpecker ! <u>(Dryocopus pileatus)</u>	F	R-P resident	Unknown	Mature coniferous and mixed forests with many snags
30 Red-headed Woodpecker <u>(Melanerpes erythrocephalus)</u>	B	R-P resident	Unknown	Groves, farm country, riparian areas, towns and scattered trees
! Yellow-bellied Sapsucker <u>(Sphyrapicus varius)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer woodlands and aspen groves; in winter orchards and other trees
X Williamson's Sapsucker <u>(Sphyrapicus thyroideus)</u>	F	U-P summer resident	Unknown	Higher coniferous forests and burns
X Lewis Woodpecker <u>(Asyndesmus lewis)</u>	F	K-P summer resident and transient	Unknown	Scattered or logged forests, burns, cottonwood groves and ponderosa pine
! Hairy Woodpecker <u>(Dendrocopos villosus)</u>	A,B,C,D,E,F	C-P resident	Unknown	Mountain forests, woodlands and river groves

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Downy Woodpecker <u>(Dendrocopos pubescens)</u>	A,B,C,D,E,F	C-P resident	Unknown	Broken or mixed forest, willows, poplars, riparian woodlands, orchards and shade trees
! Northern Three-toed Woodpecker <u>(Picoides tridactylus)</u>	A,B,C,E,F	U-P resident	Unknown	Coniferous forests
Order Passeriformes				
Family Tyrannidae				
Western Kingbird <u>(Tyrannus verticalis)</u>	A,B,C,D,E,F	C-P summer resident	Stable	Open country with scattered trees, farms and roadsides
! Cassin's Kingbird <u>(Tyrannus vociferans)</u>	A,B,C,D,E,F	U-P summer resident	Unknown	Semi-open high country, scattered trees, pine- oak mountains and ranch groves
! Eastern Kingbird <u>(Tyrannus tyrannus)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Wood edges, parklands, riparian areas, farms, shelter belts, orchards and roadsides
! Ash-throated Flycatcher <u>(Myiarchus cinerascens)</u>	A,B,C,D,E,F	C-P summer resident	Stable	Semi-arid country, deserts, brush, pinion- juniper and open woods
Black Phoebe <u>(Sayornis nigricans)</u>	F	C-P resident	Unknown	Streamside woodlands, farmyards and towns with cliffs near water
! Say's Phoebe <u>(Sayornis saya)</u>	A,B,C,D,E,F	C-P resident	Unknown	Open arid country, deserts, bushy plains, prairie farms, canyon mouths and buttes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
{ Willow (Traill's) Flycatcher <u>(Empidonax traillii)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Breeds in willow thickets in low valleys, along canyons or in high mountain meadows
! Hammond's Flycatcher <u>(Empidonax hammondi)</u>	A,B,C,E,F	U-P summer resident	Unknown	High coniferous forests
! Dusky Flycatcher <u>(Empidonax oberholseri)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Breeds in mountain brush with a scattering of trees
{ Gray Flycatcher <u>(Empidonax wrightii)</u>	A,B,C,D,E,F	K-P summer resident	Unknown	Breeds in sagebrush and pinion-juniper woodlands
! Western Flycatcher <u>(Empidonax difficilis)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Moist woods, mixed or coniferous forests, canyons, groves; must have water and shade
! Western Wood Peewee <u>(Contopus sordidulus)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Woodlands, pine-oak forests, open conifers and river groves
! Olive-sided Flycatcher <u>(Contopus borealis)</u>	A,B,C,D,E,F	U-P summer resident	Unknown	Coniferous forests, burns and clearings; in migration habitats used are varied; usually seen on tip of dead tree or branch

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Alaudidae ! Horned Lark <u>(Eremophila alpestris)</u>	A,B,C,D,E,F	C-P resident	Unknown	Plains, desert, prairies, fields, sparse sagebrush flats, dirt roads, shores, alpine meadows, alkali flats and areas of sparse vegetation
Family Hirundinidae ! Violet-green Swallow <u>(Tachycineta thalassina)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Widespread when foraging; when nesting, open forests foothill woods, mountains, canyons, cliffs and towns
! Tree Swallow (<u>Iridoprocne bicolor</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Open country near water, marshes, mountain meadows, streams, lakes and wires; when nesting requires dead trees and snags, preferably near water
! Bank Swallow (<u>Riparia riparia</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Usually near water; over fields, marshes, streams and lakes
! Rough-winged Swallow <u>(Stelgidopteryx ruficollis)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Near streams, lakes and washes
! Barn Swallow (<u>Hirundo rustica</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Open or semi-wooded country, farms, ranches, fields, marshes and lakes; usually near man's habitation

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Cliff Swallow <u>(Petrochelidon pyrrhonota)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Open to semi-wooded country, neat farms, cliffs, canyons, rivers or lakes
! Purple Martin <u>(Progne subis)</u>	A,B,C,E,F	U-P summer resident	Unknown	Open forests of aspen and conifers
Family Corvidae				
! Steller's Jay <u>(Cyanocitta stelleri)</u>	A,B,C,D,E,F	C-P resident	Unknown	Conifers and pine-oak forests
! Gray Jay <u>(Perisoreus canadensis)</u>	A,B,C,E,F	R-P resident	Unknown	Coniferous forests
! Scrub Jay <u>(Aphelocoma coerulescens)</u>	A,B,C,D,E,F	C-P resident	Unknown	Foothills, oaks, mountain brush, river woods and pinion-juniper woodlands
! Black-billed Magpie <u>(Pica pica)</u>	A,B,C,D,E,F	C-P resident	Unknown	Foothills, ranches, sagebrush, river thickets, shelterbelts and prairie brush
! Common Raven <u>(Corvus corax)</u>	A,B,C,D,E,F	C-P resident	Unknown	Mountains, deserts, canyons and cliffs
! Common Crow <u>(Corvus brachyrhynchos)</u>	A,B,C,D,E,F	O-P transient	Unknown	Deciduous, mixed and open coniferous woodlands farmlands and river grove
! Pinion Jay <u>(Gymnorhinus cyanocephala)</u>	A,B,C,D,E,F	C-P resident	Unknown	Pinion-juniper woodlands, but ranges into sagebrush
Clark's Nutcracker <u>(Nucifraga columbiana)</u>	A,B,C,E,F	C-P resident	Unknown	High mountains in conifer: near tree line

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Paridae				
! Black-capped Chickadee (<u>Parus atricapillus</u>)	A,B,C,D,E,F	C-P resident	Unknown	In summer aspen-conifer, mixed woodlands and forest edges; in winter woodlands along valley streams and tree rows
! Mountain Chickadee (<u>Parus gambeli</u>)	A,B,C,D,E,F	C-P resident	Unknown	In summer mountain forests and conifers; in winter riparian woodlands at lower elevations
! Plain Titmouse (<u>Parus inornatus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Pinion-juniper woodlands
! Bushtit (<u>Psaltriparus minimus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Oak woodlands, mountain brush, broad-leaved and mixed woods and pinion-juniper forest
Family Sittidae				
! White-breasted Nuthatch (<u>Sitta carolinensis</u>)	A,B,C,D,E,F	C-P resident	Unknown	Coniferous forests, pinion-juniper woodlands, oak brush, and riparian woodlands
! Red-breasted Nuthatch (<u>Sitta canadensis</u>)	A,B,C,E,F	C-P resident	Unknown	Coniferous forests
! Pygmy Nuthatch (<u>Sitta pusilla</u>)	A,B,C,D,E,F	C-P resident	Unknown	Ponderosa pines and Douglas fir

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Family Certidae Brown Creeper (<u>Certhia familiaris</u>)	A,B,C,E,F	C-P resident	Unknown	In summer mature montane mixed and coniferous forests; lower elevations in winter
Family Cinclidae Dipper (<u>Cinclus mexicanus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Fast-flowing streams in or near mountains; lower levels in winter
! Family Troglodytidae House Wren (<u>Troglodytes aedon</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Woodlands of mountains and valleys
! Rock Wren (<u>Salpinctes obsoletus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Desert to high mountain areas with talus slopes and cliffs
! Canyon Wren (<u>Catherpes mexicanus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Rocky cliffs, crevices, and rock slides
! Bewick's Wren (<u>Thryomanes bewickii</u>)	A,B,C,D,E,F	C-P resident	Unknown	Under brush and pinion-juniper woodlands
Long-billed Marsh Wren (<u>Cistothorus palustris</u>)	A,B,C,D,E,F	L-P resident	Unknown	Cattail marshes
Family Mimidae ! Mockingbird (<u>Mimus polyglottos</u>)	A,B,C,D,E,F	U-P transient and summer resident	Unknown	Towns, farms, ranches, roadsides, brush and desert streambanks
Gray Catbird (<u>Dumetella carolinensis</u>)	A,B,C,D,E,F	U-P summer resident	Unknown	Undergrowth, brush or thickets along valley streams

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Brown Thrasher (<u>Toxostoma rufum</u>)	D,E,F	R-P resident	Unknown	Brushy places and thorny thickets
Bendire's Thrasher (<u>Toxostoma bendirei</u>)	F	R-P resident	Unknown	Desert scrub and farmlands
! Sage Thrasher (<u>Oreoscoptes montanus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Sagebrush, rabbit-brush, brushy slopes and mesas
Family Muscicapidae				
! American Robin (<u>Turdus migratorius</u>)	A,B,C,D,E,F	C-P resident	Unknown	In summer towns, lawns, farmland, open forests, streamsides and any wooded habitat; in winter berry-bearing trees
Varied Thrush (<u>Ixoreus naevius</u>)	E,F	O-P winter resident	Unknown	Deciduous and coniferous forests usually near water
! Hermit Thrush (<u>Catharus guttatus</u>)	A,B,C,D,E,F	C-P summer resident and transient	Unknown	In summer mixed woodlands and open coniferous forest in winter woods, thickets and parks
! Swainson's Thrush (<u>Catharus ustulatus</u>)	A,B,D	C-P summer resident	Unknown	Willow thickets, river woodlands, aspens, forest undergrowth and conifers
! Veery (<u>Catharus fuscescens</u>)	A,B	U-P summer resident	Unknown	Streamside woodlands

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! x Western Bluebird <u>(Sialia mexicana)</u>	A,B,C,D,E,F	U-P summer resident	Unknown	Scattered trees, open conifers, forests and farms
! x Mountain Bluebird <u>(Sialia currucoides)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer open areas where mountain meadows and pastures are interspersed with loose stands or single coniferous trees; in winter lower elevations, often open areas with available perching sites
38 Townsend's Solitaire <u>(Myadestes townsendi)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer open coniferous forests in the mountains; in winter canyons, brushy slopes and junipers
Family Sylviidae				
! Blue-gray Gnatcatcher <u>(Polioptila caerulea)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Open mixed woods, stream-side thickets, mountain brush and pinion-juniper woodlands
! Golden-crowned Kinglet <u>(Regulus satrapa)</u>	A,B,C,D,E,F	U-P resident	Unknown	In summer coniferous forests; in winter pinion-juniper and brush in lower elevations
! Ruby-crowned Kinglet <u>(Regulus calendula)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer coniferous forests; in winter other woodlands and thickets

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Motacillidae Water Pipet (<u>Anthus spinoletta</u>)	A,B,C,D,E,F	C-P resident	Unknown	In summer alpine zone; in migration and winter plains, bare fields, shores and irrigated fields
Family Bombycillidae ! Bohemian Waxwing (<u>Bombycilla garrulus</u>)	A,B,C,D,E,F	U-P winter resident	Unknown	Widespread and feeds on berries
! Cedar Waxwing (<u>Bombycilla cedrorum</u>)	A,B,C,D,E,F	C-P winter resident	Unknown	Open woodlands, Russian olive and other fruiting trees or orchards
Family Laniidae ! Northern Shrike (<u>Lanius excubitor</u>)	A,B,C,D,E,F	U-P winter resident	Unknown	Semi-open country or open country with look- out posts
Loggerhead Shrike (<u>Lanius ludovicianus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Deserts and other open country with lookout posts, wires, scattered trees and low scrub
Family Sturnidae ! Starling (<u>Sturnus vulgaris</u>)	A,B,C,D,E,F	C-P resident	Unknown	Cities, fields, orchards and woodlands
Family Vireonidae Gray Vireo (<u>Vireo vicinior</u>)	D,E,F	U-P summer resident	Unknown	Brushy mountain slopes, scrub oak and junipers
! Solitary Vireo (<u>Vireo solitarius</u>)	A,B,C,D,E,F	U-P summer resident	Unknown	Streamside woodlands, pinion-juniper and Ponderosa pine forests

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Warbling Vireo (<u>Vireo gilvus</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Deciduous and mixed aspen woodlands near mountain and valley streams
Family Parulidae				
! Orange-crowned Warbler (<u>Vermivora celata</u>)	A,B,C,D,E,F	C-P summer resident and transient	Unknown	Brushy woodland clearings, hillsides, aspens and mountain brush; in migration streamside woodlands
! Nashville Warbler (<u>Vermivora ruficapilla</u>)	A,B,C,D,E,F	U-P transient	Unknown	Open mixed woods with undergrowth and at forest edges
! Virginia's Warbler (<u>Vermivora virginiae</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Oak canyons, brushy slopes and pinion-juniper brushland
Lucy's Warbler (<u>Vermivora luciae</u>)	E,F	U-P summer resident	Unknown	Along desert streams in willows and cottonwoods
! Yellow Warbler (<u>Dendroica petechia</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Willows, aspens, streamside trees and shrubs or town shade trees
X Grace's Warbler (<u>Dendroica graciae</u>)	E,F	U-P summer resident	Unknown	Ponderosa pine-oakbrush communities of the mountains
! Magnolia Warbler (<u>Dendroica magnolia</u>)	A,B,C,D,E,F	U-P transient	Unknown	Coniferous forests

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Hermit Warbler <u>(Dendroica occidentalis)</u>	E,F	U-P summer resident and transient	Unknown	Coniferous forests; in migration other trees
! Yellow-rumped Warbler <u>(Dendroica coronata)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	In summer coniferous and mixed forests; in winter varied woods, river thickets, brush and gardens
! Black-throated Gray Warbler <u>(Dendroica nigrescens)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	In summer dry oak slopes, pinion-juniper woodlands, open mixed woods; in migration varied trees and brush
! Townsend's Warbler <u>(Dendroica townsendi)</u>	A,B,C,D,E,F	U-P transient	Unknown	Coniferous forests
Northern Waterthrush <u>(Seiurus noveboracensis)</u>	B,C,D,E,F	U-P transient	Unknown	Swampy or wet woods, streamsides and lake- shores; in migration thickets
! MacGillivray's Warbler <u>(Oporornis tolmiei)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Low dense undergrowth and shady, damp thickets
Yellowthroat <u>(Geothlypis trichas)</u>	A,B,C,D,E,F	L-P summer resident	Unknown	Cattail and bulrush marshes, willow thickets and streamsides
; Yellow-breasted Chat <u>(Icteria virens)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Dense brush along water courses, willow thickets and moist canyons

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Wilson's Warbler (<u>Wilsonia pusilla</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Deciduous shrubbery or thickets, streamside growth, willows and fir thickets in the mountains
! American Redstart (<u>Setophaga ruticilla</u>)	A,B,C	U-P transient	Unknown	Open secondary deciduous woodlands and riparian woodlands
Family Ploceidae				
! House Sparrow (<u>Passer domesticus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Cities, farms and houses
Family Icteridae				
42 Western Meadowlark (<u>Sturnella neglecta</u>)	A,B,C,D,E,F	C-P resident	Unknown	Open fields, meadows and plains
Yellow-headed Blackbird (<u>Xanthocephalus xanthocephalus</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Marshes with cattail and bulrushes; forages in fields and open country
Red-winged Blackbird (<u>Agelaius phoeniceus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Breeds in marshes with emergent aquatic vegetation, forages in cultivated land and at the edge of water
! Northern Oriole (<u>Icterus galbula</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Open woodlands, cottonwoods or other shade trees and riparian areas

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
* <u>Scotts Oriole</u> <u>(Icterus parisorum)</u>	C,D,E,F	U-P summer resident	Unknown	Pinion-juniper woodlands of desert mountains oak slopes and cottonwood trees in canyons
! <u>Rusty Blackbird</u> <u>(Euphagus carolinus)</u>	A	O-P transient	Unknown	Wooded marshes and riparian woodlands
<u>Brewer's Blackbird</u> <u>(Euphagus cyanocephalus)</u>	A,B,C,D,E,F	C-P resident	Unknown	Varied open country, lakeshores, irrigated pastures, feed lots, parks and cities
! <u>Common Grackle</u> <u>(Quiscalus quiscula)</u>	A,B,D	A-P transient	Unknown	Farms, fields, stream-sides and wet woodlands
! <u>Brown-headed Cowbird</u> <u>(Molothrus ater)</u>	A,B,C,D,E,F	C-P resident	Unknown	Farms, fields, barnyards wood edges and riparian woodlands
Family <u>Thraupidae</u>				
! <u>Western Tanager</u> <u>(Piranga ludoviciana)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Open coniferous, aspen or mixed forests; widespread in migration
Family <u>Embarizidae</u>				
<u>Rose-breasted Grosbeak</u> <u>(Pheucticus ludovicianus)</u>	F	O-P summer resident	Unknown	Broadleaf riparian areas and aspens
! <u>Black-headed Grosbeak</u> <u>(Pheucticus melanocephalus)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Edges of second growth deciduous woods, pinion, riparian areas, orchards and parks

43

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Blue Grosbeak (<u>Guiraca caerulea</u>)	B,C,D,E,F	C-P summer resident	Unknown	Brushy and weedy places willows and river thick and other riparian areas
Lapland Longspur (<u>Calcarius lapponicus</u>)	A,B,C,D,E,F	R-P winter resident	Unknown	Fields, grasslands, saline flats, desert shrub; often seen with horned larks
Indigo Bunting (<u>Passerina cyanea</u>)	A,B,D	R-P summer resident	Unknown	Brush, farm lands and streamsides
! Lazuli Bunting (<u>Passerina amoena</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Mountain brush, stream- side shrubs and farmland tree rows
! Green-tailed Towhee (<u>Chlorura chlorura</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Low mountain brush, greasewood and pinion- juniper woodlands
! Rufous-sided Towhee (<u>Pipilo erythrophthalmus</u>)	A,B,C,D,E,F	C-P resident	Unknown	Mountain brush, forest edges and city shrubs
! Lark Bunting (<u>Calamospiza melanocorys</u>)	A,B,C,D,E,F	O-P transient	Unknown	Plains, prairies, desert shrub and sagebrush
Savannah Sparrow (<u>Passerculus sandwichensis</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Grasslands, fields, saltgrass meadows and open country
!x Grasshopper Sparrow (<u>Ammodramus saviannarum</u>)	A,B,C,D,E,F	R-P transient	Unknown	Dry grasslands
LeConte's Sparrow (<u>Ammospiza leconteii</u>)	F	A-P transient	Unknown	Tall grass, weedy meadows and marshes

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Vesper Sparrow <u>(Poocetes gramineus)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Alfalfa and grain fields, meadows, sagebrush and desert shrub
! Lark Sparrow <u>(Chondestes grammacus)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Open country in sagebrush and desert shrub with available perch sites
! Sage Sparrow (<u>Amphispiza belli</u>)	A,B,C,D,E,F	U-P summer resident	Unknown	Sagebrush, greasewood and other desert shrubs
! Dark-eyed Junco (<u>Junco hyemalis</u>)	A,B,C,D,E,F	C-P resident	Unknown	In summer openings and edges of coniferous and mixed woodlands; in winter greasewood and undergrowth
45 ! Gray-headed Junco (<u>Junco caniceps</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Coniferous, mixed forests and mountain brush
! Tree Sparrow (<u>Spizella arborea</u>)	A,B,C,D,E,F	U-P winter resident	Unknown	Willow thickets and brushy areas
! Chipping Sparrow (<u>Spizella passerina</u>)	A,B,C,D,E,F	C-P summer resident	Unknown	Mountain coniferous and deciduous woodlands, valley woodlands, farms, orchards, parks and brushlands
! Brewer's Sparrow <u>(Spizella breweri)</u>	A,B,C,D,E,F	C-P summer resident	Unknown	Sagebrush, greasewood and other desert shrubs or brushy areas
! Harris Sparrow <u>(Zonotrichia querula)</u>	A,B,C,D,E,F	U-P winter resident	Unknown	Brushy edges of open woodlands, Russian olives and willows

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! White-crowned Sparrow <u>(Zonotrichia leucophrys)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer forest edges and clearings, low brush and mountain thickets; in winter widespread in the valleys, along fence row willows, brushy areas, corn and greasewood
White-throated Sparrow <u>(Zonotrichia albicollis)</u>	E,F	R-P winter resident	Unknown	Coniferous and mixed woodlands, woodland undergrowth thickets and brush
Golden-crowned Sparrow <u>(Zonotrichia atricapilla)</u>	E,F	R-P winter resident	Unknown	Mountain brush and brushy areas in the lower valleys
Swamp Sparrow <u>(Zonotrichia georgiana)</u>	F	U-P winter resident	Unknown	Marshes; in migration weedy fields
! Fox Sparrow <u>(Zonotrichia iliaca)</u>	A,B,C	K-P summer resident and transient	Unknown	Valley and mountain woodlands and brushy areas usually near water
Lincoln's Sparrow <u>(Zonotrichia lincolni)</u>	A,B,C	U-P summer resident R-P winter resident	Unknown	In summer willow thickets, brushy bogs; in winter lowland thickets, tall weeds and bushes
! Song Sparrow <u>(Zonotrichia melodia)</u>	A,B,C,D,E,F	C-P resident	Unknown	Woodland edges, grasslands, cattail marshes, thickets and brushy fence rows

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Black-throated Sparrow <u>(Amphispiza bilineata)</u>	A,B,C,D,E,F	U-P summer resident	Unknown	Pinion-juniper, mountain brush and sagebrush
Family Fringillidae Evening Grosbeak <u>(Coccothraustes vespertinus)</u>	A,B,C,D,E,F	C-P winter resident	Unknown	Boxelders, Russian olive trees and fruiting shrubs
! Cassin's Finch <u>(Carpodacus cassinii)</u>	A,B,C,D,E,F	C-P summer resident U-P winter resident	Unknown	In summer, open conifer forests of high mountains in winter valleys
! House Finch <u>(Carpodacus mexicanus)</u>	A,B,C,D,E,F	C-P resident	Unknown	Varied habitats; towns, ranches, open woods, mountain scrub, canyons, deserts and riparian area
! Pine Grosbeak <u>(Pinicola enucleator)</u>	A,B,C,E,F	U-P resident	Unknown	In summer coniferous forests; in winter mixed woods and fruiting trees
Rosy Finch <u>(Leucosticte arctoa)</u>	A,B,C,D,E,F	C-P resident	Unknown	In summer alpine tundra, meadows and snowfields; winters in lowlands
! Pine Siskin <u>(Carduelis pinus)</u>	A,B,C,D,E,F	C-P resident	Unknown	Coniferous forests, along edges of second growth deciduous forests; in migration seen in large flocks in the lower valle

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! American Goldfinch (<u>Carduelis tristis</u>)	A,B,C,D,E,F	C-P resident	Unknown	Riparian woodlands, willows, cottonwoods, orchards, roadsides and sunflowers
! Lesser Goldfinch (<u>Carduelis psaltria</u>)	A,B,C,D,E,F	C-P resident	Unknown	Open brushy country, open woods, wooded streams and gardens
! Red Crossbill (<u>Loxia curvirostra</u>)	A,B,C,E,F	U-P summer resident	Unknown	Coniferous forests
Mammals -- 103 species in southeastern Utah				
Order Insectivora				
Family Soricidae				
48 x Dwarf Shrew (<u>Sorex nanus</u>)	B,C,D,E,F	R-N	Unknown	Open grass-covered areas which may have scattered brush, marshes, coniferous forests and openings in woods
! North Water Shrew (<u>Sorex palustris</u>)	A,B,C,E,F	C-N	Unknown	Along nearly all permanent streams in mountainous areas
! Merriam Shrew (<u>Sorex merriami</u>)	A,B,C,D,E,F	U-N	Unknown	Arid sagebrush or grassland areas, mountain mahogany, coniferous forests, aspen and cottonwoods
! Vagrant Shrew (<u>Sorex vagrans</u>)	A,B,C,F	C-N	Unknown	Marshes, bogs, wet meadows and along streams in forests

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Masked Shrew (<u>Sorex cinereus</u>)	A,B,D,E	C-N	Unknown	Moist sites in forests, open country and brushland
! Dusky Shrew (<u>Sorex obscurus</u>)	A,B,C,F	C-N	Unknown	Marshes, coniferous forests and dry hillsides
* Gray (Desert) Shrew (<u>Notiosorex crawfordi</u>)	E,F	R-N	Unknown	Arid alluvial fans, brushy slopes, sagebrush and other low desert shrub communities
Order Chiroptera				
Family Vespertilionidae				
67 ! Little Brown Myotis (<u>Myotis lucifugus</u>)	A,B,C,D,E,F	C-N	Unknown	Caves, mine tunnels, hollow trees or buildings usually near water
! Fringed Myotis (<u>Myotis thysanodes</u>)	A,B,C,D,E,F	U-N	Unknown	Caves, old buildings, rock crevices, pinion-juniper and desert shrub
! Long-eared Myotis (<u>Myotis evotis</u>)	A,B,C,D,E,F	C-N	Unknown	Coniferous forests in high mountains, around buildings or trees and occasionally caves
! Long-legged Myotis (<u>Myotis volans</u>)	A,B,C,D,E,F	C-N	Unknown	Buildings, small pockets, crevices in rock ledges and trees

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Yuma Myotis (<u>Myotis yumanensis</u>)	A,B,C,D,E,F	U-N	Unknown	Caves, tunnels and buildings in arid areas
California Myotis (<u>Myotis californicus</u>)	A,B,C,D,E,F	C-N	Unknown	Mine tunnels, hollow trees, loose rocks, buildings, bridges; chiefly a crevice dweller (up to 6,000 feet in elevation)
! Small-footed Myotis (<u>Myotis leibii</u>)	A,B,C,D,E,F	U-N	Unknown	Caves, mine tunnels, crevices in rocks and in buildings
! Silver-haired Bat (<u>Lasionycteris noctivagans</u>)	A,B,C,D,E,F	C-N	Unknown	Forest areas, occasionally in caves or buildings
50 ! Western Pipistrelle (<u>Pipistrellus hesperus</u>)	A,B,C,D,E,F	C-N	Unknown	Caves, under loose rocks, crevices, in cliffs, buildings; arid areas near water courses
! Big Brown Bat (<u>Eptesicus fuscus</u>)	A,B,C,D,E,F	C-N	Unknown	Caves, tunnels, crevices, hollow trees, buildings and wooded areas
! * Red Bat (<u>Lasiurus borealis</u>)	A,B,C,D,E,F	U-N	Unknown	Wooded areas; roosts in trees and occasionally enters caves
! Hoary Bat (<u>Lasiurus cinereus</u>)	A,B,C,D,E,F	U-N	Unknown	Wooded areas
! * Western Big-eared Bat (<u>Plecotus townsendii</u>)	A,B,C,D,E,F	C-N	Unknown	Caves, mine tunnels and buildings utilized for roosting; inhabits arid western desert shrub, pinion-juniper and pine forests

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Mexican Big-eared Bat (<u>Plectus phyllotis</u>)	F	R-N	Unknown	Caves in pine-oak forests between 5,000 to 8,500 feet elevation
* Spotted Bat (<u>Euderma maculata</u>)	Unknown	K-N	Unknown	Arid country; it occasionally enters buildings and caves
Pallid Bat (<u>Antrozous pallidus</u>)	A,B,C,D,E,F	C-N	Unknown	Caves, mine tunnels, crevices in rocks, buildings and trees are utilized for roosts; inhabits scattered desert shrub and pine-oak forests below 6,500 feet elevation
Order Family Molossidae				
Mexican Free-tailed Bat (<u>Tadarida brasiliensis</u>)	A,B,C,D,E,F	C-N	Unknown	Caves and buildings are utilized for roosts; inhabits lower and upper Sonoran Life Zones
Order Lagomorpha				
Family Ochotonidae				
Pika (<u>Ochontona princeps</u>)	A,B,C,E,F	C-N	Unknown	Talus slopes and rock-slides above 8,000 feet elevation
Family Leporidae				
! White-tailed Jackrabbit (<u>Lepus townsendii</u>)	A,B,C,D	C-N	Stable	Open, grassy or sage-brush areas at medium elevation
! * Snowshoe Hare (<u>Lepus americanus</u>)	A,B,C	C-P	Cyclic	Coniferous forests and aspen, riparian and brush types near conifers

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! x Black-tailed Jackrabbit (<u>Lepus californicus</u>)	A,B,C,D,E,F	C-N	Stable	Open grassland, sagebrush and desert shrub areas at low to medium elevations
! x Mountain Cottontail (<u>Sylvilagus nuttallii</u>)	A,B,C,E,F	C-P	Stable	Thickets, sagebrush, loose rocks, cliffs and forests
! x Desert Cottontail (<u>Sylvilagus audubonii</u>)	A,B,C,D,E,F	C-P	Stable	Open plains, foothills and low valleys with grass, sagebrush or scattered pinion-juniper
Order Rodentia				
Family Sciuridae				
! x Zuni Prairie Dog (<u>Cynomys gunnisoni</u>)	F	C-N	Stable	Mountain valleys, 5,000-12,000 feet elevation; open to slightly brushy country with scattered pinion-juniper
White-tailed Prairie Dog (<u>Cynomys leucurus</u>)	A,B,C,D,E,F	C-N	Stable	Valleys and flatlands where vegetation is sparse
x Abert Squirrel (<u>Sciurus aberti</u>)	F	L-P	Stable	Ponderosa pines
! Red Squirrel (<u>Tamiasciurus hudsonicus</u>)	A,B,C,F	C-N	Stable	Coniferous forests in the mountains

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
* Spotted Ground Squirrel (<u>Spermophilus spilosoma</u>)	F	L-N	Unknown	Open forests, scattered brush and grassy areas with sandy soil is preferred
! Rock Squirrel (<u>Spermophilus variegatus</u>)	A,B,C,D,E,F	C-N	Stable	Rocky canyons with boulder strewn slopes, riparian woodlands, and ditchbanks
! Uintah Ground Squirrel (<u>Spermophilus armatus</u>)	A,B	C-N	Stable	Meadows and edges of fields near green vegetation up to 8,000 feet elevation
⁵ Golden-mantled Ground Squirrel (<u>Spermophilus lateralis</u>)	A,B,C	C-N	Stable	Mountain brush, open pine and spruce-fir forests to above timberline
Whitetail Antelope Squirrel (<u>Ammospermophilus leucurus</u>)	A,B,C,D,E,F	C-N	Stable	Arid areas of low desert and foothills with sparse vegetation
! Yellow-billied Marmot (<u>Marmota flaviventris</u>)	A,B,C,E,F	C-N	Stable	Rocky sites or talus slopes along valleys or in foothills 5,000 to 9,000 feet elevation
! * Northern Flying Squirrel (<u>Glaucomys sabrinus</u>)	A,B,C,F	C-N	Unknown	Coniferous and mixed forests in high mountains

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
{ Least Chipmunk (<u>Eutamias minimus</u>)	A,B,C,D,E,F	C-N	Stable	Variety of habitat types including sagebrush, desert shrub, mountain bush, coniferous and mixed forest areas
Colorado Chipmunk (<u>Eutamias quadrivittatus</u>)	C,E,F	C-N	Stable	Coniferous forests, mountain brush areas, rocky slopes and ridges
{ Uintah Chipmunk (<u>Eutamias umbrinus</u>)	A,B,D,E,F	C-N	Stable	Coniferous forest and mountain brush areas up to timberline with rocky slopes
SA Cliff Chipmunk (<u>Eutamias dorsalis</u>)	A,B,C,D,E	U-N	Stable	Pinion-juniper slopes, riparian woodlands with rocky areas
Family Geomyidae				
! Northern Pocket Gopher (<u>Thomomys talpoides</u>)	A,B,C,D,E,F	C-N	Unknown	Grassy prairies, alpine meadows, brush areas, open pine forests; generally restricted to the mountains
! Valley or Botta Pocket Gopher (<u>Thomomys bottae</u>)	A,B,C,D,E,F	C-N	Unknown	Valleys and mountain meadows; prefers loam soil but may be found in sandy or rocky situations

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Ord Kangaroo Rat (<u>Dipodomys ordii</u>)	A,B,C,D,E,F	C-N	Unknown	Desert shrub, pinion-juniper and tamarisk communities; sandy soils preferred but found on hard soils
Baird Pocket Mouse (<u>Perognathus flavus</u>)	F	C-N	Unknown	Prefers short grass areas with sandy or rocky soils
! Great Basin Pocket Mouse (<u>Perognathus parvus</u>)	A,D	C-N	Unknown	Sagebrush or greasewood and other desert shrub communities and pinion-juniper
! Apache Pocket Mouse (<u>Perognathus apache</u>)	C,D,F	C-N	Unknown	Sparse brushlands and scattered pinion-juniper, usually 5,000-7,200 feet elevation
Family Castoridae				
! x Beaver (<u>Castor canadensis</u>)	A,B,C,D,E,F	C-P	Increasing	Streams, lakes and irrigation systems with poplars, birch or willows on the bank
Family Cricetidae				
Western Harvest Mouse (<u>Reithrodontomys megalotis</u>)	A,B,C,D,E,F	C-N	Unknown	Grasslands, open desert, wetlands, irrigated farmland of dense vegetation near water
! Canyon Mouse (<u>Peromyscus crinitus</u>)	A,B,C,D,E,F	C-N	Unknown	Rocky canyons and slopes with mountain brush

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Deer Mouse <u>(Peromyscus maniculatus)</u>	A,B,C,D,E,F	C-N	Unknown	All dry-land habitat and irrigated farmland within its range
! Brush Mouse <u>(Peromyscus boyleyi)</u>	A,B,C,D,E,F	C-N	Unknown	Brushy areas of arid and semi-arid regions; prefers rocky sites
! Pinion Mouse <u>(Peromyscus truei)</u>	A,B,C,D,E,F	C-N	Unknown	Rocky terrain in pinion-juniper areas
Northern Grasshopper Mouse <u>(Onychomys leucogaster)</u>	C,F	U-N	Unknown	Open country of grass, sagebrush or greasewood and sandy or gravelly soil
♂ ✕ White-throated Wood Rat <u>(Neotoma albigula)</u>	F	C-N	Unknown	Brushland with rocky cliffs and shallow caves
! Desert Wood Rat <u>(Neotoma lepida)</u>	A,B,C,D,E	C-N	Unknown	Desert floors and rocky slopes with low desert vegetation or arid mountain brush
✕ Mexican Wood Rat <u>(Neotoma mexicana)</u>	F	C-N	Unknown	Rocks, cliffs and mountains
! Bushy-tailed Wood Rat <u>(Neotoma cinerea)</u>	A,B,C,D,E,F	C-N	Unknown	High mountains with rimrock, rock slides and pines
Muskrat <u>(Ondatra zibethicus)</u>	A,B,C,D,E,F	C-N	Stable	Marshes, edge of ponds, lakes, streams and irrigation canals

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! Meadow Vole <u>(Microtus pennsylvanicus)</u>	A, D	C-N	Unknown	Moist areas with dense growth of grasses
! Mountain Vole <u>(Microtus montanus)</u>	A, B, D, E	C-N	Unknown	Dense vegetation in sagebrush-grass communities
! Richardson's Vole <u>(Microtus richardsoni)</u>	A	C-N	Unknown	Creekbanks and marshes in mountains to above timberline
! Longtail Vole <u>(Microtus longicaudus)</u>	A, B, C, D, E, F	C-N	Unknown	In summer streambanks, mountain meadows with dry sites; in winter brushy areas
57 Sagebrush Vole <u>(Lagurus curtatus)</u>	C, F	C-N	Unknown	Scattered sagebrush with loose soil and arid conditions
Family Muridae				
! Black Rat <u>(Rattus rattus)</u>	A, B, C, D, E, F	C-N	Unknown	Buildings and dumps
! Norway Rat <u>(Rattus norvegicus)</u>	A, B, C, D, E, F	C-N	Unknown	Burrows along building foundations and beneath rubbish piles
! House Mouse <u>(Mus musculus)</u>	A, B, C, D, E, F	C-N	Unknown	Buildings and occasionally in fields

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
Family Zapodidae Western Jumping Mouse <u>(Zapus princeps)</u>	A	C-N	Unknown	Low meadows near streams with lush growth of grasses and forbs; found in various land habitats
Family Erethizontidae ! Porcupine <u>(Erethizon dorsatum)</u>	A,B,C,D,E,F	C-N	Stable	Forested areas, occasionally away from trees if brush is available
Order Carnivora Family Canidae				
58 ! Coyote <u>(Canis latrans)</u>	A,B,C,D,E,F	C-N	Stable	Ubiquitous
Red Fox <u>(Vulpes fulva)</u>	A,B,C,D,E,F	C-N	Stable	Forest and open country preferred
x Kit Fox <u>(Vulpes macrotis)</u>	A,B,C,D,E,F	U-N	Stable	Open level, sandy ground preferred with low desert vegetation
! Gray Fox <u>(Urocyon cinereoargenteus)</u>	A,B,C,D,E,F	C-N	Stable	Brush and open forests

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! * Gray Wolf (<u>Canis lupus</u>)	A,B,C,D,E,F	X-P	Extirpated	Wilderness forests
Family Ursidae				
! * Black Bear (<u>Ursus americanus</u>)	A,B,C,E,F	C-P	Increasing	Mountainous areas
! * Grizzly Bear (<u>Ursus horribilis</u>)	A,B,C,E,F	X-P	Extirpated	Remote mountainous regions
Family Procyonidae				
! Ring-tailed Cat (<u>Bassariscus astutus</u>)	A,B,C,D,E,F	C-N	Stable	Near water on slopes with mountain brush, rocky ridges and cliffs
* Raccoon (<u>Procyon lotor</u>)	A,B,C,D,E,F	O-N	Increasing	Along streams, lake borders and near wooded areas or rock cliffs
Family Mustelidae				
! * Short-tailed Weasel (<u>Mustela erminea</u>)	A,B,C,F	R-P	Stable	Brushy or wooded areas not far from water
! * Long-tailed Weasel (<u>Mustela frenata</u>)	A,B,C,D,E,F	C-P	Stable	All land habitat types near water
! * Mink (<u>Mustela vison</u>)	A,B,C,F	L-P	Unknown	Along streams and lakes
! * Wolverine (<u>Gulo luscus</u>)	A,B	X-P	Extirpated	Remote mountain regions
* Black-footed Ferret (<u>Mustela nigripes</u>)	A,B,C,D,F	E-P	Unknown	Prairie dog towns
! * Marten (<u>Martes caurina</u>)	A,B,C,F	R-P	Unknown	Coniferous forests at high elevations

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! * Badger (<u>Taxidea taxus</u>)	A,B,C,D,E,F	C-P	Stable	Open grasslands, deserts and high mountain forests where prey is available
! * Striped Skunk (<u>Mephitis mephitis</u>)	A,B,C,D,E,F	C-P	Increasing	Semi-open country of prairie, brushlands or mixed woodlands within two miles of water
! * Spotted Skunk (<u>Spilogale gracilis</u>)	A,B,C,D,E,F	C-P	Stable	Prairies or grasslands with brushy or sparsely wooded areas along streams with boulders
g * River Otter (<u>Lutra canadensis</u>)	A,B,C,D,E,F	R-P	Unknown	Along streams and lake borders
Family Felidae				
! * Bobcat (<u>Lynx rufus</u>)	A,B,C,D,E,F	C-P	Declining	Rimrock and mountain brush areas
! * Canada Lynx (<u>Lynx canadensis</u>)	A,B,C,E,F	X-P	Extirpated	Forested areas in the mountains
! * Cougar (<u>Felis concolor</u>)	A,B,C,D,E,F	C-P	Stable	Rugged mountains with forests, cliffs and ledges
Order Artiodactyla				
Family Cervidae				
! * Mule Deer (<u>Odocoileus hemionus</u>)	A,B,C,D,E,F	C-P	Increasing	Coniferous forests, desert shrub, mountain brush, grassland with shrubs and other habitats where browse species are present

Species	Biogeographic Area Inhabited	Status	Population Trend	Habitat Use Area
! * Moose (<u>Alces alces</u>)	A	L-P	Increasing	Mountainous areas, forests, mountain brush and willow bottoms
! * Rocky Mountain Elk (<u>Cervus canadensis</u>)	A, B, C, E, F	C-P	Increasing	Semi-open forests, mountain meadows (in summer), foothills, plains and valleys
Family Antilocapridae				
* Pronghorn Antelope (<u>Antilocapra americana</u>)	B, C, D, E, F	L-P	Stable	Open prairies and sagebrush or desert shrub plains
61 Family Bovidae				
* Desert Bighorn Sheep (<u>Ovis canadensis nelsoni</u>)	D, E, F	L-P	Increasing	Precipitous terrain on mountain and canyon slopes and rims with sparse growth of trees
* Rocky Mountain Bighorn Sheep (<u>Ovis canadensis canadensis</u>)	B, C	L-P	Increasing	Precipitous terrain on mountain and canyon slopes and rims with sparse growth of trees
* Bison (<u>Bison bison</u>)	E	L-P	Stable	Desert shrub plains of the Burr Desert and mountain brush forest habitats associated with steep mountain slopes of the Henry Mountains

Table 1. List of Game Species and Region of Inhabitation Within Utah.

Game Species of Utah	REGION				
	Southeastern	Southern	Central	Northeastern	Northern
10 BIG GAME SPECIES					
Bison	x	x			
Black Bear	x	x	x	x	x
Cougar	x	x	x	x	x
Desert Bighorn Sheep	x	x			
Elk	x	x	x	x	x
Moose	x		x	x	x
Mountain Bighorn Sheep	x		x	x	x
Mountain Goat			x		
Mule Deer	x	x	x	x	x
Pronghorn Antelope	x	x	x	x	x
Subtotal	9	7	8	7	7
20 GAME FISH SPECIES					
Arctic Grayling		x		x	x
Black Bullhead	x	x	x	x	x
Black Crappie	x	x	x	x	x
Bluegill	x	x	x	x	x
Bonneville Cisco					x
Brook Trout	x	x	x	x	x
Brown Trout	x	x	x	x	x
Channel Catfish	x	x	x	x	x
Cutthroat Trout	x	x	x	x	x
Golden Trout			x	x	
Kokanee Salmon				x	x
Lake Trout		x	x	x	x
Largemouth Bass	x	x	x	x	x
Mountain Whitefish			x	x	x
Northern Pike	x	x			
Perch	x	x	x	x	x
Rainbow & Albino Trout	x	x	x	x	x
Smallmouth Bass			x	x	x
Striped Bass	x	x			
Walleye	x	x	x	x	x
White Bass		x	x		
Subtotal	13	16	16	17	17

Game Species of Utah	REGION				
	Southeastern	Southern	Central	Northeastern	Northern

9 FURBEARER SPECIES

Badger	x	x	x	x	x
Beaver	x	x	x	x	x
Long-tailed Weasel	x	x	x	x	x
Marten	x	x	x	x	x
Mink	x	x	x	x	x
River Otter	x			x	x
Short-tailed weasel	x	x	x	x	x
Spotted Skunk	x	x	x	x	x
Striped Skunk	x	x	x	x	x
Subtotal	9	8	8	9	9

43 MIGRATORY GAME BIRD SPECIES

American Widgeon	x	x	x	x	x
Band-tailed Pigeon	x	x	x		x
Barrows Goldeneye	x	x	x		
Black Brant		x		x	x
Black Duck		x			x
Blue-winged Teal		x	x		x
Bufflehead	x	x	x	x	x
Canada Goose	x	x	x	x	x
Canvasback	x	x	x	x	x
Cinnamon Teal	x	x	x	x	x
American Coot	x	x	x	x	x
Common Gallinule	x	x	x		x
Common Goldeneye	x	x	x		x
Common Merganser	x	x	x	x	x
Common Snipe	x	x	x	x	x
European Widgeon			x		x
Fulvous Tree Duck					x
Gadwall	x	x	x		x
Greater Scaup	x	x	x	x	x
Green-winged Teal	x	x	x	x	x
Harlequin Duck				x	x

Game Species of Utah	REGION				
	Southeastern	Southern	Central	Northeastern	Northern
Hooded Merganser	x	x	x	x	x
Lesser Scaup	x	x	x	x	x
Mallard	x	x	x	x	x
Mourning Dove	x	x	x	x	x
Old Squaw		x	x		x
Pintail	x	x	x	x	x
Red-breasted Merganser	x	x	x	x	x
Redhead	x	x	x	x	x
Ring-necked Duck	x	x	x	x	x
Ross Goose	x	x			x
Ruddy Duck	x	x	x	x	x
Sandhill Crane	x	x	x	x	x
Shoveler	x	x	x	x	x
Snow Goose	x	x	x	x	x
Sora Rail	x	x	x	x	x
Surf Scoter			x		x
Trumpeter Swan		x	x		x
Virginia Rail	x	x	x	x	x
Whistling Swan	x	x	x	x	x
White-fronted Goose	x	x	x	x	x
White-winged Scoter	x	x	x		x
Wood Duck	<u>x</u>	<u>x</u>	<u>x</u>	<u>x</u>	<u>x</u>
Subtotal	35	40	39	31	42

5 SMALL GAME-MAMMAL SPECIES

Abert Squirrel	x				
Desert Cottontail	x	x	x	x	
Mountain cottontail	x	x	x	x	x
Pigmy Cottontail		x	x		x
Snowshoe Hare	<u>x</u>	<u>x</u>	<u>x</u>	<u>x</u>	<u>x</u>
Subtotal	4	4	4	3	3

Game Species of Utah	REGION				
	Southeastern	Southern	Central	Northeastern	Northern
12 SMALL GAME-UPLAND BIRD SPECIES					
Blue Grouse	x	x	x	x	x
California Quail	x	x	x	x	x
Chukar	x	x	x	x	x
Gambels Quail	x	x			
Hungarian Partridge			x		x
Merriam's Turkey	x	x			
Ring-necked Pheasant	x	x	x	x	x
Ruffed Grouse	x	x	x	x	x
Sage Grouse	x	x	x	x	x
Sharp-tailed Grouse					x
White-tailed Ptarmigan				x	x
White-winged Pheasant	x	x			
Subtotal	9	9	7	7	9
<hr/>					
100 Total Game Species in Utah	78	83	81	73	86

Table 2. Classification of the 466 species of vertebrate wildlife that inhabit six biogeographic areas within Southeastern Utah.

	Biogeographic Areas ¹					
	A	B	C	D	E	F
FISH	14	20	15	15	24	31
Protected-Threatened	(0)	(1)	(1)	(1)	(1)	(1)
Protected-Endangered	(0)	(3)	(2)	(1)	(1)	(2)
Protected-Nongame	(10)	(11)	(9)	(10)	(12)	(16)
Protected-Game	(4)	(5)	(3)	(3)	(10)	(12)
AMPHIBIANS	6	5	6	7	7	10
Protected-Nongame	(1)	(1)	(1)	(1)	(1)	(2)
Unprotected-Nongame	(5)	(4)	(5)	(6)	(6)	(8)
REPTILES	18	14	15	14	21	28
Unprotected-Nongame	(18)	(14)	(15)	(14)	(21)	(28)
BIRDS	242	244	242	235	251	262
Protected-Extirpated	(1)	(1)	(1)	(1)	(1)	(1)
Protected-Threatened	(0)	(0)	(0)	(0)	(0)	(0)
Protected-Endangered	(2)	(2)	(2)	(2)	(2)	(2)
Protected-Nongame	(199)	(202)	(202)	(193)	(208)	(217)
Protected-Game	(39)	(38)	(36)	(38)	(39)	(41)
Unprotected-Nongame	(1)	(1)	(1)	(1)	(1)	(1)
MAMMALS	84	80	80	65	66	90
Protected-Threatened	(0)	(0)	(0)	(0)	(0)	(0)
Protected-Endangered	(1)	(1)	(1)	(1)	(0)	(1)
Protected-Extirpated	(2)	(2)	(2)	(0)	(2)	(2)
Protected-Game	(18)	(19)	(19)	(12)	(16)	(19)
Unprotected-Extirpated	(0)	(0)	(0)	(0)	(0)	(0)
Unprotected-Nongame	(63)	(58)	(58)	(52)	(53)	(62)
Total Protected Species	277	286	279	263	293	317
TOTAL:	364	363	358	336	369	421

¹ Biogeographic areas of southeastern Utah
A- Wasatch Plateau east of Skyline Drive
B- West Tavaputs Plateau
C- East Tavaputs Plateau
D- San Rafael Swell and Desert
E- Henry Mountains and Burr Desert
F- Mountains and Deserts south of I-70 in Grand and San Juan counties

LITERATURE CITED

- Bailey, R. M., J.E. Fitch, E.S. Herald, E.A. Lachner, C.C. Lindsey, C.R. Robins and W.B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada. American Fisheries Society Special Publication No. 6. 149 pp.
- Behle, W.H. and M.L. Perry. 1975. Utah birds; guide, check-list and occurrence charts. Utah Museum of Natural History. University of Utah, Salt Lake City, Utah. 144 pp.
- Burt, W.H. and R.P. Grossenheider. 1976. A field guide to the mammal. Houghton Mifflin Company. Boston, Massachusetts. 289 pp.
- Durrant, S.D. 1952. Mammals of Utah. Museum of Natural History. University of Kansas, Lawrence, Kansas. 6:1-549.
- Eddy, Samuel. 1969. The freshwater fishes. Wm. C. Brown Company Publishers. Dubuque, Iowa. 286 pp.
- Hayward, C.L., C. Cottom, A.M. Woodbury and H.H. Frost. 1976. Great Basin Naturalist Memoirs: Birds of Utah. Brigham Young University Press. Provo, Utah. 229 pp.
- Holden, P.B. 1973. Distribution, abundance and life history of the fishes of the upper Colorado River Basin. Utah State University. 59 pp.
- Peterson, R.T. 1969. A field guide to western birds. Houghton Mifflin Company. Boston, Massachusetts. 366 pp.
- Robbins, C.S., B. Bruun and H.S. Zim. 1966. A guide to field identification: birds of North America. Golden Press. New York City, New York. 340 pp.
- Sigler, W.F and R.R. Miller. 1963. Fishes of Utah. Utah State Department of Fish and Game. Salt Lake City, Utah. 203 pp.
- Sparks, E.A. 1974. Checklist of Utah wild mammals. Utah Division of Wildlife Resources Publication 74-3. Salt Lake City, Utah.
- Stebbins, R.C. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Company. Boston, Massachusetts. 279 pp.
- Tanner, W.W. 1975. Checklist of Utah amphibians and reptiles. Proceedings of the Utah Academy of Sciences, Arts and Letters. Vol. 52 (1):4-8.
- Udvardy, M.D.F. and S. Rayfield. 1977. The Audubon Society field guide to North American birds -- western region. Published by Alfred A. Knopf, Inc. Chanticleer Press, Inc., New York. 855 pp.

Appropriations No. 01-59-09
Archives Approval No. 7900014

APPENDIX B

Recommended Plant Materials and Rates of Application
for Restoration or Enhancement of
Wildlife Habitats

COMMON AND BOTANICAL NAMES FOR VEGETATION SPECIES IN THE ATTACHED TABLES THAT HAVE BEEN SUGGESTED FOR USE WITH ENHANCEMENT OR RECLAMATION PROJECTS THAT WOULD BENEFIT WILDLIFE

Common Name	Botanical Name
Alfalfa, (Ladak, Nomad, Rambler, Teton, Travois)	<i>Medicago sativa</i>
Alfalfa, sickle	<i>M. falcatus</i>
Alfileria	<i>Erodium cicutarium</i>
Alkaligrass, nuttall	<i>Puccinellia airoides</i>
Angelica, small-leaf	<i>Angelica pinnata</i>
Apache-plume	<i>Fallugia paradoxa</i>
Ash, singleleaf	<i>Fraxinus anomala</i>
Aspen, quaking	<i>Populus tremuloides</i>
Aster, alpine leafybract	<i>Aster foliaceus</i>
Aster, Engelmann	<i>A. engelmannii</i>
Aster, Pacific	<i>A. chilensis adscendens</i>
Aster, smooth (or blue)	<i>A. glaucodes</i>
Balsamroot, arrowleaf	<i>Balsamorhiza sagittata</i>
Balsamroot, cutleaf	<i>B. macrophylla</i>
Barberry, creeping	<i>Berberis repens</i>
Barberry, Fremont	<i>B. fremontii</i>
Barley, bulbous	<i>Hordeum bulbosum</i>
Barley, meadow	<i>H. brachyantherum</i>
Bassia, fivehook (alkaliweed, ragweed, smotherweed)	<i>Bassia hyssopifolia</i>
Bitterbrush, antelope	<i>Purshia tridentata</i>
Bitterbrush, desert	<i>P. glandulosa</i>
Blackbrush	<i>Coleogyne ramosissima</i>
Bladdersenna, common	<i>Colutea arborescens</i>
Bluegrass, big	<i>Poa ampla</i>
Bluegrass, bulbous	<i>P. bulbosa</i>

Common Name	Botanical Name
Bluegrass, Canada	<i>P. compressa</i>
Bluegrass, Kentucky	<i>P. pratensis</i>
Bluegrass, Nevada	<i>P. nevadensis</i>
Bluegrass, Sandberg	<i>P. secunda</i>
Bouncing-bet	<i>Saponaria officinalis</i>
Boxelder	<i>Acer negundo negundo</i>
Brome, cheatgrass	<i>Bromus tectorum</i> <i>tectorum</i>
Brome, meadow	<i>B. erectus</i>
Brome, mountain	<i>B. carinatus</i>
Brome, nodding	<i>B. anomalus</i>
Brome, red (foxtail)	<i>B. rubens</i>
Brome, smooth (northern)	<i>B. inermis</i>
Brome, smooth (southern)	<i>B. inermis</i>
Brome, subalpine	<i>B. tomentellus</i>
Buffaloberry, roundleaf	<i>Shepherdia rotundifolia</i>
Buffaloberry, russet	<i>S. canadensis</i>
Buffaloberry, silver	<i>S. argentea</i>
Burnet, small	<i>Sanguisorba minor</i>
Buttercup, bur	<i>Ranunculus testiculatus</i>
Cacti	Cactaceae
Canarygrass, reed	<i>Phalaris arundinacea</i>
Ceanothus, Martin	<i>Ceanothus martinii</i>
Ceanothus, redstem	<i>C. sanguineus</i>
Ceanothus, snowbrush	<i>C. velutinus</i>
Checkermallow, Oregon	<i>Sidalcea oregana</i>
Cherry, Bessey (sand)	<i>Prunus besseyi</i>
Chokecherry, black (common)	<i>P. virginiana</i> <i>melanocarpa</i>

<u>Common Name</u>	<u>Botanical Name</u>
Cinquefoil, bush	Potentilla fruticosa
Cliffrose, Stansbury	Cowania mexicana stansburiana
Clover, alsike	Trifolium hybridum
Clover, strawberry	T. fragiferum
Collomia, slenderleaf	Collomia linearis
Columbine, Colorado	Aquilegia coerulea
Cotoneaster, Peking	Cotoneaster acutifolia
Cowparsnip, common	Heracleum lanatum
Creosotebush, spreading	Larrea divaricata
Crownvetch, coronilla	Coronilla varia
Currant, golden	Ribes aureum
Currant, gooseberry	R. montigenum
Currant, squaw	R. cereum inebrians
Currant, sticky	R. viscosissimum viscosissimum
Cypress, Arizona	Cupressus arizonica
Cypress, Belvedere summer	Kochia scoparia
Daisy, common oxeye	Chrysanthemum leucanthemum
Dandelion, common	Taraxacum officinale
Deathcamas	Zigadenus spp.
Dogwood, redosier	Cornus stolonifera stolonifera
Douglas-fir	Pseudotsuga menziesii menziesii
Dropseed, sand	Sporobolus cryptandrus
Dropseed, spike	S. contractus
Elder, blueberry	Sambucus cerulea
Elder, redberry	S. racemosa pubens microbotrys
Ephedra, green	Ephedra viridis
Ephedra, Nevada	E. nevadensis
Eriogonum, cushion	Eriogonum ovalifolium
Eriogonum, Wyeth	E. heracleoides

<u>Common Name</u>	<u>Botanical Name</u>
Fescue, hard sheep	Festuca ovina duriscula
Fescue, reed (alta or tall)	F. arundinacea
Fescue, sulcata sheep	F. sulcata
Fescue, Thurber	F. thurberi
Fir, subalpine	Abies lasiocarpa
Fir, white	A. concolor
Flax, Lewis (or blue)	Linum lewissii
Fleabane, Oregon	Erigeron speciosus macranthus
Forestiera, New Mexican	Forestiera neomexicana
Forestiera, New Mexican olive	F. phillyneoides
Foxtail, barley	Hordeum jubatum jubatum
Foxtail, meadow	Alopecurus pratensis
Foxtail, reed	A. arundinaceus
Galleta	Hilaria jamesii
Geranium, sticky	Geranium viscosissimum
Giant hyssop, nettleleaf	Agastache urticifolia glaucifolia
Globemallow, gooseberry leaf	Sphaeralcea grossulariaefolia
Globemallow, stream	S. rivularis
Goldeneye, Nevada showy	Viguiera multiflora nevadensis
Goldeneye, Canada	Solidago canadensis
Goldenrod, low	S. multiradiata
Goldenrod, Parry	S. parryi
Goosefoot	Chenopodium spp.
Greasewood, black	Sarcobatus vermiculatus vermiculatus
Goldeneye, showy	Viguiera multiflora

<u>Common Name</u>	<u>Botanical Name</u>
Groundsel, butterwood	<i>Senecio serra</i>
Hair-grass, tufted	<i>Deschampsia caespitosa</i>
Halogeton	<i>Halogeton glomeratus</i>
Hawthorn, river	<i>Crataegus douglasii rivularis</i>
Helianthella, oneflower	<i>Helianthella uniflora</i>
Honeylocust, common	<i>Gleditsia triacanthos</i>
Honeysuckle, bearberry	<i>Lonicera involucrata</i>
Honeysuckle, Tatarian	<i>L. tatarica</i>
Hopsage, spineless	<i>Grayia brandegei</i>
Hopsage, spiny	<i>G. spinosa</i>
Iodine bush	<i>Allenrolfea occidentalis</i>
Iris, German (common iris)	<i>Iris germanica</i>
Ivesia, Gordon	<i>Ivesia gordonii</i>
Juniper, Rocky Mountain	<i>Juniperus scopulorum</i>
Juniper, Utah	<i>J. osteosperma</i>
Knotweed, Douglas	<i>Polygonum douglasii douglasii</i>
Larkspur	<i>Delphinium spp.</i>
Leptotaenia, carrotleaf	<i>Lomatium dissectum</i>
Lettuce, prickly	<i>Lactuca serriola</i>
Ligusticum, Porter	<i>Ligusticum porteri</i>
Lilac, common	<i>Syringa vulgaris</i>
Lilac, late	<i>S. villosa</i>
Locust, black	<i>Robinia pseudoacacia</i>
Lomatium, nineleaf	<i>Lomatium triternatum</i>
Lomatium, Nuttall	<i>L. nuttallii</i>
Lupine, mountain	<i>Lupinus alpestris</i>
Lupine, Nevada	<i>L. nevadensis</i>

<u>Common Name</u>	<u>Botanical Name</u>
Lupine, silky	<i>L. sericeus</i>
Lupine, silvery	<i>L. argenteus</i>
Maple, bigtooth	<i>Acer grandidentatum</i>
Maple, Manchurian	<i>A. mandshuricum</i>
Maple, Rocky Mountain	<i>A. glabrum</i>
Matrimony-vine	<i>Lycium halimifolium</i>
Medick black	<i>Medicago lupulina</i>
Mesquite	<i>Prosopis spp.</i>
Milkvetch, chickpea	<i>Astragalus cicer</i>
Milkvetch, sicklepod	<i>A. falcatus</i>
Milkvetch, Snakeriver plains	<i>A. filipes</i>
Milkvetch, tall	<i>A. galegiformis</i>
Mountain-mahogany, curleaf	<i>Cercocarpus ledifolius ledifolius</i>
Mountain-mahogany, littleleaf	<i>C. ledifolius intricatus</i>
Mountain-mahogany, true or birchleaf	<i>C. montanus montanus</i>
Muhly, mat	<i>Muhlenbergia richardsonis</i>
Mustard, African	<i>Malcolmia africana</i>
Needlegrass, green	<i>Stipa viridula</i>
Needlegrass, Letterman	<i>S. lettermani</i>
Oak, Gambel (shrubby)	<i>Quercus gambelii</i>
Oatgrass, tall	<i>Arrhenatherum elatius</i>
Orchardgrass	<i>Dactylis glomerata</i>

Common NameBotanical Name

Painted-cup, Northwestern	<i>Castilleja hispida</i>
Peachbrush, desert	<i>Prunus fasciculata</i>
Peashrub, Siberian	<i>Caragana arborescens</i>
Peavine, flat	<i>Lathyrus sylvestris</i>
Peavine, perennial	<i>L. latifolius</i>
Peavine, thickleaf	<i>L. lanszwertii</i>
Peavine, Utah	<i>L. utahensis</i>
Penstemon, Eaton	<i>Penstemon eatonii</i>
Penstemon, littlecup	<i>P. sepalulus</i>
Penstemon, low	<i>P. humilis</i>
Penstemon, Palmer	<i>P. palmeri</i>
Penstemon, Rydberg	<i>P. rydbergii</i>
Penstemon, sidehill	<i>P. platyphyllus</i>
Penstemon, thickleaf	<i>P. pachyphyllus</i>
Penstemon, toadflax	<i>P. linarioides</i>
Penstemon, Wasatch	<i>P. cyananthus</i>
Pine, pinyon	<i>Pinus edulis</i>
Pine, ponderosa	<i>P. ponderosa</i>
Pine, singleleaf pinyon	<i>P. monophylla</i>
Plum, American	<i>Prunus americana</i>
Quackgrass	<i>Agropyron repens</i>
Rabbitbrush, Douglas	<i>Chrysothamnus viscidiflorus</i> <i>viscidiflorus</i>
Rabbitbrush, dwarf	<i>C. depressus</i>
Rabbitbrush, Parry	<i>C. parryi parryi</i>
Rabbitbrush, rubber	<i>C. nauseosus nauseosus</i>
Rabbitbrush, small	<i>C. stenophyllus</i>
Raspberry, American red	<i>Rubus idaeus sachalinensis</i>
Redtop	<i>Agrostis alba</i>
Reedgrass, chee	<i>Calamagrostis epigeios</i>

Common NameBotanical Name

Rhubarb, garden	<i>Rheum rhapenticum</i>
Ricegrass, Indian	<i>Oryzopsis hymenoides</i> <i>hymenoides</i>
Rose, Woods	<i>Rosa woodsii</i> <i>ultramontana</i>
Rush, Baltic	<i>Juncus balticus</i>
Russian-olive	<i>Elaeagnus angustifolia</i>
Russianthistle	<i>Salsola kali tenuifolia</i>
Rye, mountain	<i>Secale montanum</i>
Rye, winter	<i>S. cereale</i>
Sacaton, alkali	<i>Sporobolus airoides</i> <i>airoides</i>
Sagebrush, Louisiana	<i>Artemisia ludoviciana</i> <i>ludoviciana</i>
Sagebrush, tarragon	<i>A. dracunculus</i>
Sagebrush, big	<i>A. tridentata tridentata</i>
Sagebrush, black	<i>A. arbuscula nova</i>
Sagebrush, bud	<i>A. spinescens</i>
Sagebrush, fringed	<i>A. frigida</i>
Sagebrush, silver	<i>A. cana cana</i>
Salsify, vegetable- oyster	<i>Tragopogon porrifolius</i>
Saltbush, fourwing	<i>Atriplex canescens</i>
Saltbush, Gardner	<i>A. gardneri</i>
Saltbush, shadscale	<i>A. confertifolia</i>
Saltgrass, inland	<i>Distichlis spicata</i> <i>stricta</i>
Salt-tree, Siberian	<i>Halimodendron</i> <i>halodendron</i>
Sedge, ovalhead	<i>Carex festivella</i>
Seepweed (pickleweed)	<i>Suaeda</i> spp.
Serviceberry, Saskatoon	<i>Amelanchier alnifolia</i>

Common NameBotanical Name

Serviceberry, Utah	<i>A. utahensis utahensis</i>
Snowberry, longflower	<i>Symphoricarpos longiflorus</i>
Snowberry, mountain	<i>S. oreophilus</i>
Solomon-plume, fat	<i>Smilacina racemosa</i> <i>amplexicaulis</i>
Sophora, Arizona	<i>Sophora arizonica</i>
Spruce, Colorado blue	<i>Picea pungens</i>
Spruce, Engelmann	<i>P. engelmannii</i>
Squirreltail, bottlebrush	<i>Sitanion hystrix</i>
Squaw-apple	<i>Peraphyllum ramosissimum</i>
Starwort, tuber	<i>Stellaria jamesiana</i>
Sumac, Rocky Mountain smooth	<i>Rhus glabra cismontana</i>
Sumac, skunk bush	<i>R. trilobata trilobata</i>
Sweetanise	<i>Osmorhiza occidentalis</i>
Sweetclover, white	<i>Melilotus alba</i>
Sweetclover, yellow	<i>M. officinalis</i>
Sweetroot, spreading	<i>Osmorhiza chilensis</i> <i>(divaricata)</i>
Sweetvetch, Utah	<i>Hedysarum boreale</i> <i>utahensis</i>
Tansymustard, flixweed	<i>Descurainia sophia</i>
Tansymustard, pinnate	<i>D. pinnata</i>
Tarweed, cluster	<i>Madia glomerata</i>
Tenella weed	<i>Chorispora tenella</i>
Timothy	<i>Phleum pratense</i>
Tumblemustard	<i>Sisymbrium altissimum</i>
Valerian, edible	<i>Valeriana edulis</i>
Vetch, American	<i>Vicia americana minor</i>
Vetch, bramble	<i>V. tenuifolia</i>

Common NameBotanical Name

Violet, goosefoot	<i>Viola purpurea</i>
Virginsbower, western	<i>Clematis ligusticifolia</i>
Wheatgrass, bearded	<i>Agropyron subsecundum</i>
Wheatgrass, bearded bluebunch	<i>A. spicatum</i>
Wheatgrass, beardless bluebunch	<i>A. spicatum inerme</i>
Wheatgrass, bluestem	<i>A. smithii</i>
Wheatgrass, crested (Fairway)	<i>A. cristatum</i>
Wheatgrass, crested (Standard)	<i>A. desertorum</i>
Wheatgrass, intermediate	<i>A. intermedium</i>
Wheatgrass, pubescent or stiffhair	<i>A. trichophorum</i>
Wheatgrass, Scribner	<i>A. scribneri</i>
Wheatgrass, Siberian	<i>A. sibiricum</i>
Wheatgrass, slender	<i>A. trachycaulum</i>
Wheatgrass, tall	<i>A. elongatum</i>
Wildrye, blue	<i>Elymus glaucus</i>
Wildrye, Colorado	<i>E. ambiguus ambiguus</i>
Wildrye, creeping	<i>E. triticoides</i>
Wildrye, Great Basin	<i>E. cinereus</i>
Wildrye, mammoth	<i>E. giganteus</i>
Wildrye, Russian	<i>E. junceus</i>
Wildrye, sabulosa	<i>E. sabulosus</i>
Wildrye, Salina	<i>E. salina</i>
Wildrye, yellow	<i>E. flavescens</i>
Willow, Gyer	<i>Salix exigua</i> <i>stenophylla</i>
Willow, purpleosier	<i>S. purpurea purpurea</i>

Common Name

Willow, Scouler
Winterfat, common
Woad, Dyers
Wormwood, oldman
Wyethia, mulesears

Yarrow, western
Yellowbrush

Yucca
Yucca, Joshua-tree

Botanical Name

S. scouleriana
Eurotia lanata lanata
Isatis tinctoria
Artemisia abrotanum
Wyethia amplexicaulis

Achillea millefolium lanulosa
Chrysothamnus viscidiflorus
 lanceolatus
Yucca spp.
Yucca brevifolia brevifolia

Common Name

Botanical Name

Table 1. Recommended seed mixtures that will benefit wildlife through enhancement of moderately disturbed shrublands habitats of the montane ecological association. Also included are acceptable alternatives if seed for a plant species is not available. Alternatives marked with an asterisk (*) are for use in special treatments such as erosion control or roadbank stabilization. If disturbance was severe and total reclamation is needed, increase amount of seed by a factor of 2 to 3 times. Information assembled from Plummer, A.P., D.R. Christensen and S.B. Monsen. 1968. Restoring big game range in Utah. Utah Division of Fish and Game (now Utah Division of Wildlife Resources) Publication No. 68-3. 183 pp. Also from personal contacts with A. Perry Plummer.

Species	North exposures and shady areas		Sunny exposures (south, west, east)		Mixture for tall mountain brush type, shaded sites.	
	Broadcast	Drilled	Broadcast	Drilled	Species	Seeding per acre
	-Pounds per acre -					<u>Pounds</u>
Grasses:					Grasses:	
Fairway crested wheatgrass	2	1	2	1	Smooth brome (southern strain)	5
Smooth brome (southern strains)	4	2	2	1	Fairway crested wheatgrass	1
Intermediate wheatgrass	4	2	2	1	Intermediate wheatgrass	3
Pubescent wheatgrass	0	0	2	1	Orchardgrass (Utah grown)	2
Bluestem wheatgrass	0	0	1	1/2	Tall oatgrass	1
Orchardgrass	1	1/2	1	1/2	Mountain brome	1
Russian wildrye	0	0	1	1/2		
Tall oatgrass	1	1/2	0	0		
Forbs:					Forbs:	
Alfalfa (Nomad, Rambler, Travois, Ladak-equal parts)	2	1	2	1	Alfalfa (creeping strains or Ladak)	1
Chickpea milkvetch	0	0	1	1/2	Pacific aster	1/4
Utah sweetvetch	0	0	1	1/2	Oneflower hellanthella	1/2
Yellow sweetclove	0	0	1	1/2	Showy goldeneye	1/4
Arrowleaf balsamroot	1	1/2	1	1/2		
Pacific aster	1	1/2	1	1/2	Totals	15