

FINAL

**PRELIMINARY CHARACTERIZATION OF
ENVIRONMENTAL ISSUES ASSOCIATED WITH
CONSTRUCTION AND OPERATION OF
RADIOACTIVE WASTE TRANSPORTATION
SYSTEMS WITHIN ESMERALDA COUNTY**

**SUBMITTED TO:
Esmeralda County Nuclear
Waste Project
P.O. Box 490
Goldfield Nevada 89013**

**SUBMITTED BY:
Intertech Services Corporation
P. O. Box 93537
Las Vegas, NV 89193
(702) 732-0970**

December 1, 1994

TABLE OF CONTENTS

	<u>Page</u>
BACKGROUND	1
BIOLOGICAL AND PHYSICAL ISSUES	8
Air Quality	8
Wind Speed and Direction	10
Precipitation	11
Hydrology	12
Flood Zones	14
Drainage Design Considerations	14
Geology and Soil	15
Seismic Activity	20
Land Ownership	23
Land Use	23
Grazing Allotments	23
Flora and Fauna	26
Threatened and Endangered Species	27
Wild Horses and Burros	28
Wildlife	29
Noise	31
Viewshed	31
CULTURAL/HISTORICAL RESOURCES	33
REFERENCES	35
APPENDIX A Types and Characteristics of Soils Located in Proximity to Candidate Rail Corridors in Esmeralda County	A1

LIST OF FIGURES AND TABLES

	<u>Page</u>
Figure 1. Alternative Rail Access Corridors Identified by the U.S. Department of Energy	6
Figure 2. Alternative Highway Routes Identified by the State of Nevada	7
Table 1. Standards of Quality for Ambient Air	9
Table 2. EPA Pollutant Emission Factor (1976)	10
Table 3. Nevada Drinking Water Standards - Goldfield and Silverpeak Samples	13
Figure 3. Wetland Areas in Esmeralda County	19
Figure 4. Seismic Activity in Relation to Alternative Rail Corridors in Esmeralda County	21
Figure 5. Historic Faults in Relation to Alternative Rail Corridors in Esmeralda County	22
Figure 6. Grazing Allotments and Water Resources in Relation to Alternative Rail Corridors	24
Table 4. Grazing Allotments in Esmeralda County	26
Table 5. Known Locations of Sensitive Plant and Animal Species Proximate to Candidate Rail and Highway Transportation Corridors in Esmeralda County	28
Table 6. Wild Horse and Burro Herd Management Areas in Esmeralda County	29
Table 7. Wildlife Habitat Ranges in Esmeralda County	29
Figure 7. Air Force Training Corridors Within Esmeralda County	32
Table 8. Known Historical and Archeological Sites Within Esmeralda County	34

BACKGROUND

The Nuclear Waste Policy Act of 1982 (NWPA) as amended by the Nuclear Waste Policy Amendments Act of 1987 (NWPAA) establishes a national program for the management and permanent disposal of commercial spent nuclear fuel and high-level radioactive waste. The Department of Energy (DOE), Office of Civilian Radioactive Waste Management (OCRWM), is vested with responsibility for the development of a radioactive waste management system. Transportation is an integral part of the waste management system and an extensive effort is underway by DOE to develop a system to transport radioactive waste. Pursuant to the NWPA, as amended, DOE will accept commercial waste at nuclear power reactors or other waste generator sites for transport to an interim storage facility and/or a geologic repository. Defense radioactive waste will be delivered from federal nuclear weapons facility sites for disposal at the repository site. Under current schedules, DOE may begin receiving commercial waste for interim storage beginning in 1998.

The NWPAA directed DOE to concentrate its search for a permanent geologic repository site on Yucca Mountain, located in Nye County, Nevada. Presently, no other sites are being considered by DOE for a repository. If Yucca Mountain is found suitable as a repository site and if the Nuclear Regulatory Commission (NRC) provides DOE with a license to construct and operate a repository at Yucca Mountain, current schedules would anticipate spent fuel and radioactive waste shipments to the site to begin around the year 2010. In the event that Congress determines that interim storage of wastes near to Yucca Mountain is prudent, shipments of wastes through Nevada to the site could commence as early as 1998.

As part of the site evaluation process, an Environmental Impact Statement (EIS) will be prepared. The EIS will address the environmental and socioeconomic effects of constructing, operating, closing, and decommissioning a geologic repository at Yucca Mountain. In compliance with the National Environmental Policy Act (NEPA), DOE will conduct public scoping hearings, present a draft EIS and hold scoping hearings to receive comments on the document. These hearings will give Esmeralda County an opportunity to voice concerns about potential impacts of the Yucca Mountain Project. The EIS scoping hearings may be held as early as 1995, and the draft EIS may be ready in 1997.

In October 1992, the DOE directed the Civilian Radioactive Waste Management System (CRWMS) Management and Operating (M&O) Contractor to study the feasibility of using a Multi-Purpose Canister (MPC) for acceptance, transportation, storage, and disposal of spent nuclear fuel. The results of the studies indicate that the MPC is an acceptable option for all aspects of waste handling. However, additional consideration is needed for cost impacts, design feasibility, and licensing issues before implementing the MPC system (DOE, 1993). DOE will prepare an environmental impact statement regarding the decision to fabricate and deploy MPCs. The draft MPC EIS is scheduled for completion in late 1996. A decision by DOE to utilize MPC technology would result in 90 percent of all spent fuel shipments being by rail.

The site currently lacks rail service or an existing right-of-way. To transport the controlled quantities of radioactive materials and high-level radioactive waste to the Yucca

Mountain site, DOE has initiated studies to identify rail routes to the site. Ten rail options, with alternatives within each major option, were identified. Each option was further evaluated for potential land use conflicts and potential access to regional rail carriers. Of the ten original rail options, three routes with the fewest land conflicts and access to regional rail carriers were selected for further study (DOE, 1990).

The proposed rail routes considered for further study include Jean, Carlin and Caliente. However the Mina route (Figure 1) which follows the U.S. 95 corridor to the south past the Columbus Salt Marsh and the town of Coaldale has not been ruled out as a possible rail route to the repository site. The construction of the proposed rail line, from the town of Mina to Yucca Mountain, would follow the old grade along Nevada Highway 265, then cross the highway via a grade separation and continue to the west of the town of Silverpeak. The rail route ascends the Montezuma Mountains through Railroad Pass. Due to the average grade of 4.7 percent, Railroad Pass will require considerable development to keep the maximum grade from exceeding 2.5 percent. From the Montezuma Mountains, the proposed track would descend to follow the south side of US Highway 95 past the town of Scotty's Junction. About 12 miles southwest of Scotty's Junction the track would cross over to the north side of the highway. The track would be fairly close to the highway due to the rough terrain (DOE, 1990).

In addition to the rail alternatives, highway routes have been considered by DOE. The highway routing studies for the State of Nevada were managed by the Nevada Department of Transportation and completed by the University of Nevada, Reno. The study utilizes

highway routing and risk models to determine the routes that minimize risk to the public. These models were provided by the U.S. Department of Transportation, Sandia National Laboratories, Oak Ridge National Laboratory, Pacific Northwest Laboratory, and a Ph.D. dissertation (Nevada Department of Transportation, 1989).

The Caliente route (alternatives A and B) which is one of the considered rail routes for further studies, also involves Esmeralda County (Figure 1). Alternative A of the Caliente route, would pass just west of Goldfield, crossing the route of the historic Las Vegas & Tonopah Railroad. This railroad grade is steeper than the 2.5 percent acceptable grade, thus it would also require significant development. Alternative B of the Caliente route would cross to the north of Goldfield and join the Mina route just south of the town of Silverpeak.

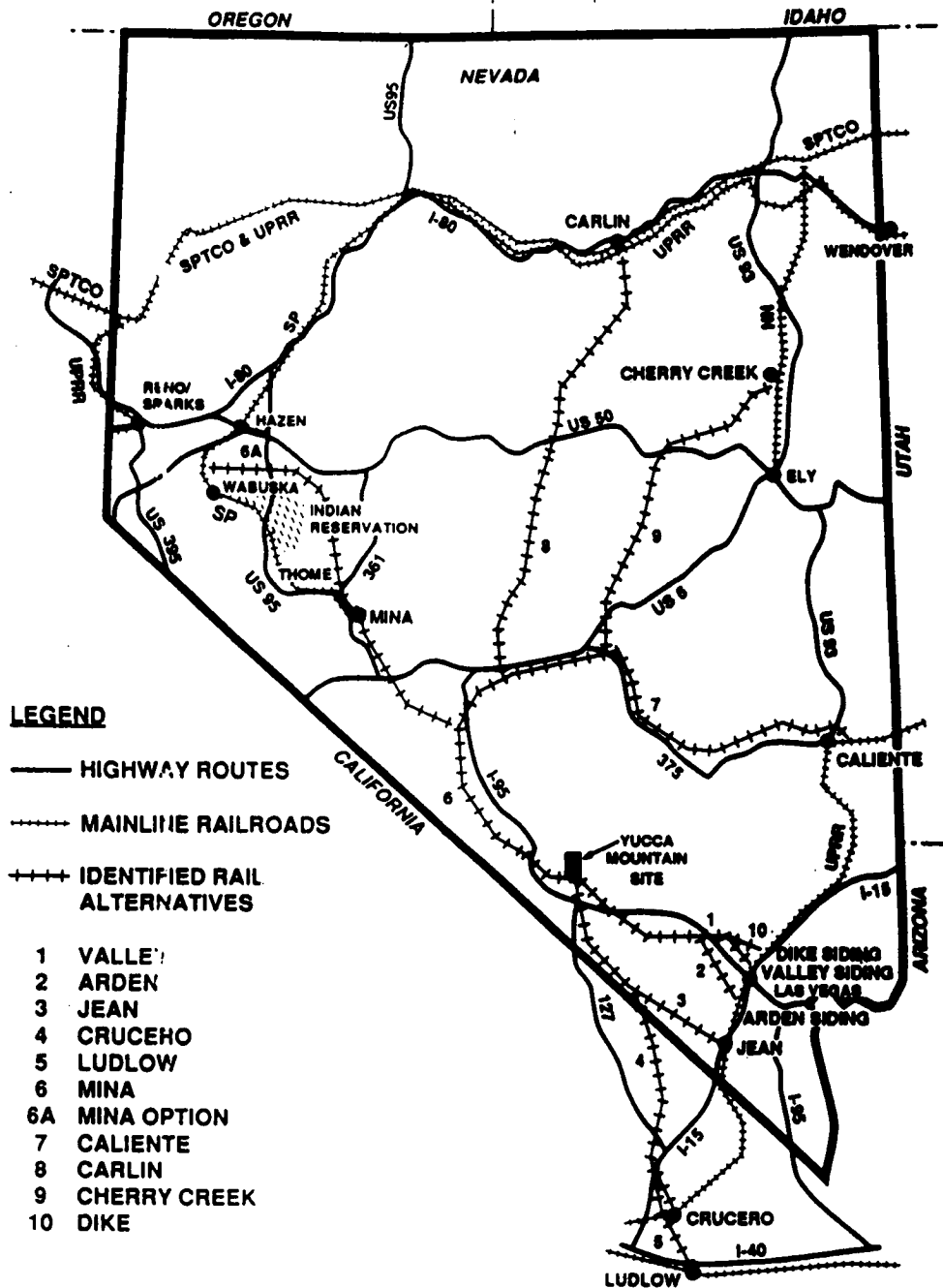
Of the two highway routes (A & B) considered, highway route B (U.S. 95) which enters Esmeralda County south of Tonopah at the county line (Figure 2), has several critical grades and one critical curve at Goldfield. In the event of an accident, due to poor visibility or road conditions combined with the critical curve, residents of Goldfield could be placed at a higher risk of radiation exposure.

Estimates of quantities of the shipments, during the estimated 25 year shipping period, range from 22,550 truck and 1,846 rail shipments to 94,203 truck to 6,962 rail shipments (Battelle, 1989 and Halstead, et. al., 1991). The actual number of shipments depends on a number of variables such as the distribution of shipments between rail and truck, a

decision by DOE to utilize MPC's cask capacity, age and activity of fuel, and other factors.

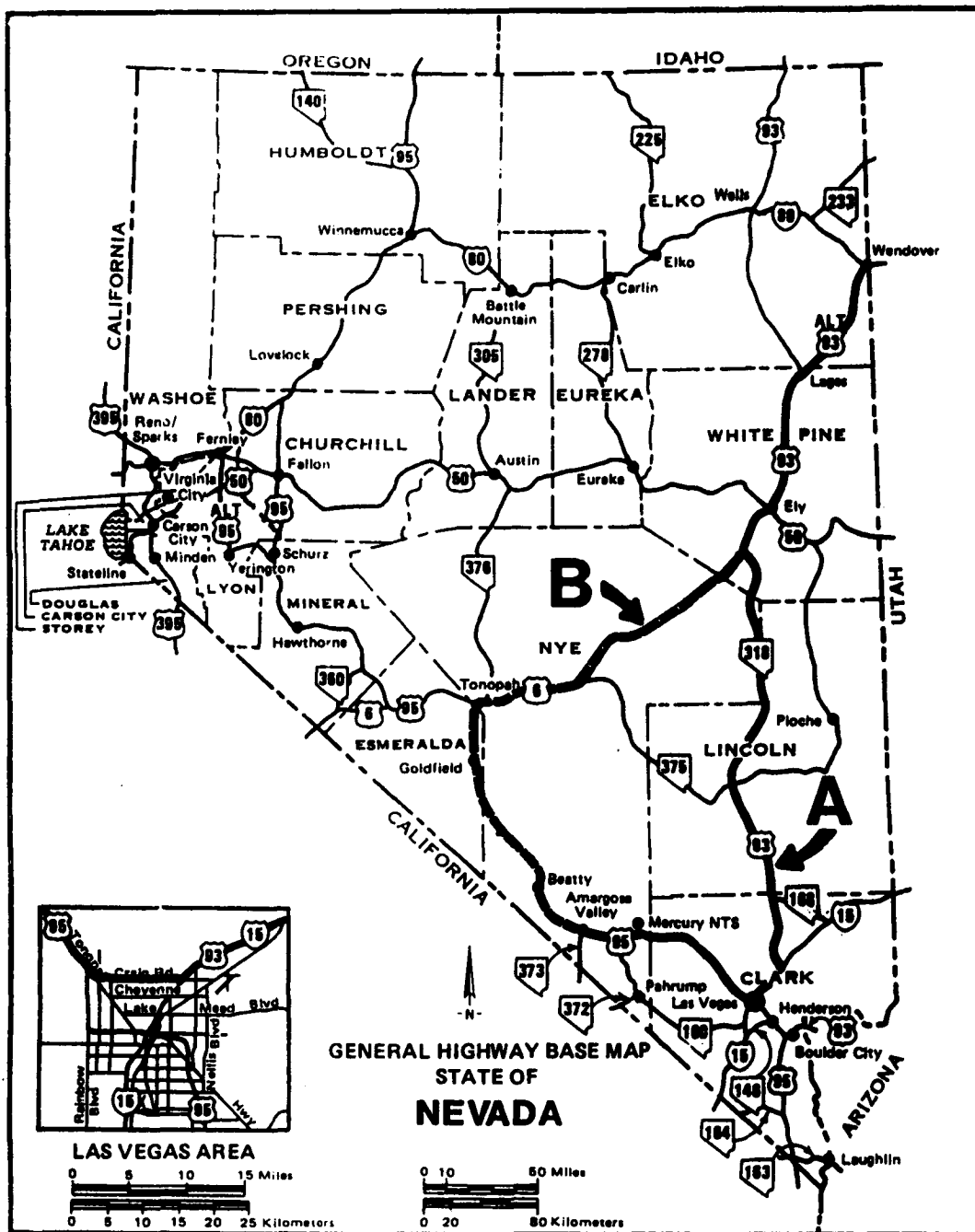
In accordance with NEPA, an Environmental Impact Statement should be prepared to address all issues regarding public health and the well-being of the environment. This report is a preliminary assessment of the issues that might arise in Esmeralda County, due to impacts or conflicts between the existing environment and the construction and transportation of spent nuclear fuel. The construction of the proposed rail lines could produce temporary and permanent damage to the ecosystem. Some of the damaging activities include: clearing and grubbing to remove all organic matter; grading extensive areas with large compacted cuts and fills; development of borrow pits and soils disposal sites; debris burning with resulting waste; stream modifications, either temporary or permanent, which may change hydrologic velocities; placement of bridges or culverts at all waterways, resulting in some disruption to stream bed and potential dewatering; and establishment of drainage ditches. These activities and their impacts, to the environment and residents, are described under Biological And Physical Issues. Conflicts and impacts to archeological and historical sites are described in the Cultural/Historical Issues section of this report.

Figure 1
Alternative Rail Access Corridors Identified by
the U.S. Department of Energy



Source: U.S. Department of Energy. Preliminary Rail Access Study. 1990.

Figure 2
Alternative Highway Routes
Identified by the State of Nevada



Source: Nevada Department of Transportation. The Statewide Radioactive Materials Transportation Plan, Phase II. 1989.

BIOLOGICAL AND PHYSICAL ISSUES

Biological and physical issues are those that arise when certain natural events occur such as earthquakes, rain, ice, and sand storms that can cause impacts during the construction and operation of a rail line, or during the use of a highway route. Biological and physical issues can also arise from conflicts between the proposed rail corridor and improvements to the highway system, and the existing environment, such as wildlife, soils, and viewshed.

Air Quality

Air quality standards, as enforced by the State of Nevada Department of Conservation and Natural Resources, are not to be exceeded in areas where the general public has access. Presently, Esmeralda County is in the attainment status and is qualified as "better than national standards" in the emissions of total suspended particulates (TSP), and sulfur dioxide (SO₃). Table 1 illustrates State and National standards for air pollutants.

During Construction of Rail Lines and Improvement to Highway 95 - Exhaust emissions and fugitive dust caused by construction traffic and excavation activities will increase sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrocarbons, and particulates found in local air sheds, thus decreasing air quality. Estimates of pollution potential resulting from construction vehicles are shown in Table 2. Construction related dust and vehicle emissions could increase the total amount of pollution in the County, moving it closer to non-attainment status, which may impede other industries from developing in the County.

During Operation of Rail Lines and Highway Transportation Systems - Exhaust emissions from locomotives, service vehicles, and truck transportation can be expected reducing local air quality. Poor visibility, caused by fugitive dust, may accentuate the possibilities of a highway accident. Trucks traveling on Highway 95, near the town of

Goldfield and its mine district, may be involved in an accident at any of the critical grades or the 90 degree curve located in Goldfield. In the event of a truck or train accident significant amounts of diesel fuel might spill and through evaporative processes, degrade local air quality. In the event of an accident resulting in a breach of shipping container containment, radioactive particles might be released to the environment. These particles could be inhaled or ingested by cattle and other animals affecting the human food chain, or worse yet, particles could be absorbed directly by humans increasing their susceptibility to cancer.

Table 1
Standards of Quality for Ambient Air

POLLUTANT	AVERAGE TIME	CONCENTRATION	PRIMARY^{C,E}	SECONDARY^{C,F}
Ozone	1 Hour	235 $\mu\text{g}/\text{m}^3$ * (0.12 ppm)**	235 $\mu\text{g}/\text{m}^3$ (0.12 ppm)	Same as Primary
Carbon Monoxide at <5000' above sea level		10,000 $\mu\text{g}/\text{m}^3$ (9.0 ppm)	10 $\mu\text{g}/\text{m}^3$	Same as Primary
Carbon Monoxide at >5000' above sea level	8 Hours	6.670 $\mu\text{g}/\text{m}^3$ (6.00 ppm)	(9.0 ppm)	Same as Primary
Carbon Monoxide at any elevation	1 Hour	40,000 $\mu\text{g}/\text{m}^3$ (35 ppm)	40 $\mu\text{g}/\text{m}^3$ (35 ppm)	Same as Primary
Nitrogen Dioxide	Annual Arithmetic Mean	100 $\mu\text{g}/\text{m}^3$ (0.05 ppm)	100 $\mu\text{g}/\text{m}^3$ (0.05 ppm)	Same as Primary
Sulfur Dioxide	Annual Arithmetic Mean	80 $\mu\text{g}/\text{m}^3$ (0.03 ppm)	80 $\mu\text{g}/\text{m}^3$ (0.03 ppm)	Same as Primary
Particulate Matter as PM ₁₀	Annual Arithmetic Mean	50 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$	Same as Primary
Particulate Matter as PM ₁₀	24 Hours	150 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$	Same as Primary
Lead (Pb)	Quarterly Arithmetic Mean	1.5 $\mu\text{g}/\text{m}^3$	1.5 $\mu\text{g}/\text{m}^3$	Same as Primary
Hydrogen Sulfide	1 Hour	112 $\mu\text{g}/\text{m}^3$ (0.08 ppm)	-	-

* $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

** ppm = parts per million

Adapted from: State of Nevada Administrative Code 445.843 Standards of quality for Ambient Air.

Table 2
EPA Pollutant Emission Factors
(1976)

Type of Equipment	CO*	Exhaust Hydrocarbons*	NOx*	SOx*	Particulate*
Track laying tractor	19.3	5.5	73.5	6.8	5.6
Wheeled tractor	107.5	7.4	49.7	4.5	6.8
Wheeled dozer	36.9	11.7	252.5	17.4	8.2
Scraper	73.0	31.3	311.0	23.1	20.3
Motor grader	10.7	2.7	52.5	4.3	3.0
Wheeled loader	27.6	9.3	120.3	9.1	8.6
Track laying loader	8.0	1.6	29.2	3.8	2.9
Off-Highway truck	67.0	21.8	381.5	22.7	12.8
Roller	9.2	2.7	52.0	3.3	2.5
Miscellaneous	20.7	7.8	113.5	7.1	6.9

* Tons/Hr x 10

Source: Dames & Moore. Technical Report For The White Pine Power Project.
 Ecological Resources Baseline Report. 1983.

Wind Speed And Direction

According to the Soil Conservation Service the average prevailing wind in the County is from the southwest. Average wind speed peaks at 11 miles per hour in the spring (USDA, 1982).

During Construction of Rail Lines - Gusting winds may result in large amounts of dust becoming airborne. At an average speed of 11 miles per hour, dust could travel to nearby springs and other sources of drinking water used by wildlife. Rail alternatives A and B from the proposed Caliente route would cross Clayton Valley, and Montezuma Range. The proposed Mina route would cross Monte Cristo Range, and Silverpeak Range. Dust can deposit on forage and other existing vegetation, restricting wildlife of its natural diets, and posing a threat to the native plants.

During Operation of Rail Lines - An accident along certain segments of the rail and highway routes (i.e. Township 2 North/Range 36 East, T2S/R39E, and T2S/R42E) could pose greater risk to towns and populated areas located downwind. Emergency managers in downwind communities might have less than one hour to inform and evacuate residents of threatened areas. Currently, Esmeralda County does not have an evacuation plan.

Precipitation

Precipitation in Esmeralda County is normally light at lower elevations year-round, and greater at higher elevations. The total average annual precipitation in the County is 5 inches. Fifty-five percent of the total rainfall usually falls between April and September. Snow accumulates to considerable depths at higher elevations. The average seasonal snowfall is 13 inches at Dyer (Soil Conservation Service, 1991) Snowfall can be expected in most areas of the proposed rail corridor and highway route.

During Construction of Rail Lines and Improvements to Highway 95 - Delays can occur due to rain and/or snow. Under wet conditions, construction traffic and workers can create ruts in existing County dirt roads. During construction of highway improvements along U.S. 95, extreme weather conditions could impose a threat to the safety of commuters.

Impact of Environment on Safe Transportation- Blowing and drifting snow can affect visibility and vehicle traction, thus increasing accident potential. Icy County roadways, coupled with a sudden stop, can cause a truck to skid out of control. Area passes, such as Goldfield Summit and Tonopah Summit, can have accumulations of ice and snow, increasing accident risk in these areas.

Hydrology

In a basin, the withdrawal of water from one aquifer may influence the occurrence and movement of water in another aquifer which is within the same overall flow system. At the same time, regional ground water flow systems may or may not be hydraulically connected. Thus, it is difficult to forecast the impacts resulting from ground water flow regime, and the locations where withdrawals will be made, (Henningson, Durham & Richardson, Inc., 1981).

The water supply in Esmeralda County is limited. The sources of surface water for irrigation are Chiatovich, Indian, Leidy, Busher, Perry Aiken, and McAfee Creeks, which are perennial streams flowing from the White Mountains. Additionally, ground water is used for irrigation. Water for household use is obtained from wells. The quality of the water is highly variable; in some areas the water is unsuitable for household use (Soil Conservation Service, 1982). Further degradation of ground water quality could pose constraints to future growth and development within Esmeralda County.

The Nevada State Health Division requires sampling of drinking water wells in Goldfield and Silverpeak (among other areas) on a regular basis. Table 3 compares State of Nevada Drinking Water Standards with Goldfield and Silverpeak sample results for the years 1991 and 1992. Table 3 suggests water quality in these communities meets or exceeds safe drinking water standards. The waters do exhibit relatively high levels of salinity and, in the case of Silverpeak, total dissolved solids.

During Construction of Rail Lines - Construction of the proposed rail lines will inevitably require the use of water from nearby sources. While not considered likely, construction related overuse of ground water sources can lower the water table in source aquifers, can reduce spring flows, and in a worst case scenario, can irreversibly dewater a

source aquifer harming the surrounding ecosystem. In some areas the proposed rail lines may act as a dam, which could force infiltration patterns to change. Changes in local hydrology could affect area vegetation, springs, and aquifer characteristics.

During Operation of Rail Lines and Highway Transportation Systems - In the event of an accident, there is the possibility that water resource contamination might result from oil, diesel, and chemical spills, and radiation exposure. The increase in local water use to support crew change and other support facilities which could be located in the County, could tax local water supply systems and/or aquifers. Goldfield and Silverpeak water quality currently meets and exceeds Nevada's Drinking Water Standards. However, an accident involving spilling of hazardous substances could endanger the quality of drinking water enjoyed today. The proximity of rail and highway shipments to existing community water production storage facilities may result in public perceptions of risk and could influence their acceptance of local water supplies.

Table 3
Nevada Drinking Water Standards
Goldfield and Silverpeak Samples

Nevada Drinking Water Standards	(ppm)	Goldfield	Silverpeak
		(1992 sample)	(1991 sample)
Chloride	400	30	162
Color	15 color units	3	3
Copper	1.0	0.00	0.00
Fluoride	2.0	0.90	0.67
Iron	0.6	0.06	0.02
Magnesium	150	0.00	27
Manganese	0.1	0.00	0.00
pH	6.5 - 8.5	8.20	7.68
Sulfate	500	94	207
T.D.S.	1000	384	746
Zinc	5.0	0.00	0.04

Adapted From: State of Nevada Public Drinking Water Standards, and Nevada State Health Laboratory (1991 and 1992 samples).

Flood Zones

Flood zones are determined by soils, slope, drainage area, and amount and intensity of precipitation. The proposed rail corridor crosses through several soils in the County that have a potential for flash floods. Neither the US Geological Survey nor the National Insurance Program (through Federal Emergency Management Agency) have developed any flood hazard maps for Esmeralda County.

Drainage Design Considerations

In the arid southwest desert, several unique flood related design difficulties must be considered such as: the random flow patterns associated with active alluvial fans, long duration flooding in closed basin lakes, and sediment content from natural sand bed streams in flood flows (De Leuw, Cather & Co., 1991).

Alluvial fans that are active have several particular characteristics. Usually an active alluvial fan has a convex shape, the surface soils are very erodible, and have many shallow channels dispersing from the highest point or peak. Where alluvial fan flood hazards might exist, special care should be taken in the selection of drainage structures. Bulk from each flooding discharge could travel to several locations (De Leuw, Cather & Co., 1991).

Esmeralda County is located within the Great Basin Province, where closed basin lakes are common. Areas flooded within a closed basin, can be inundated for long periods of time such as days, weeks or even months (De Leuw, Cather & Co., 1991).

During Construction of Rail Lines and Improvement of Highway 95 - Prior to and during construction of diversion channels, high intensity storms could produce localized flooding placing in danger the health and safety of the workers and existing public and private infrastructure. Flooding, due to possibly inadequate drainage systems near the

proposed transportation corridors, could significantly increase average channel velocities and/or alter the floodway patterns upstream and downstream of the corridors, and could significantly damage transportation structures.

During Operation of Rail Lines and Highway Transportation Systems - The potential for an accident during construction and operation of the rail route and during highway transportation, increases during the months when high intensity storms can produce flash floods. Floods can have damaging effects on infrastructure, increasing the possibility of an accident during transportation of hazardous materials.

Geology and Soil

A two mile corridor was used for characterizing the soils of the proposed rail and highway routes. The corridor lines were loosely sketched on soil maps, obtained from the Soil Survey of Esmeralda County Areas (USDA, 1991), for issue identification purposes only.

Within the two mile corridor, topography is dominated by ranges of different types of rock and by intervening valleys. The igneous rock in the northern and eastern (affected) areas of the County are ash flows, lava flows, and volcanic breccia. General soil types found within the corridor include:

Typic Torrifluvents-Playas-Duric Camborthids: The slopes are nearly level to gently sloping (0 to 4 percent), well drained soils, and typically stratified. The playas are seasonally flooded by runoff from higher areas. Wildlife habitat is limited by the sparseness of the vegetation and its lack of diversity. (USDA, 1991).

Typic Torriorthents-Duric Heplargids-Typic Durargids: The Typic Torriorthents and Duric Heplargids soils are very deep and of coarse texture. Typic Durargids are shallow, well drained soils with a gravelly, moderately coarse upper layer. Vegetation in these types of soils are mainly shadscale, bud sagebrush, galleta, and Indian ricegrass. These areas are used for rangeland and wildlife habitats, although wildlife habitat is limited by the sparseness of the vegetation and its lack of diversity. (USDA, 1991).

Xerollic Camborthids-Xerollic Durargids-Haploxerollic Durargids. These soils are found at an elevation of 6,700 to 7,400 feet. Slopes are 2 to 15 percent. Xerollic Camorthids soils are very deep and are well to excessively drained. They have a coarse upper layer and a gravelly middle and lower layer. Xerollic Durargids soils are well drained also, but very shallow with gravelly upper layer, a fine textured middle layer, and a hardpan at a shallow depth. Hyploxerollic Durargids are very shallow, well drained soils on fan remnants. Areas characterized by these soils are typically used as rangeland and wildlife habitat. These areas provide habitat for a number of wildlife species. (USDA, 1991).

Typic Torriorthents-Typic Haplargids. Both of these types of soils are found at an elevation of 4,300 to 5,200 feet. Slopes are 2 to 8 percent. These soils are very deep and excessively drained to well drained soils. The vegetation found are populations of sparse shadscale, Bailey greasewood, and Cooper wolfberry. Since it is sparse, this vegetative community can only support a limited wildlife habitat. (USDA, 1991).

870-8284

**Emergency Preparedness Working Group
DOE Nevada Support Facility
232 Energy Way
Sedan Conference Room
1:00 PM, October 4, 2001.**

- | | |
|--|---------------------------------|
| 1. Call to Order and Introductions | Milton Chilton
Co-Chair EPWG |
| 2. Approval of Agenda | Committee |
| 3. Fire and Medical Assistance to Counties | Ken Hoar or Alt. |
| 4. Inyo County Participation in EPWG | Milton/Committee |
| 5. County Grant Scope Changes | Committee |
| 6. County HazMat Exercises | Committee |
| 7. Budget Reports to the State | Mike Alexander |
| 8. County Status Reports for Future Meetings?? | Committee |
| 9. Other Business or Issues | Committee |
| 10. Next Meeting | |

Oct-04-01 10:40 From-NNSA OFC PUBLIC AFFAIRS & INFORMATION 7022950154 T-009 P.001/001 F-014

Lithic Haplargids-Lithic Torriorthents-Typic Haplargids, shallow. These soils are very shallow, found at an elevation of 4,800 to 7,200 feet, with slopes of 15 to 75 percent. They are well drained to excessively drained soils. Vegetation is mainly shadscale, bud sagebrush, galleta, and Indian ricegrass. These soils are used as rangeland and wildlife habitat. Wildlife habitat is limited due to the sparseness of the vegetation and its lack of diversity (USDA, 1991).

Hydroponic soils delineate wetland areas which serve as important habitats for many species of flora and fauna. Because of their limited extent and important value to species survival, wetlands are valued land areas which enjoy federal regulatory protection from inadvertent destruction. Construction in or adjacent to wetland areas requires a permit from the U.S. Army Corps of Engineers. Projects which threaten to reduce total acres of wetland are often required to establish new wetland areas as mitigation.

There are seven predominately wetland areas in the County. As illustrated in Figure 3, two of the wetland areas (in the vicinity of T1N R38 Section 10, and T1S R41 Sections 13, 21, & 29) might be in direct conflict with the proposed Mina rail line, and Caliente alternative B rail line, respectively. In addition, three of the seven wetland areas are within 3 to 6 miles of both proposed rail lines. A description of the various soils can be found in Appendix A.

During Construction of Rail Lines and Improvements to Highway 95 - Clearing, grubbing and rough grading creates extreme erosion prone conditions by exposing large areas of bare soil which can then be removed by wind and water. If during construction the soil is compacted, natural infiltration may be reduced, increasing the percentage of

rainfall runoff. If the disturbance includes removing soil, natural re-vegetation of non-weedy plants may require several years.

During Operation of Rail Lines and Highway Transportation Systems - After construction of the rail corridor and/or highway improvements, most of the soil in the disturbed area will remain scarred and unable to support agriculture and/or wildlife. Rock falls and landslides may occur in areas of unstable, steep slopes. Certain soils have steep slopes which under certain conditions (such as significant rainfall on loam sitting on top of clay or bedrock) could cause a landslide thereby increasing the risk of a potential transportation incident or accident.

Figure 3
Wetland Areas in Esmeralda County



Source: U.S. Department of The Interior, Fish and Wildlife Service. Wetland Resources of The United States. 1991.

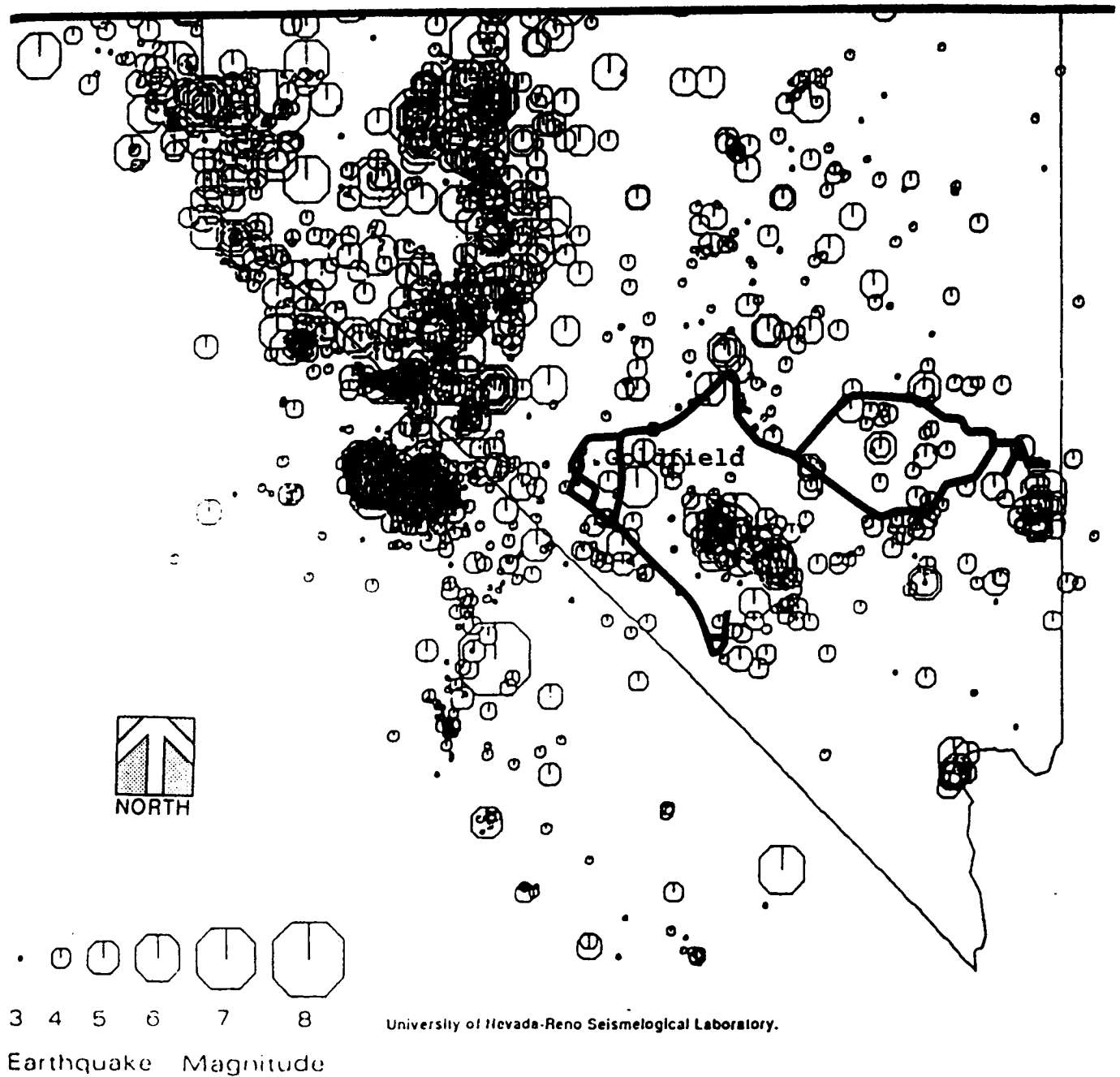
Seismic Activity

Nevada lies within the Basin and Range province, one of the most seismically active regions in the United States. Several earthquakes between Richter magnitude 4 and 6 have occurred in the immediate vicinity of proposed rail corridors through the County. Figure 4 shows seismic activity in Esmeralda County. Richter magnitude above 5 or 5.5 are potentially destructive at the epicenter. The average frequency of earthquakes of magnitude 6 and greater in Nevada has been approximately one every ten years, while earthquakes of magnitude 7 and greater average one every 27 years. Geologically young faults, which are the source of earthquakes, can be found throughout the proposed rail and highway corridors (De Leuw, Cather, & Co., 1991). Figure 5 shows faults in Esmeralda County in relation to the candidate high-level waste transportation system corridors.

During Construction of Rail Lines and Improvements to Highway 95 - An earthquake could induce land or rock slides and cause damage to the rail and highway transportation systems, and could endanger the lives of those working on the proposed rail and highway system infrastructure.

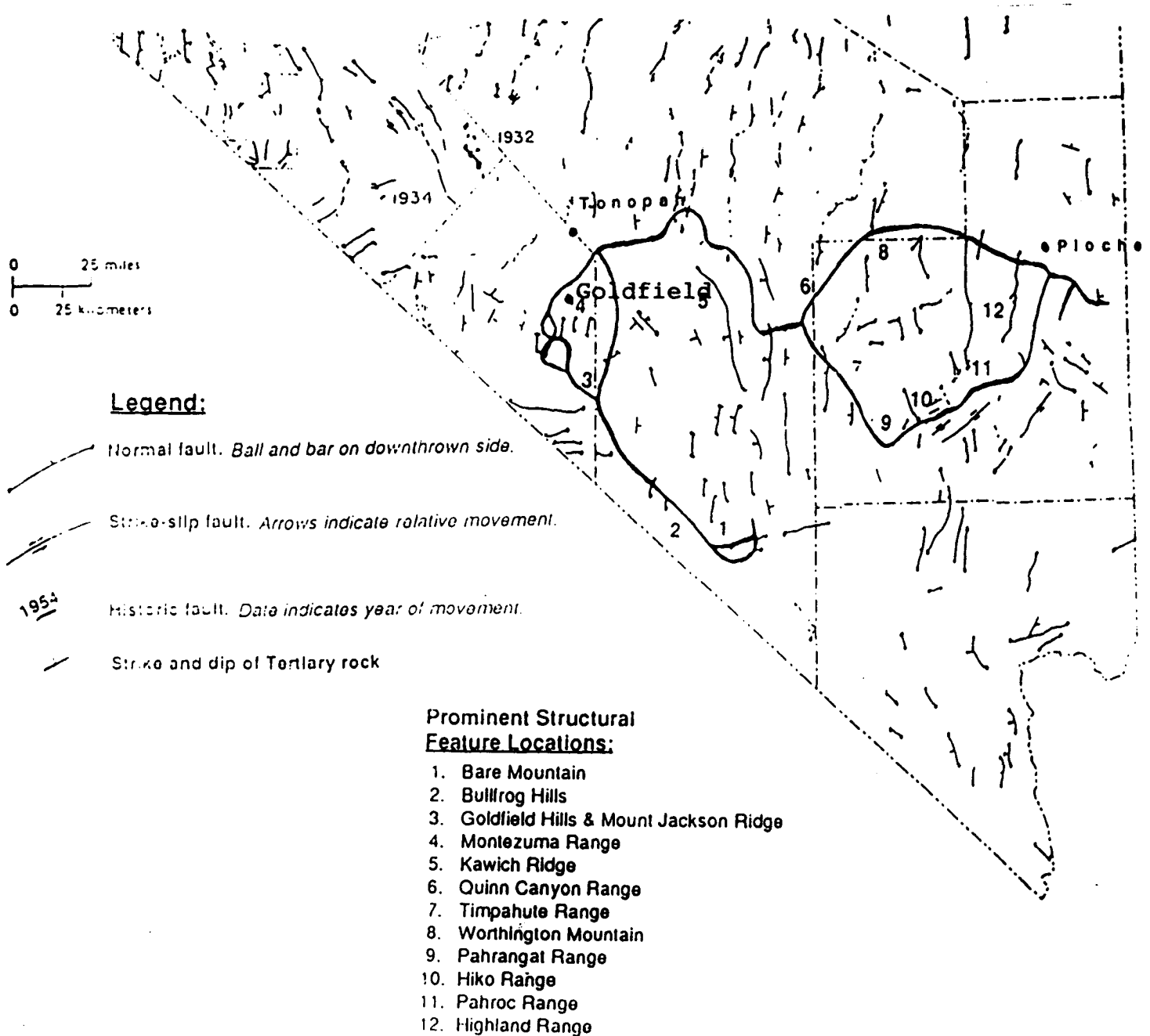
During Operation of Rail Lines and Highway Transportation Systems - A significant earthquake could pose a lengthy stop time or even force a train to derail or vehicle to crash. A derailed train might not only destroy local vegetation, it could disperse hazardous materials into the ground and the air. A train or vehicle accident could, under certain unlikely but possible scenarios, result in a breach of containment producing heightened exposure risks to the public and accessible environment.

Figure 4
Seismic Activity in Relation to Alternative
Rail Corridors in Esmeralda County



Adapted From: De Leuw, Cather, & Co., Yucca Mountain Rail Access Study Caliente Route. 1991

Figure 5
Historic Faults in Relation to Alternative
Rail Corridors in Esmeralda County



Adapted From: De Leuw, Cather, & Co., Yucca Mountain Rail Access Study Caliente Route. 1991

Land Ownership

The BLM administers most of the land in the County. There are parcels of public land in proximity to all population centers. A small area of land administered by the State of Nevada is located inside Clayton Valley near the town of Silverpeak. A utility corridor containing minor transmission lines (less than 138KV), enters the County from the northwest and exits in the southeast (BLM, 1984).

Land Use

Within a two mile corridor centered along existing highway and candidate rail lines, at least five mining sites are located, a mill, an evaporation pond, the Lida Junction Airstrip, and the towns of Coaldale, Goldfield, and Silverpeak. There are 142 clusters of mines, prospects, and mineral locations in the County (Raney, 1989). Most land along the corridor is open rangeland used for livestock grazing and providing wildlife habitat of varying qualities. The corridors also support dispersed recreation uses such as hunting, hiking, and offroading.

Grazing Allotments

Most of the public land administered by BLM in Esmeralda County is divided into several grazing allotments ranging in size from 120 acres to 625,015 acres each. Table 4 displays the names and acreages of grazing allotments in the County. Aside from Allotment Area 3 which is unallocated, most livestock in the County are cattle. Licenses are given for a period of three to five years. In Esmeralda County, allotments of Animal Unit Months (AUM's) of forage vary from 52 to 12,348. Figure 6 illustrates the relationship of grazing allotments and water resources to proposed rail corridors.

The Icehouse and Red Springs allotments have a combined 20 acres of riparian vegetation (vegetation that grows along streams and springs). Riparian zones on public lands administered by BLM in the County contain 8 springs and 55 streams (BLM, 1984).

During Construction and Operation of Rail Lines and Highway Transportation Systems - The rail line corridors and highway transportation routes being considered are located within 2 miles of private lands (Towns of Coaldale, Silverpeak, and Goldfield). There is the possibility of adverse taking of private lands in order to proceed with the rail line development. Construction of rail lines in the vicinity of existing mining sites, could pose conflicts over sharing of available access roads and limited water resources in the region. Rail infrastructure could also restrict access to future mine sites. If the rail lines are constructed, industries such as mining, might benefit from shared use in transporting mineral commodities.

Clearing and grubbing along with rough grading may create extreme erosion prone conditions, and it may impede natural revegetation of non-weedy plants for several years. For many years the soil may remain scarred incapable of providing forage for livestock and wildlife. The proposed transportation corridors which bisect several grazing allotments might impede domestic livestock and wildlife from access to vegetation and water. Water resources in Lida Wash, Jackson Wash, Rail Road Springs, Alkali Spring, and Hot Springs are within a two mile corridor defining possible rail routes.

During Operation of Rail Lines and Highway Transportation System - Residential, commercial, and grazing lands adjacent to the candidate rail corridors could be significantly devalued, due to the perceived risk of radioactive exposure. An accident could cause indefinite closure of nearby mining activities, airfields, community facilities

and businesses. During construction and operation of the candidate rail lines, grazing allotments 1, 5, 9, 10, 11, and 12 (as displayed in Table 4 and Figure 6), may be affected.

Table 4
Grazing Allotments
in Esmeralda County

Grazing Allotment Name	Identification Number	AUM's	Acres of Public Land
Monte Cristo	1	9,352	496,018
Red Springs	2	5,536	144,277
unallocated	3	-	17,382
Icehouse	4	890	78,923
Silverpeak	5	5,952	319,553
White Wolf	6	1,088	21,567
White Sage	7	600	10,315
Silver King	8	150	8,969
Sheep Mountain	9	1,740	88,435
Montezuma	10	10,688	538,297
Yellow Hills	11	1,212	62,203
Magruder Mountain	12	12,348	625,015

Adapted From: Bureau of Land Management. Esmeralda Planning Area Resource Management Plan and Environmental Impact Statement. 1984.

Flora and Fauna

The extremes of climate, elevation, exposure and soil type combine to produce a diverse living environment for a wide variety of plants and animals. Small springs, wet meadows, saline meadows, streams, and reservoirs provide habitats for wildlife. Livestock and wild horses place heavy demands upon certain riparian habitat associated with springs throughout these areas, especially in grazing allotment areas used year long. These areas would be particularly sensitive to transportation system related disturbances.

Threatened And Endangered Species

There are no known occurrences of Threatened and Endangered (T&E) Species in Esmeralda County. However, the Northern Nevada Native Plant Society (NNNPS) maintains an annually revised list of candidate "watch" status and T&E species. Through a review of the Nevada Natural Heritage Program database, three sensitive species were found to be in proximity to the candidate rail lines. One of the species (Eastwood Milkweed) is listed as candidate T&E by the U.S. Fish and Wildlife Service. The other two species (Squalid Milkvetch, and Dune Linanthus) formerly candidates, are now listed as being adequately protected. Table 5 lists the species, their Federal Status, and their location where last observed. All the information on sensitive species is dependent on the research and observations of many individuals and organizations, and in most cases are not the result of site-specific field surveys. Therefore sensitive species may occur in the County which have not been recorded to date. Various raptors may also occur within the rail corridors under construction. Information on raptors can be obtained through the Nevada Department of Wildlife. It is important to note that all cactuses, yuccas and various species of pine trees are protected by Nevada State law NRS 527.060-120 (Nevada Natural Heritage Program, 1994).

Table 5
Known Locations of Sensitive Plant and Animal Species
Proximate To Candidate Rail and Highway Transportation Corridors
in Esmeralda County

Scientific Name	Common Name	Federal Status	Township Range	Last Observed
Asclepies Eastwoodiana	Eastwood Milkweed	Candidate, category 2	1N 39 E	05-06-81
Astragalus Serenoi Var.	Squalid Milkvetch	Former Candidate	1N 39E	05-06-81
Linanthus Erenicola	Dune Linanthus	Former Candidate	3N 36E	05-13-88
Mentzelia Candelarise	Candelaria Blazing-Star	none	5S 41E	05-04-85
Mentzelia Candelarise	Candelaria Blazing-Star	none	2N 38E	05-06-86

Adapted From: Nevada Natural Heritage Program. February, 1994.

Wild Horses and Burros

The Bureau of Land Management's Resource Management Plan and Environmental Impact Statement (EIS) lists 13 wild horse and burro herds in the Esmeralda Southern Nye Planning Area. The October 1993 census showed a population of approximately 609 horses and approximately 500 burros. Several herd areas are in proximity to each other and movement between areas are common. Since there is no vegetative allocation to wild horses and burros, vegetative conditions within the 13 herd areas varies. Competition for forage may occur between horses, burros and cattle, since their diets overlap considerably. Habitat conflicts between horses, burros, cattle, and wildlife are related to the availability and distribution of water in specific areas. Table 6 lists wild horse and burro herd management areas in the County. Construction and operation of new rail lines through Esmeralda County could serve to restrict access by wild horses, wildlife, and cattle to various sources of forage and water.

Table 6
Wild Horse and Burro
Herd Management Areas in Esmeralda County

Area	Herd
Dunlap	Horse
Lone Mountain/Playmaster	Horse
Fish Lake Mountain	Horse and Burro
Silverpeak	Horse
Montezuma Peak	Horse
Goldfield	Horse and Burro
Palmetto	Horse
Gold Mountain	Horse

Source: Bureau of Land Management. Esmeralda-Southern Nye Planning. 1984.

Wildlife

Large animals such as big horn sheep, mule, deer and elk are located throughout the County. They are an important factor to the local hunting community, and any alterations to their current status may influence local economy. Table 7 illustrates the distribution of wildlife in the County.

Table 7
Wildlife Habitat Ranges
In Esmeralda County

Range	Herd
Monte Cristo	Big Horn Sheep, Mule, Deer
Silverpeak	Big Horn Sheep, Mule, Deer
Stonewall	Big Horn Sheep
Lone Mtn./Playmaster	Big Horn Sheep, Mule, Deer
Magruder/Palmetto	Big Horn Sheep*, Mule, Deer
Montezuma	Big Horn Sheep, Mule, Deer
Goldfield Hills	Big Horn Sheep
Gold Mountain	Big Horn Sheep**, Mule, Deer
Amargosa	Big Horn Sheep, Mule, Deer
Spring Mountain	Mule, Deer

* Historical Distribution

** Potential Distribution

Source: Bureau of Land Management. Esmeralda-Southern Nye Planning Area. 1984.

During Construction of Rail Lines and Improvement to Highway 95 - Construction of rail lines and related access roads, and improvements to highway infrastructure will remove soil and vegetation within project corridors. Changes in vegetative characteristics could disrupt migration and reproductive patterns of sensitive species and other wildlife. Noise produced by heavy machinery might interfere with natural recovery of sensitive species and wildlife by compelling fauna to redistribute and overpopulate other areas. Construction workers may increase pressure on wildlife species by hunting and/or harassing the animals. Indiscriminate off-road vehicular traffic may disrupt species, and could cause severe damage to vegetation. All of the above mentioned impacts may place additional barriers to wildlife movement and migration. Construction induced runoff may result in sedimentation of aquatic habitats. Gill breathing and filtering-feeding organisms would be particularly vulnerable.

Borrow pits and/or other aggregate material source areas may contribute to soil and vegetative disturbances. The movement of soil from the source areas will most likely contribute to additional blowing of dust that could cover existing wildlife forage. Once removed, vegetation from the source areas could take several years to restore. While in the process of vegetative recuperation, wildlife could be forced to relocate and compete with other herds in the area. Area ranchers could face temporary and/or permanent loss of AUM's.

During Operation of Rail Lines and Highway Transportation Systems - Adjustments and redistribution of wildlife populations may influence hunting activities, and could impact local expenditures, income, and employment. During highway transportation of hazardous materials there is always the possibility of an unexpected encounter with wildlife.

Noise

Background noise in Esmeralda County is generally limited to activities on the highways, in existing towns, mining, milling, and military aircraft. Department of Defense aircraft training is associated with the County's proximity to the Tonopah Test Range (TTR) and the Nellis Range. Air Force training routes avoid airports, specified safety or noise-sensitive towns, populated areas, and some wildlife habitat areas (Science Applications International Corp. 1990). Figure 7 shows the Air Force training routes in relation to communities in the County.

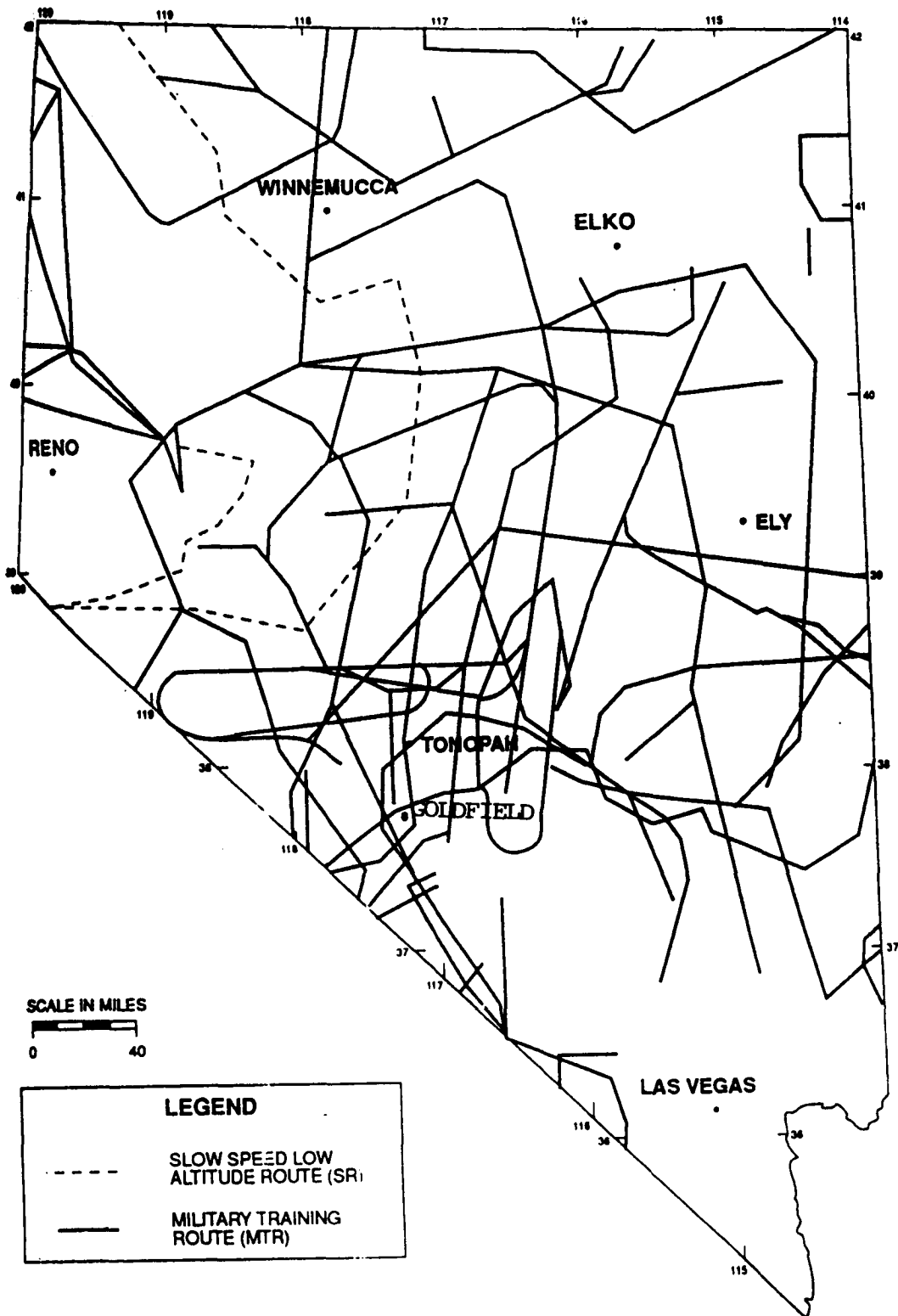
During Construction of Rail Lines and Improvements of Highway 95 - Noise from construction equipment or blasting may significantly exceed background noise levels. Increased noise could annoy existing wildlife and/or residents. Patterns of wildlife movement and migration may be disrupted, at least on a temporary basis.

During Operation of Rail Lines and Highway Transportation Systems- Additional noise beyond background levels may diminish the aesthetic quality of communities in the County. Excessive noise could discourage vacationers from camping and participating in other outdoors activities. Train horns used in the vicinity of communities could become an annoyance to community residents and visitors.

Viewshed

The Bureau of Land Management's Record of Decision for the Esmeralda-Southern Nye Resource Management Plan, stipulates that visual quality is to be maintained at its present high scenic levels along State Highway 374 between Beatty and Death Valley National Monument; State Highway 267 Between Scotty's Junction and Death Valley National Monument; State Highway 266 between Lida Junction and the California border; State

Figure 7
Air Force Training Systems Within Esmeralda County



Source: Adapted from Science Applications International Corporation. 1990.

Highway 265 between Blair Junction and Silverpeak; and State Highway 264 between U.S. 6 and the California Border.

During Construction and Operation of Rail Lines Transpiration Systems - Visual quality could be compromised if the candidate corridors are utilized. During construction clearing, grubbing and the development of borrow pits may dominate the landscape reducing the present high visual integrity. Following construction, scars upon the landscape will remain indefinitely. Trains crossing the County once or twice a day might degrade the high visual quality of the areas affected.

CULTURAL RESOURCES

A review of possible rail corridors by the University of Nevada, Las Vegas (Harry Reid Center For Environmental Studies) revealed more than 100 cultural resources sites known to exist within the project vicinity. Table 8 lists most known historical and/or archeological sites in or near the rail corridors. Based upon the frequency of known sites, field work within the rail corridors is likely to identify additional locations of historical and/or archeological resources.

During Construction and Operation of Rail Lines Transportation Systems - Since several of the sites are extremely close to the rail corridor it may be almost impossible to avoid disturbance to all sites. Worker related dispersed recreation in the area may result in vandalism of historical and archeological resources.

Table 8
Known Historical and Archeological Sites
Within Esmeralda County

Site	Number and Type	Site	Number and Type
T1S R41E	2 A	T6S R41.5E	1 A
T2S R42E	1 A	T6S R42E	3 A
T2N R37E	2 A	T2N R42E	1 H&A, 1 H
T2N R38E	3 A, 2 H&A	T2N R43E	1 H
T3N R36E	1 H	T1N R42E	1 H&A, 5 H
T2N R36E	2 A	T1S R41E	1 H, 1 A
T2N R37E	2 H, 3 A	T2S R41E	1 A
T2N R41E	2 H	T4S R42E	3 A
T1N R42E	2 H	T4S R43E	1 A
T6S R41E	3A, 1H	T5S R43E	1 H, 3 A
T2S R39E	2 H	T1S R38E	1 H, 1 H&A
T3S R39E	1 A	T2S R38E	1 H&A
T3S R38E	2 A	T1N R38E	1 A
T4S R39E	1 A	T1S R38E	1 A
T2S R37E	4 H&A	T1N R36E	1 A, 1 H, 1 H&A
T2S R38E	2 H	T2N R36E	1 A
T3S R41E	1 A	T3N R36E	3 H&A
T2S R41E	1 A	T1S R39E	2 A, 1 H, 1 H&A
T2S R42E	3 A, 1 H&A, 1 H	T2S R38E	1 H, 4 H&A, 1 A
T3S R41E	1 A	T2S R39E	1 H&A, 2 H, 1 A
T4S R41E	1 A	T5S R42E	1 A
T4S R42E	2 A	T5S R43E	5 A
T5S R42E	1 A	T6S R43E	1 A

A - Archeological site

H - Historical site

Source: Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas.

APPENDIX A

**Types and Characteristics of Soils
Located in Proximity to Candidate Rail Corridors
in Esmeralda County**

SOIL CODE	SOIL ASSOCIATION NAME	HAZARD OF FLOODING	PERMIABILITY	RUNOFF	HAZARD OF EROSION BY WATER	HAZARD OF EROSION BY WIND
100	Unsel-Belted-Orphant	none	moderately slow to slow	moderately slow	slight	moderate to severe
101	Unsel-Wadenot-Izo	none to occasional	slow to rapid	slow	slight to severe	severe to moderate
103	Unsel-Silverbow-Izo	none to occasional	moderately slow to rapid	slow	slight to severe	slight to severe
106	Unsel-Wardenot-Terico	none to rare	moderately slow to rapid	slow	slight	moderate to slight
108	Unsel-Izo	none to occasional	moderately slow to rapid	slow	slight to severe	slight to moderate
110	Blacktop-Rock outcrop- Pintwater	none	moderate to moderately rapid	very rapid	severe	slight
111	Blacktop-Rodad-Theriot	none	moderate to slow	very rapid to rapid	severe to moderate	slight
112	Blacktop-Rock outcrop	none	moderate	very rapid	severe	slight
121	Leo-Ardivey	rare to none	rapid to moderately slow	slow	slight	slight
122	Leo-Izo	none to occasional	rapid	slow	slight to severe	severe to moderate
144	Stumble-Wardenot-Unsel	none to rare	rapid to moderately slow	very slow to slow	slight	severe to slight
162	Yomba-Playas-Youngston	none to occasional	moderate to moderately slow	very slow	slight	severe to moderate
191	Terico-Advokay-Downeyville	none	slow to moderately slow	medium to rapid	slight	slight to severe
221	Advokay-Blacktop-Itme	none to rare	moderately slow to very rapid	rapid to very slow	slight to moderate	slight to severe
225	Advokay-Blacktop-Tomel	none	moderate to moderately slow	rapid to slow	moderate to slight	slight to severe
230	Stewval-Downeyville-Rock outcrop	none	moderate	rapid	moderate to slight	slight
231	Stewval-Pintwater-Rock outcrop	none	moderate to moderately rapid	rapid	moderate to severe	slight
251	Theriot-Rock outcrop	none	moderate	rapid	severe	slight
253	Theriot-Slatery-Rock outcrop	none	moderate	rapid	severe to moderate	slight
280	Tognoni-Blacktop	none	slow to moderate	medium to very rapid	slight to severe	slight
310	Gynelle-Oricto	rare	rapid to moderate	slow	slight	slight
311	Gynelle-Cirac	rare	rapid to moderately rapid	slow to very slow	slight	slight to severe
312	Gynelle-Oricto, alkali	rare	rapid	slow	slight	slight
313	Gynelle-Luning	rare	rapid	slow	slight	slight
316	Gynelle-Wardenot	rare	rapid	slow	slight	slight
317	Gynelle-Oricto, warm	rare	rapid to moderate	slow	slight	slight
323	Oricto-Terico-Roic	none	slow to moderately rapid	slow to rapid	slight	slight to moderate
327	Oricto-Gynelle	rare	moderate to rapid	slow	slight	slight
334	Candelaria-Izo	none to occasional	moderate to rapid	slow	slight to severe	moderate to slight
340	Zaba very gravelly loam	none	moderate	slow	slight	slight

SOIL CODE	SOIL ASSOCIATION NAME	HAZARD OF FLOODING	PERMIABILITY	RUNOFF	HAZARD OF EROSION BY WATER	HAZARD OF EROSION BY WIND
341	Zaba-Gynelle	none to rare	moderate to rapid	slow	slight	slight
352	Roic-Wardenot-Badland	none to rare	moderately rapid to rapid	rapid to slow	moderate to slight	slight to severe
356	Roic-Advokay-Blacktop	none	moderately rapid to mod. slow	rapid	slight to severe	slight to severe
360	Downeyville-Pinwater-Rock outcrop	none	moderate to moderately rapid	rapid	slight to severe	slight
363	Downeyville-Silverbow-Rock outcrop	none	moderate to moderately slow	rapid	slight	slight
364	Downeyville-Vindicator-Advokay	none	moderate to moderately slow	rapid	slight to moderate	slight to severe
368	Downeyville-Pintwater-Upspring	none	moderate to moderately rapid	rapid	slight to severe	slight
400	Annaw-Wardenot-Ardivey	rare to none	moderately rapid to mod. low	slow	slight	slight to moderate
414	Pinwater-Blacktop-Downeyville	none	moderate to moderately rapid	rapid to very rapid	severe to slight	slight
442	Wardenot-Izo	rare to occasional	rapid	slow	slight to severe	slight to moderate
443	Wardenot-Roic	rare to none	rapid to moderately rapid	slow to medium	slight	severe to slight
445	Wardenot-Gynelle-Stonell	rare to none	rapid to moderately slow	slow to medium	slight	slight to severe
446	Wadernot-Annaw-Izo	rare to occasional	rapid to moderately rapid	slow	slight to severe	slight to moderate
454	Cirac-Playas-Kawich	rare to none	moderately rapid to very rapid	ponded to very slow	slight	severe
455	Cirac-Kawich	rare	moderately rapid	ponded to very slow	slight	severe
460	Tomel-Ardivey-Wardenot	none to rare	moderately slow to rapid	slow to medium	slight	moderate to slight
462	Tomel-Wardenot	none to rare	moderately slow to rapid	slow	slight	moderate to slight
475	Ardivey-Tomel-Izo	none to occasional	slow to rapid	medium to slow	slight to severe	slight to moderate
476	Ardivey-Wardenot-Izo	rare to occasional	moderately slow to rapid	slow to medium	slight to severe	slight to moderate
480	Stonell-Wardenot-Izo	rare to occasional	moderately slow to rapid	medium to slow	slight to severe	severe to slight
481	Stonell-Roic-Wardenot	none to rare	moderately slow to rapid	medium to rapid	slight to moderate	severe to slight
510	Silverbow-Wardenot-Izo	none to occasional	moderately slow to rapid	medium to slow	slight to severe	slight to moderate
550	Luning-Timper-Gynelle	rare to none	rapid to moderately rapid	very slow to slow	slight	severe to slight
570	Espint-Vindicator	none	slow to moderately slow	rapid	slight	slight to severe
591	Vindicator-Unsel-Leo	none to rare	moderately slow to slow	slow	slight	moderate to severe
592	Vindicator-Gabbvally-Advokay	none	moderately slow to moderate	rapid	slight to moderate	moderate to severe
593	Vindicator-Downeyville-Blacktop	none	moderately slow to moderate	rapid to very rapid	slight to severe	moderate to slight
651	Gabbvally-Bellehelen-Stewval	none	moderate to moderately slow	rapid	moderate to slight	moderate to slight
680	Malmesa-Stewval-Gabbvally	none	slow to moderate	medium to rapid	slight to moderate	slight
690	Entero-Penelas-Rodad	none	slow to moderately slow	rapid	moderate	slight
692	Entero-Penlas-Slatery	none	slow to moderate	rapid	moderate	slight

SOIL CODE	SOIL ASSOCIATION NAME	HAZARD OF FLOODING	PERMIABILITY	RUNOFF	HAZARD OF EROSION BY WATER	HAZARD OF EROSION BY WIND
710	Tokoper-Blacktop	none	moderately slow to moderate	medium to very rapid	slight to severe	slight
711	Tokoper-Adivay	none	moderately slow	medium to slow	slight	slight
712	Tokoper-Stewval	none	moderately slow to moderate	medium to rapid	slight to moderate	slight
721	Penelas-Ubehebe-Entero	none	slow to moderate	rapid	moderate	slight to severe
792	Handpah-Breko-Veet	none to rare	slow to moderate	medium to moderate	slight	slight to severe
794	Handpah-Tomel-Breko	none	slow to moderately slow	medium to slow	slight	slight to severe
811	Slatery-Rodad	none	moderate to slow	rapid	moderate	slight
900	Playas	-	-	-	-	-
901	Badland-Belcher-Belted	none	moderately rapid to mod. slow	slow	slight	severe
902	Slickens	-	-	-	-	-
910	Stargo-Playas	occasional	moderately slow	very slow	slight	severe
931	Laxal-Wardenot-Ardivey	none to rare	moderately rapid to mod. slow	slow	slight	severe to slight
960	Beano-Wardenot	none to rare	moderately slow to rapid	slow	slight	moderate to severe
971	Blappert-Slatery	none	moderate	rapid	slight to severe	slight
1030	Papoose-Roic-Cirac	none to rare	moderate to moderately rapid	medium to very slow	slight	slight to severe
1032	Papoose-Cirac	none to rare	moderate to moderately rapid	very slow	slight	severe
1034	Papoose-Izo	none to occasional	moderate to rapid	slow	slight to severe	severe to moderate
1121	Rodad-Theriot-Rock outcrop	none	slow to moderate	rapid	moderate to severe	slight
1125	Rodad-Theriot-Kyler	none	slow to moderate	rapid	moderate to severe	slight

*severe denotes flash floods

REFERENCES

Battelle Nuclear Systems Group, Office of Transportation Systems and Planning. MRS Systems Study, Task F: Transportation Impacts of a Monitored Retrievable Storage Facility, BMI/OTSP-07, May, 1989.

College of Engineering, University of Nevada - Reno. The Statewide Radioactive Materials Transportation Plan, Phase II. December, 1989.

De Leuw, Cather, & Company. Yucca Mountain Rail Access Study Caliente Route. Conceptual Design Report. Appendices F & G. June, 1991.

Halstead, Robert J., Reginald R. Souleyrette, and Russel di Bartolo. Transportation Access to Yucca Mountain: Critical Issues, Volume 1 of the Proceedings of the International High Level Radioactive Waste Management Conference, Las Vegas, Nevada, Published by the American Nuclear Society/American Society of Civil Engineers, no date.

Harry Reid Center for Environmental Studies, University of Nevada - Las Vegas. Unpublished search of database for known cultural resource sites along candidate corridors. 1994.

Science Applications International Corporation, Desert Research Institute. Special Nevada Report, Draft. December, 1990.

U.S. Department of Energy, Office of Civilian Radioactive Waste Management. Preliminary Rail Access Study. January, 1990.

U.S. Department of Energy, Office of Civilian Radioactive Waste Management. Multi-Purpose Canister (MPC) Implementation Program Conceptual Design Phase Report. Volume I - MPC Conceptual Design Summary Report. September, 1993.

U.S. Department of the Interior, Bureau of Land Management. Esmeralda - Southern Nye Planning Area Draft Resource.

U.S. Department of the Interior, Bureau of Land Management. Esmeralda - Southern Nye Record of Decision Planning Area A. 1986.

U.S. Department of the Interior, Bureau of Land Management. Esmeralda - Southern Nye Wilderness Final Environmental Impact Statement. 1988.

U.S. Department of the Interior, Bureau of Land Management. Management Plan and Environmental Impact Statement. 1984.

U.S. Department of the Interior, Bureau of Mines. Mine, Prospects, and Mineral Locations in Clark, Esmeralda, Lincoln, and Nye Counties, Nevada, Inyo County, California, and Portions of Mono and San Bernardino County, California. February, 1989.

U.S. Department of the Interior, Fish and Wildlife Service. Wetland Resources of the United States. 1991. (map)

U.S. Department of the Interior, Soil Conservation Service. Soil Survey of Esmeralda County Area, Nevada. 1991.