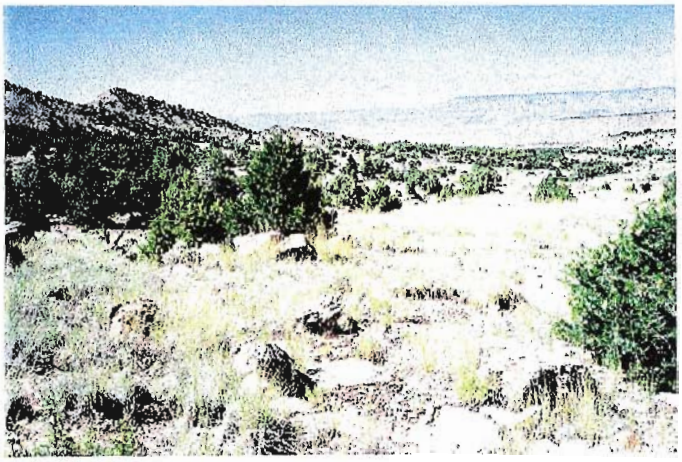
APPENDIX 2-3

ORDER 1 SOIL SURVEY (1998)

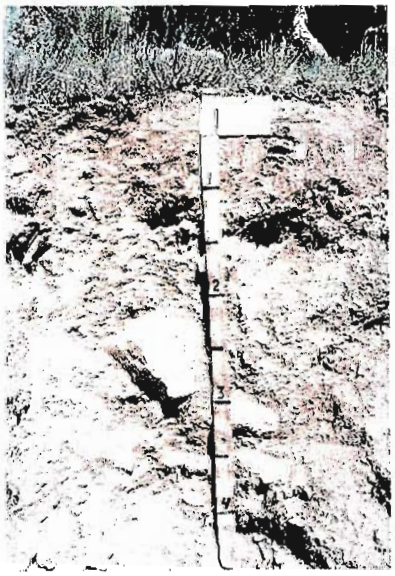
Lila Canyon

Soil Resource Inventory and Assessment



Prepared for:

UtahAmerican Energy, Incorporated
(UEI)
P.O. Box 986
Price, UT 84501



Prepared by:
Environmental Industrial Services
31 North Main
Helper, UT 84526

October 1, 1998

SOIL RESOURCE INVENTORY AND ASSESSMENT

LILA CANYON AREA
EMERY COUNTY , UTAH

FOR
Utah American Energy, Inc.

Environmental Industrial Services
31 North Main
Helper, Utah 84526

By
Daniel M. Larsen
Professional Soil Scientist

October 1998
Revised January 18, 1999

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1.0 INTRODUCTION

This report presents soils information compiled from a detailed soil survey (order one intensity level) of the facilities site at the proposed Lila Canyon Coal mine. The study area is located at the mouth of Lila Canyon in Emery County about ten miles southeast of East Carbon City, Utah; S15, T16S, R14E. It covers about 48 acres on an old alluvial fan and toe slope adjacent to the Book Cliffs. The site is about 5850 to 6100 feet in elevation and has a semi-arid climate supporting primarily a pinyon-juniper vegetation type.

1.1 OBJECTIVES

This detailed soil survey was conducted to provide sufficient information on the existing soil resources to facilitate the development and reclamation needs at the Lila Canyon mine site and for environmental impact assessment. The objectives were to document physical and chemical properties of the soils and assess the soil suitability and limitations related to the proposed activities. A prime objective was to determine the amount of suitable soil materials to salvage for reclamation purposes. This material, sometimes referred to as "topsoil," is the soil material which has the properties that are suitable for plant growth of native species. Included in the soil survey are maps showing the distribution of different soil types and the thickness of salvageable soil materials, laboratory analysis results of soil testing, and photographs of soils and landscape.

The information presented is to fulfill the requirements of the state of Utah Department of Natural Resources, Division of Oil, Gas and Mining (UDOGM) pertaining to guidelines for management of topsoil and overburden for mining.

2.0 METHODS AND PROCEDURES

2.1 DATA REVIEW AND EVALUATION

The project area has been mapped at the order three soil survey intensity level as part of the Soil Survey of the Emery area, Utah by the USDA Natural Resources Conservation Service(NRCS). Available field information in the form of soil maps at a scale of 1:24,000 and the soil map unit description were provided by Leland Sasser, Soil Scientist, NRCS, Price, Utah. This data was determined to be too general for the mine facilities site, therefore, a more detailed inventory was initiated.

2.2 SOIL INVENTORY AND MAPPING

Soil inventory and mapping was conducted by Daniel M. Larsen, Professional Soil Scientist, at the order one intensity level during August, 1998. Field mapping was done at a scale of one inch equal to 200 feet. Eight soil pits were excavated with a backhoe to an average depth of about five feet each. Full soil descriptions were taken at these location plus one on a road cut and one hand dug soil

pit. Two ten point transects were also completed, for a total of an additional twenty partial descriptions. Transect data consisted of hand dug excavations that were deep enough to document surface conditions and predict subsoil characteristics. This was typically into the calcium carbonate accumulation zone (calcic horizon).

Soil samples from six of the soil pedons were submitted for detailed laboratory analysis.

Observations of surface stone and boulder content, steepness of slope, vegetation, drainage characteristics and surface soil conditions (bare ground, erosion, color etc.) were made by extensively traversing the area. Photographs of soils and the landscape were taken for further documentation.

2.3 SOIL PROFILE (PEDON) DESCRIPTION

Soil profile descriptions, technically referred to as pedon descriptions, were made on a cleaned off representative section of the soil pit wall. Descriptions were taken on form SCS-Soils-232G and completed according to methods and standards of the National Cooperation Soil Survey as described in: the Soil Survey Manual (Soil Survey Staff, 1993); the National Soil Survey Handbook (Soil Survey Staff, 1993); and Keys to Soil Taxonomy, seventh edition (Soil Survey Staff, 1993).

The following parameters were described for each soil pedon description:

- horizon symbol, depth, thickness, and relative position;
- clarity and continuity of horizon boundaries;
- soil color (Munsell), both moist and dry;
- texture (fine earth fraction - <2mm);
- rock fragment content [type and size - (gravel - 2mm to 3"), (cobble - 3" to 10"), (stone - 10" to 2'), (boulder - >2'), and amount - % by volume];
- soil structure (type, size and grade);
- roots (size and abundance);
- clay films, if present (number, thickness, location);
- effervescence with 0.1N HC1 (none, slight, moderate, strong, violent);

In addition, the following soil and general site features were also described:

- existing dominant vegetation

- climate (moisture and temperature regimes)
- parent material
- physiography-landform
- relief
- elevation (obtainable from topographic maps)
- slope
- aspect
- erosion condition
- permeability
- drainage class
- depth to a saturated zone or ground water if encountered
- salts or alkali if present
- surface stoniness

2.4 SOIL SAMPLING AND LABORATORY ANALYSIS

A total of 21 soil samples taken from six soil pedons were selected for detailed laboratory analysis. The samples were taken from representative soil layers (horizons) and placed in clean plastic bags. About four to five pounds of each sample was sent to Inter-Mountain Laboratories, Inc., Farmington, New Mexico. The samples were mostly dry, collected on August 4 and 5, 1998, and received at the laboratory on August 24, 1998. Laboratory results were received September 23, 1998.

The following parameters were included in the soil analysis:

PH
Electrical conductivity
Saturation percentage
Sodium Absorption Ration
    includes Ca, Mg, and Na in meq/L
Mechanical Analysis

includes % very fine sand, sand, silt, clay, and texture classification

Total Organic Carbon

includes calculation for % organic matter

%Calcium carbonate

Boron ($CaCl_2$ extraction)

Selenium (AB-DPTA extraction)

Available water capacity

includes 1/3 bar and 15 bar analyses

Exchangeable sodium percentage

includes available Na, exchangeable Na, and cation exchange capacity. Analyzed only if SAR > 15 for sandy soils or >12 for clays

This list of parameters for testing was compiled through communications with Robert A. Davidson, Reclamation Soil Scientist, State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining (August 1993). Mr. Davidson has also communicated with Inter-Mountain Laboratories, Inc., to assure that approved laboratory methods were used.

2.5 SOIL SUITABILITY FOR SALVAGE

Criteria to establish suitability of soil (topsoil) or soil substitute material were those contained in Table 2 of UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining," included as Appendix B. Although the UDOGM suitability criteria considers >30% (by volume) rock fragments (for both gravels <3" in size and cobbles 3 to 10" in size) to be unacceptable, and >10% stones and boulders >10" in size to also be unacceptable, recent discussion with Robert Davidson (Nyenhuis 1997) indicates his preference for salvaging soil with higher rock content. Although unacceptable thresholds were not set, the general idea is to salvage otherwise suitable soil with higher amounts of rock content in the soil than typical, perhaps as high as 50 or 60% for gravels and cobbles, up to 35% for 10 to 24' stones, and up to 20% for small boulders.

Surface stones and boulders in the soil that area present during salvage operations, could be moved to a rock pile on site and held there until replacement (some being placed in the reapplied soil and others put on the soil surface) during reclamation activities. It is thought that for those native sites that have a higher rock content than the UDOGM guideline deems acceptable, reclaiming with the higher rock content will give a greater opportunity for reclamation success. Rock content aids water holding capacity, can provide for a more stable reclaimed surface, and creates wildlife habitat niches on the surface where rocks are piled.

Potential salvage depths were generated for each map unit based on an evaluation of all of the field and laboratory data.

Based on discussion with Robert Davidson (Nyenhuis 1997), a minimum of 18 inches of suitable soil is needed for application to all disturbed areas.

3.0 RESULTS AND DISCUSSION

3.1 SOIL SURVEY MAP

A detailed soil survey map was compiled at a scale of 1"= 200' for the Lila Canyon mine facilities site (shown in Appendix A). Six soil map units were identified which represent areas having differences related to soil and landscape characteristics. These soil map units are:

- SBG - Strych boulder fine sandy loam, 5 to 15 percent slopes (grass)
- VBJ - Strych very bouldery fine sandy loam 5 to 15 percent slopes (juniper)
- XBS - Strych extremely bouldery sandy loam, 10 to 45 percent slopes
- DSH - Strych fine sandy loam variant, 3 to 8 percent slopes
- RBL - Rubbleland - Strych - Gerst complex, 20 to 70 percent slopes
- RBT - Rock outcrop - Travessilla complex

3.2 SOIL AND MAP UNIT DESCRIPTIONS

Ten soil pedon descriptions were taken in the study area. These are identified by a code of LC1 through LC10 and are presented in Appendix D. Notes from transects made in the area are also presented in Appendix D. Photographs of the soil and landscape at each of the soil description sites are presented in Appendix E.

Soil mapping in Emery County at the order three intensity level by the Natural Resources Conservation Service shows the Strych soil series as the dominant soil in the study area. It was mapped at very stony fine sandy loam and very bouldery fine sandy loam phases. Detailed soil survey confirmed Strych as the dominant soil. The soil map unit differences are primarily due to variation in amount of boulders at the surface, surface soil rock fragment content, and slope steepness.

The Strych series consists of very deep, well drained, moderately rapidly permeable soils on outwash plains, alluvial fans, toe slopes, fan terraces, and the sides of benches. These soils formed in alluvium, colluvium, and glacial outwash derived dominantly from sandstone and shale. Slope is 3 to 70 percent. Elevation is 5,300 to 7,500 feet, average annual precipitation ranges from 8 to 14 inches, and average annual air temperature ranges from 45 to 47 degrees F. These soils are classified as loamy-skeletal, mixed mesic Ustollic Calciorthids (NRCS, Soil Survey of Carbon Area, Utah). Updated taxonomy revisions classifies these soils as Ustic Haplocalcids.

Evaluation of field and laboratory data resulted in six soil map units as described below:

<u>SBG - Strych boulder fine sandy loam, 5 to 15 percent slopes (grass)</u>

This map unit is in the northwest section of the study area. It has a bouldery surface and supports mostly grass with scattered small of junipers. The unit slopes to the southwest at about a 10%

gradient.

The soils have formed in coarse alluvium composed of sandstone rock fragments ranging from gravel to boulders. The general soil textures are sandy loam, however, in this unit a thin layer of sandy clay loam was noted at several spots in the 3 to 10 inch depth zone.

Typically the surface layer is a light brown to brown fine sandy loam about 3 to 5 inches thick. At a depth of about 8 to 12 inches, and extending to 30 to 48 inches, there is a zone of calcium carbonate accumulation. Below about 48 inches the soil materials are usually gravelly to very cobbly sandy loams with little or no soil development evident. Rock fragment content in the upper 48 inches average about 35 to 60 percent by volume. Although potential rooting depth is not restricted in the upper 60 inches, the basic rooting zone extends to about 48 inches.

VBJ - Strych very bouldery fine sandy loam 5 to 15 percent slopes (juniper)

This map unit occurs near the central and southwestern portions of the study area. It has a very bouldery surface and supports a pinyon-juniper stand. The general slope is about 10 percent, facing to the southwest. The unit is similar to soil map unit SBG but has more and larger boulders on the surface and a greater amount of juniper present.

The soils are of the Strych series and are well representative of that soil. Characteristics of the soil conform with the discussion on Strych soils.

XBS - Strych extremely bouldery sandy loam, 10 to 45 percent slopes

This map unit occurs along slope breaks near drainage dissections and at the upper edge of the alluvial fan. It has steeper slopes and more boulders at the surface than map unit VBJ. Slopes range from about 10 to 45 percent. Boulders and stones cover about 50 percent of the surface. The vegetation is dominantly pinyon-juniper.

The soils are typically of the Strych series but may vary by having a higher rock fragment content than normal.

Management is severely limited by the high percentage of boulders.

DSH - Strych fine sandy loam variant, 3 to 8 percent slopes

This map unit is of small extent and is in association with the Strych soils of map units SBG and VBJ. It occurs in slight depressions which receive some runoff moisture and soil sediments. The presence of saltbush (Atriplex canescens) is characteristic of these sites.

These soils show a variation from the Strych series in the vicinity by having fewer rock fragments in the upper one to two feet of soil and a lower amount of calcium carbonate accumulation (does not

qualify as a calcic horizon). A higher pH and sodium content is also indicated below 24 inches.

RBL - Rubbleland - Strych - Gerst complex, 20 to 70 percent slopes

This map unit is at the upper edge of the pediment deposit at the base of the steep, rocky clifflands. The surface is largely covered with stones and boulders, although some shale exposures are present. Much of the material is sandstone colluvium over shale. Pockets of Strych soil are present on the deeper stony materials and the Gerst soil series occurs on shale. The Gerst soil is shallow over shale. It consists of a silt loam surface layer of about four to six inches in thickness over very shaley silt loam grading to shale bedrock at 10 to 15 inches. Permeability of this soil is low and erosion hazard is high. It is classified as loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

This unit is similar to soil map unit NGG2 (Gerst-Strych-Badland complex, 30 to 70 percent slopes) as mapped in the Emery area soil survey. Much of the Badland portion of the unit is covered by bouldery sandstone colluvium.

RBT - Rock outcrop - Travessilla complex

This map unit consists of sandstone rock outcrops, boulders, and shallow soils on very steep mountain slopes. The unit extends from approximately 6,100 feet to 6,500 feet in elevation within the project area. Slope gradients range from about 30 percent to nearly vertical cliffs. Soils are mostly shallow over sandstone and interbedded shale. Those on shale are similar to the Gerst series and those on sandstone are identified as the Travessilla series. This unit is similar to the R2H (Travessilla family-Rock outcrop complex) map unit of the Emery area soil survey.

The Travessilla soil consists of shallow, well drained, moderately permeable soils formed in residual and colluvial materials derived dominantly from sandstone and interbedded shale. Texture is fine sandy loam to loam and bedrock is at depths of about seven to 20 inches. These soils are calcareous and mildly alkaline to moderately alkaline. They are classified as loamy, mixed (calcareous), mesic Lithic Ustic Torriorthents.

Selected properties of the soil map units are summarized in Table 3.21.

Table 3.21
Properties of Soil Map Units

Lila Canyon Facilities Site

MAP UNIT	% SURFACE STONES & BOULDERS	SOIL DEPTH	% SLOPE	PERMEABILITY	WATER EROSION POTENTIAL	SALINITY (EC) MMHOS/CM	REACTION (PH)
SBG	3-8	Very Deep >60"	5-15	Moderate to Moderately rapid	Moderate Low	<2	7.1-7.7
VBJ	8-20	Very Deep >60"	5-15	Moderately rapid	Moderate Low	<2	7.3-8.2
XBS	20-40	Very Deep >60"	10-45	Moderately rapid	Low to Moderate	<2	7.3-7.7
DSH	<2	Very Deep >60"	3-8	Moderately rapid	Moderate	0.35-2.5	7.3-8.6
RBL	>50	Shallow to Deep	20-70	Slow to moderately rapid	Severe on shale, Low on rock	0.35-2.5	7.0-8.5
RBT	>50	Shallow	30-100	Slow to moderately rapid	Severe to Low	0.35-2.5	7.5-8.5

3.3 SOIL LABORATORY TESTING RESULTS

The results from soil testing by Inter-Mountain Laboratories, Inc., are presented in Appendix C. This included 22 samples and duplicate analysis on two of the samples.

Overall the soil laboratory results show a good rating for soil materials for reclamation purposes. A few points may be notes:

- pH was high (rated poor) in only one sample; LC3 24-48' layer with pH 8.6, Sample LC4 40-58" had a pH of 8.2 which is considered fair to good. All other samples tested from pH 7.1 to 8.0, which is considered good.

- Electrical conductivity and sodium were high in samples LC3 48-55" and LC5 40-58". The soil materials below 48 inches at sample site LC3 is considered unacceptable as reclamation growth media since the sodium absorption ratio (SAR) was18. SAR greater than 15 is considered unacceptable. The sample below 40 inches at LC5 tested SAR 15, which is on the line of poor to unacceptable. Sample LC5 40-58" had the highest electrical conductivity (EC) at 8.89 mmhos/cm; rated poor. Samples LC3 48-55" and LC10 0-4" had EC of 2.48 and 2.58; rated fair. All other samples had EC ranging from 0.29 to 4.0, which is rated as good.

- Soil textures classified as sandy loam ,except for samples LC1 3-10" and LC10 0-4" which were sandy clay loam and silt loam respectively. Based on soil texture, all soils tested are rated as good for reclamation material. Several samples are close to being loamy sands, with sand content of 68 to 75 percent and clay content of 4 to 8 percent.

- Available water holding capacity is relatively low and rated mostly as fair.

- Soluble boron tested at less than 5.0 mg/kg on all samples, giving a suitability rating of good. Most samples tested at less than 0.2 mg/kg soluble boron. The highest recorded was 2.4 mg/kg for sample LC4 40-58".

- Selenium content tested at well below unacceptable limits. A reading of less than 0.10 mg/kg is considered good, and all results were 0.02 mg/kg or less.

- A calcic horizon was verified in soil pedons LC1, LC5 and LC6 with $CaCo_3$ at 20 to 21 percent. Pedons LC3 and LC4 have some calcium carbonate accumulation in the subsoil but it is less than the 15 percent needed to be a calcic horizon.

- Organic matter content is relatively low in these soils. Surface soils are generally about 1.0 to 1.5 percent organic matter and subsoils are about 0.5 percent.

- Below depths of about 30 inches the soluble magnesium tends to exceed the soluble calcium. In general the soluble calcium decreases and magnesium increases with depth. Generally a higher ratio of calcium to magnesium is desirable for plant growth.

3.4 SOIL SALVAGE DEPTHS AND VOLUME OF SUITABLE SOIL FOR RECLAMATION

Estimates of the amount of suitable soil material that could be salvaged for use in reclamation for each soil map unit based on UDOGM guidelines (Appendix B) are shown below:

MAP UNIT	SALVAGEABLE LAYER (Inches)	EXTENT (Acres)	ESTIMATED VOLUME (Cubic Yards)
SBG	48	12.24	78,980
VBJ	30	9.57	38,590
XBS	12	11.70	18,877
DSH	40	1.56	8,373
RBL	8	9.17	9,867
RBT	6	3.66	2,954

These calculations do not include boulders above ground level, which would add to the volume of material to be handled. Also, some of the stones and boulders from the salvageable soil material would be segregated. These estimates are for the total acres within the proposed disturbed area boundary(approximately 47.9 acres). Much of RBL and RBT units would not be disturbed, and soil salvage from these units would be difficult due to rockiness and slope. Based on these calculations a maximum of about 157,600 cubic yards of soil material suitable for plant growth could be salvaged from the site.

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APPENDIX 2-3 MRP

LILA CANYON MINE
PROPOSED PORTAL FAN SITE

ADDENDUM TO THE SOIL INVENTORY
OF THE LILA CANYON MINE FACILITIES SITE

EMERY COUNTY, UTAH

FIELD EVALUATION BY DAN LARSEN AND JAY MARSHALL

June 15, 1999

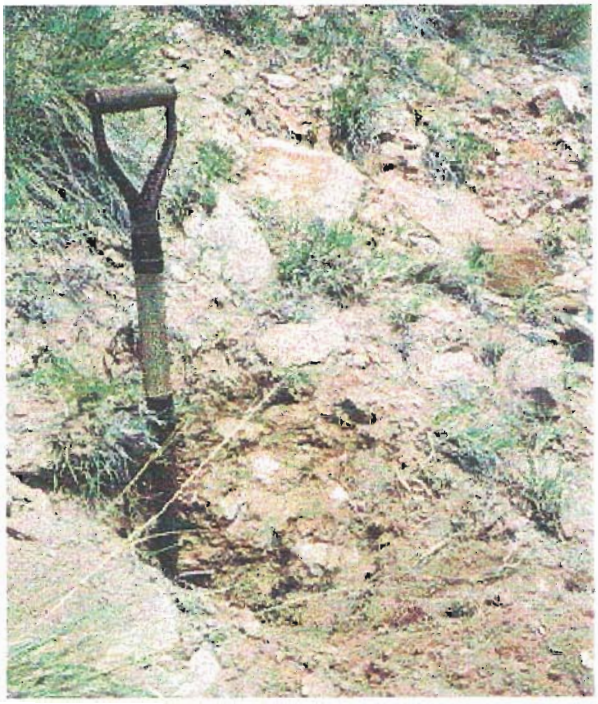
Lila Canyon Mine, Proposed Portal Fan Site Soil Evaluation

The proposed fan site is located on a narrow bench in the steep, rocky slopes of the Book Cliffs. The soils consists of shallow to moderately deep, colluvial deposits derived primarily from sandstone. This is underlain by a zone of burned coal overlying sandstone. The bench has a slope of about 40 to 45% and is surrounded by sandstone ledges. It is at an elevation of about 6400 feet and supports a few pinyon pines and salina wildrye grass with other associated species.

The soil materials are deepest at the upper edge of the bench and then to sandstone bedrock at the lower edge. Average depth of soil derived from colluvial materials on the site is about 15 inches, with a range of about three feet to zero.

Two soil descriptions were taken at the site and are identified as: Soil Descriptions LC11 and LC12. Four soil samples were submitted to Intermountain Laboratories, Farmington, N.M. for testing. The soil test results show the soils to be favorable for plant growth. Rating of soil suitability criteria shows good ratings, except for water holding capacity which rated poor. The low available water capacity of these soils and limited rainfall creates drought conditions which are evident by the native vegetation.

Lila Canyon Mine Portal fan site. Photos showing the landscape and the narrow bench



Soil Description LC11 location, Lila Canyon Mine portal fan site

Soil Description LCI2 location, Lila Canyon Mine portal fan site

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Soil type Similar to Pathead — NW¼ SE¼, SE¼, S15, T16S, R4E — File No. LC 11

Area Lila Canyon Mine Portal Fan Site, Emery County, UT — Date 6/15/99 D. Larsen — Stop No. 1

Classification Loamy-skeletal, mixed (calcareous), mesic Typic Haplustepts

Location Near center of narrow bench 2327,500E / 400,100N

N. veg. (or crop) P-J, grass (Salina wildrye) — Climate Ustic / Mesic

Parent material Colluvium from sandstone over burned coal over sandstone (Black Hawk)

Physiography Cliff lands (Book Cliffs)

Relief Extremely steep / with benches	Drainage Well drained to excessive	Salt or alkali
Elevation ≈ 6400'	Gr. water –	Stoniness
Slope 40% on bench	Moisture –	
Aspect Southwest	Root distrib.	% Clay *
Erosion Moderate	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes Lila Point, Utah 7.5 min. Quad.
Mod deep
Soil Samples LC 11-1 0-5"
LC 11-2 5-15"
LC 11-3 15-28"

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		15
Cobble 3-10"		10
Stone 10-24"		10
Boulder >24"		2
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth inches	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction Lab.	Boundary	% Rock Fragments	Root Distribution
A	0-5	Brown 7.5YR 5/4	Brown 7.5YR 4/3	9c 16si 75s sl	1fgr	so	vfr	ns np	7.5	cs	10gr 15co 10st	cvf+ f fm
Bw	5-15	Brown 7.5YR 5/4-4/4	Reddish brown 5YR 4/3	17c 20si 63s sl	1fgr 1fsbk	sfi	fr	ss sp	7.4	cw	10gr 15co 10st	ff+ m
C	15-28	Brown 7.5YR 4/4-5/4	reddish brown 5YR 4/3	17c 20si 63s sl	0m	so	fr	ss sp	7.6		10gr 20co 10st	ff

shaly burned coal zone over sandstone

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTUR
SOIL CONSERVATION SERVICE

Soil type Gerst | File No. LC 12

Area Lila Canyon Mine Portal, Emery Co., UT — Fan Site | Date 6/15/99 D. Larsen | Stop No. 2

Classification Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthent

Location Near north end of narrow bench (fan site) 2,327, 500E / 400, 100 N

N. veg. (or crop) Pinyon, saltbush, wild rye | Climate Ustic / mesic

Parent material Colluvium from sandstone over shaly burned coal (ashy) on sandstone

Physiography Clifflands (Book Cliffs)

Relief Extremely steep with benches	Drainage Well to excessive	Salt or alkali
Elevation 6400'	Gr. water —	Stoniness
Slope 40% on bench	Moisture Slightly moist below 5"	
Aspect Southwest	Root distrib. Limited mostly to upper 5-6"	% Clay *
Erosion Mod. —	% Coarse fragments * 15 in profile est 15-30 overall	% Coarser than V.F.S. *
Permeability Mod / slow		

Additional notes Lila Point, Utah 7½ min. Quad. NW¼, SE¼ SE¼, S15 T16S, R4E
Very localized soil in map unit
Thin layer of colluvium + (slope wash) over an shaly ash from buried coal

Soil Sample LC12-1 0-6"

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		25
Cobble 3-10"		5
Stone 10-24"		5
Boulder >24"		2
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction Lab.	Boundary	% Rock Fragments	Root Distribution		
A	0-6	Brown 7.5YR 5/4-4/4	Reddish brown 7.5YR 4/3	llc 20si 69s sl	1fgr	so	vfr	ns np	7.5	as	10% 5co	cvf+ f		
C	6-7	Reddish Brown 5YR 5/4	Reddish brown 5YR 4/4	sl	om	sfi	fr	ss sp		as	—	ff		
CR	7-16	gray 2.5Y 6/1	gray 2.5Y 5/1	sicl	ashy burned coal, shaly structure						—	ff		
R	Sandstone rock estimated at 18 to 24 inches													

Inter-Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Environmental Industrial Services (EIS)

Client Project ID: Lila Canyon, Emery Helper, UT IML Project #0399S02979

Date Received: 06/18/99 Report Date: 07/08/99

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	VeryFine Sand
		Inch	s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0399S02979	LC11-1	0 - 5	7.5	0.40	25	2.9	0.70	0.49	0.37	75	16	9	SL	10
0399S02980	LC11-2	5 - 15	7.4	0.42	31	2.6	1.1	0.60	0.45	63	20	17	SL	12
0399S02981	LC11-3	15 - 28	7.6	0.37	28	1.8	1.4	0.58	0.46	63	20	17	SL	11
0399S02982	LC12-1	0 - 6	7.5	0.37	26	2.8	0.81	0.32	0.24	69	20	11	SL	9
			G	G	G				G					

Inter-Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Environmental Industrial Services (EIS)

Helper, UT

Client Project ID: Lila Canyon, Emery

Date Received: 06/18/99

IML Project #0399S02979

Report Date: 07/08/99

Lab Id	Sample Id	Depths	Boron Soluble	Se AB_DTPA	CaCO3	TOC	Organic Matter	1/3 Bar Water	15 Bar Water	% Avail.
		Inch	mg/Kg	mg/Kg	%	%	%	%	%	
0399S02979	LC11-1	0 - 5	0.3	<0.02	7.3	0.3	0.4	7.6	4.2	3.4
0399S02980	LC11-2	5 - 15	0.6	<0.02	7.8	0.3	0.6	11.3	6.7	4.6
0399S02981	LC11-3	15 - 28	0.6	<0.02	8.2	0.2	0.4	10.6	5.7	4.9
0399S02982	LC12-1	0 - 6	0.3	<0.02	7.5	0.3	0.5	9.5	4.8	4.7
			G	G	G		Low			P

APPENDIX B

SOIL SUITABILITY CRITERIA

APPENDIX B

Soil Suitability Criteria

UDOGM: Overburden Evaluation for Vegetative Root Zone; Table 2 (Leatherwood and Duce 1988)

Parameters	Good	Fair	Poor	Unacceptable
pH	6.1 - 8.2	5.1 - 6.1 8.2 - 8.4	4.5 - 5.0 8.5 - 9.0	less than 4.5 greater than 9.0
Ec mmhos/cm 25°C	0 - 2	2 - 8	8 -15	greater than 15
Saturation %	25% - 80%		less than 25% greater than 80%	
Texture	sl, l, sil, scl, vfsl, fsl	c, sicl, sc, ls, lfs	slc, s, sc, c, cos, fs, vfs	g, vcos
SAR	0 - 4	5 - 10	10 - 12 Fine Texture 10 - 15 Coarse Texture	12 Fine Texture 15 Coarse Texture
Selenium	less than 0.1 mg/Kg			greater than 0.1 mg/Kg
Boron	less than 5.0 mg/Kg			greater than 5.0 mg/Kg
Acid/Base Potential	greater than -5 tons $CaCO_3$ 1,000 tons material			less than -5 tons $CaCO_3$ 1,000 tons material
% Coal fines	Undetermined at this time			
Available water capacity (in/in)	greater than 0.10	0.05 - 0.10	less than 0.05	
Rock Fragments (% volumes)				
3 inches	0 - 15	15 - 25	25 - 30	greater than 30
3 - 10 inches	0 - 15	15 - 25	25 - 30	greater than 30
10 inches	0 - 3	3 - 7	7 - 10	greater than 10

APPENDIX C

SOIL LABORATORY TESTING RESULTS

iml
Inter-Mountain
Laboratories, Inc.

2506 West Main Street
Farmington, New Mexico 87401
Tel. (505) 326-4737

September 19, 1998

Mr. Dan Larsen
ENVIRONMENTAL INDUSTRIAL SERVICES
31 North Main Street
Helper, Utah 84526

Dear Mr. Larsen:

Enclosed are the results of the analyses performed on the soil samples received by IML on August 24, 1998. The samples were labeled Lila Canyon, Utah, and correspond to IML lab numbers S04804 - 25. The requested analyses for each were pH, electrical conductivity, saturation percentage, sodium absorption ratio, mechanical analysis (including analysis of very fine sand), % calcium carbonate, soluble boron, selenium (AB-DTPA), total organic carbon, % organic matter, available water capacity, and exchangeable sodium percentage for sample with an SAR >15 for sandy soils or >12 for clays.

If you have any questions or comments, please feel free to contact me at 1-800-828-1409.

Sincerely,

Eric J Jaquez
Soil Lab Supervisor
IML - Farmington, NM

enclosure: analytical report

Inter-Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Basic Management

Price, UT

Client Project ID: Lila Canyon, UT

IML Project #0398S04804

Date Received: 08/24/98

Report Date: 09/19/98

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	Very Fine Sand
			s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0398S04804	LC1	0 - 3	7.1	0.56	29	4.3	1.6	0.20	0.12	71	23	6	SL	19
0398S04805	LC1	3 - 10	7.5	0.29	38	2.6	0.81	0.37	0.29	53	21	26	SCL	14
0398S04806	LC1	10 - 23	7.5	0.37	32	2.0	1.4	0.47	0.36	54	27	19	SL	13
0398S04807	LC1	23 - 31	7.5	0.35	28	1.8	1.4	0.54	0.43	58	28	14	SL	10
0398S04808	LC1	31 - 48	7.7	0.38	26	1.5	2.0	0.75	0.57	64	24	12	SL	10
0398S04809	LC1	48 - 54	7.7	0.40	26	1.4	2.1	0.85	0.64	66	23	11	SL	9
0398S04810	LC3	0 - 3	7.4	0.35	24	2.4	0.89	0.22	0.17	69	27	4	SL	17
0398S04811	LC3	3 - 9	7.6	0.36	23	2.2	0.65	0.61	0.50	64	26	10	SL	12
0398S04812	LC3	9 - 24	8.0	0.55	29	1.1	1.0	3.2	3.1	64	21	15	SL	21
0398S04813	LC3	24 - 48	8.6	0.89	27	0.85	2.7	5.3	4.0	62	23	15	SL	15
0398S04814	LC3	48 - 55	7.3	2.48	27	0.47	2.4	21	18	68	22	10	SL	20
0398S04815	LC4	0 - 5	7.3	0.63	30	5.4	1.0	0.60	0.22	62	30	8	SL	22
0398S04816	LC4	5 - 26	7.5	0.42	25	2.6	1.1	0.38	0.28	68	23	9	SL	15
0398S04817	LC4	26 - 50	7.7	0.42	23	1.5	2.2	0.58	0.43	75	17	8	SL	13
0398S04818	LC5	0 - 3	7.4	0.43	23	3.1	0.68	0.35	0.25	66	27	7	SL	21
0398S04819	LC5	3 - 9	7.5	0.47	24	3.1	0.67	0.44	0.32	65	23	12	SL	19
0398S04820	LC5	9 - 29	7.5	0.45	29	2.8	1.3	0.48	0.34	56	28	16	SL	17
0398S04821	LC5	29 - 40	7.8	0.67	28	1.4	3.7	1.5	0.96	60	24	16	SL	14
0398S04822	LC5	40 - 58	8.2	8.89	28	7.1	31	64	15	60	25	15	SL	12
0398S04823	LC6	0 - 5	7.5	0.50	29	3.4	0.65	0.43	0.30	66	21	13	SL	12
0398S04824	LC6	5 - 18	7.5	0.38	35	2.5	0.54	0.38	0.31	65	22	13	SL	10
0398S04825	LC10	0 - 4	7.5	2.58	28	31	3.5	0.60	0.14	21	53	26	SIL	8

Inter·Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Basic Management

Price, UT

Client Project ID: Lila Canyon, UT

IML Project #0398S04804

Date Received: 08/24/98

Report Date: 09/19/98

Lab Id	Sample Id	Depths	CaCO3 %	Boron Soluble mg/Kg	Selenium AB-DTPA mg/Kg	TOC %	Organic Matter %	Exch. Sodium %	1/3 bar water %	15 bar water %
0398S04804	LC1	0 - 3	3.1	<0.2	<0.01	0.84	1.4		8.7	4.6
0398S04805	LC1	3 - 10	8.0	<0.2	<0.01	0.70	1.2		18.0	10.4
0398S04806	LC1	10 - 23	21	0.2	<0.01	0.68	1.2		17.6	6.8
0398S04807	LC1	23 - 31	11	<0.2	<0.01	0.54	0.93		13.5	5.4
0398S04808	LC1	31 - 48	9.4	<0.2	<0.01	0.53	0.92		11.2	5.2
0398S04809	LC1	48 - 54	10	<0.2	<0.01	0.44	0.75		12.5	4.8
0398S04810	LC3	0 - 3	2.4	<0.2	<0.01	0.44	0.75		9.6	3.3
0398S04811	LC3	3 - 9	4.0	<0.2	<0.01	0.36	0.62		10.8	4.0
0398S04812	LC3	9 - 24	8.6	0.6	0.02	0.28	0.48		14.4	6.5
0398S04813	LC3	24 - 48	2.8	0.8	0.01	0.32	0.55		13.8	5.8
0398S04814	LC3	48 - 55	10	0.9	0.02	0.57	0.98	22	12.3	4.0
0398S04815	LC4	0 - 5	6.9	<0.2	<0.01	0.90	1.6		14.1	4.9
0398S04816	LC4	5 - 26	9.1	<0.2	<0.01	0.31	0.52		12.3	4.2
0398S04817	LC4	26 - 50	7.9	0.2	<0.01	0.20	0.34		10.9	3.5
0398S04818	LC5	0 - 3	3.3	<0.2	<0.01	0.57	0.98		12.5	4.0
0398S04819	LC5	3 - 9	6.3	0.2	<0.01	0.51	0.88		12.5	5.4
0398S04820	LC5	9 - 29	12	0.2	<0.01	0.52	0.89		16.1	6.2
0398S04821	LC5	29 - 40	21	0.4	0.02	0.27	0.47		17.8	5.5
0398S04822	LC5	40 - 58	13	2.4	0.02	0.32	0.55		16.1	5.3
0398S04823	LC6	0 - 5	11	<0.2	<0.01	0.80	1.4		13.6	6.0
0398S04824	LC6	5 - 18	20	<0.2	<0.01	0.67	1.1		17.1	6.7
0398S04825	LC10	0 - 4	12	0.5	<0.01	0.44	0.76		17.3	8.1

Inter-Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Basic Management

Client Project ID: Lila Canyon, UT

Price, UT

IML Project #0398S04804

Date Received: 08/24/98

Report Date: 09/19/98

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	Very Fine Sand
			s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0398S04808	LC1	31 - 48	7.7	0.38	26	1.5	2.0	0.75	0.57	64	24	12	SL	10
0398S04808D	LC1	31 - 48	7.7	0.37	27	1.5	1.9	0.73	0.56	64	24	12	SL	8
0398S04815	LC4	0 - 5	7.3	0.63	30	5.4	1.0	0.60	0.22	62	30	8	SL	22
0398S04815D	LC4	0 - 5	7.3	0.66	29	5.3	1.1	0.57	0.17	62	30	8	SL	22

Inter-Mountain Laboratories, Inc.

2506 West Main Street Farmington, New Mexico 87401 Tel. (505) 326-4737

Basic Management

Client Project ID: Lila Canyon, UT

Price, UT

IML Project #0398S04804

Date Received: 08/24/98

Report Date: 09/19/98

Lab Id	Sample Id	Depths	CaCO3	Boron Soluble	Selenium AB-DTPA	TOC	Organic Matter	Exch. Sodium	1/3 bar water	15 bar water
			%	mg/Kg	mg/Kg	%	%	%	%	%
0398S04808	LC1	31 - 48	9.4	<0.2	<0.01	0.53	0.92		11.2	5.2
0398S04808D	LC1	31 - 48	9.3	<0.2	<0.01	0.50	0.86		11.3	5.1
0398S04815	LC4	0 - 5	6.9	<0.2	<0.01	0.90	1.6		14.1	4.9
0398S04815D	LC4	0 - 5	6.9	<0.2	<0.01	0.83	1.4		13.8	4.8

APPENDIX D

FIELD SOIL PROFILE DESCRIPTIONS AND TRANSECT DATA SHEETS

SOIL PROFILE DESCRIPTIONS FOOTNOTES

[1] Soil Series, and Soil Classification according to current ~~SCS~~ NRCS information. Soil classification based on Keys to Soil Taxonomy, ~~5th~~ 7th edition (Soil Survey Staff ~~1992~~ 1996).

[2] Horizon and Depth based on site-specific conditions at the sample location.

[3] Texture and texture modifier abbreviations:

S	Sand	SCL	Sandy Clay Loam	CB	Cobbly	GR	Gravely
LS	Loamy Sand	CL	Clay Loam	CBV	Very Cobbly	GRV	Very Gravely
SL	Sandy Loam	SICL	Silty Clay Loam	CBX	Extremely Cobbly	GRX	Extremely Gravely
L	Loam	SIC	Silty Clay	CN	Channery	SH	Shaley
SIL	Silt Loam	C	Clay	CNV	Very Channery	SR	Stratified
SI	Silt			CNX	Extremely Channery		

[4] Color, Dry and Moist: Munsell Soil Color Chart, 1975 Edition.

[5] Structure:

Grade	Size	Type
1 ~~W~~ Weak	VF Very Fine	PL Platy
2 ~~M~~ Moderate	F Fine	GR Granular
3 ~~S~~ Strong	M Medium	SBK Subangular Blocky
	CO Coarse	ABK Angular Blocky
	VCO Very Coarse	PR Prismatic
		W Massive Weak Massive
		Massive
		S Massive Strong Massive
		SG Single Grained
		Cloddy

[6] Consistency:

Dry		Moist		Wet	
LO	Loose	LO	Loose	NS	Non Sticky
SO	Soft	VFR	Very Friable	SS	Slightly Sticky
SH	Slightly Hard	FR	Friable	S	Sticky
H	Hard	FI	Firm	VS	Very Sticky
VH	Very Hard	VFI	Very Firm	NP	Non Plastic
EH	Extremely Hard	EFI	Extremely Firm	SP	Slightly Plastic
				P	Plastic
				VP	Very Plastic

[7] Roots:

Number	Type	
Very Few	VF	Very Fine
Few	F	Fine
Com (Common)	M	Medium
Many	CO	Coarse

Roots are described in terms of a specified size (type) and quantity (number). The size classes are:

Very Fine: Less than 1 mm in diameter
Fine: 1 to 2 mm in diameter
Medium: 2 to 5 mm in diameter
Coarse: 5 mm or larger in diameter
Roots larger than 10 mm in diameter may be described separately.

Quantity classes or roots are defined in terms of numbers of each size per unit area—1 square centimeter for very fine and fine roots, and 1 square decimeter for medium and coarse roots. All roots smaller than 10 mm in diameter are described in terms of the following quantity classes:

Few: Less than 1 per unit area of the specified size
Common: 1 to 5 per unit area of the specified size
Many: More than 5 per unit area of the specified size
Roots are described as to number first, and type second.

FOOTNOTES continued

[8] ~~Coarse~~ Rock Fragments: All ~~coarse~~ rock fragment percentages (% by volume) are taken from the field soil profile descriptions. Geologic modifier types (gravelly, channery, etc.) are also taken from the field soil profile description forms for each sampled profile.

[9] Reaction:

Effervescence	
EO	Non-Effervescent
SE	Slightly Effervescent
EM	Moderately Effervescent
ES	Strongly Effervescent
EV	Violently Effervescent

Reaction		pH
Str. Acid	Strongly Acid	5.1 - 5.5
Mod. Acid	Moderately Acid	5.6 - 6.0
Sl. Acid	Slightly Acid	6.1 - 6.5
Neutral	Neutral	6.6 - 7.3
Mild. Alk.	Mildly Alkaline	7.4 - 7.8
Mod. Alk.	Moderately Alkaline	7.9 - 8.4
Strong Alk.	Strongly Alkaline	8.5 - 9.0
Very Strong Alk.	Very Strongly Alkaline	>9.0

[10] Horizon Boundaries:

Distinctness	
A	Abrupt (<2 cm thick)
C	Clear (2 to 5 cm thick)
G	Gradual (5 to 15 cm thick)
D	Diffuse (>15 cm thick)

Topography	
S	Smooth (the boundary is a plane with few or no irregularities)
W	Wavy (the boundary has undulations in which depressions are wider than they are deep)
I	Irregular (the boundary has pockets that are deeper than they are wide)
B	Broken (at least one of the horizons or layers separated by the boundary is discontinuous and the boundary is interrupted).

FILE CODE SOILS-11 SOIL DESCRIPTION

MUSBG

Soil type Strych

File No.

Area Lila Canyon Emery Co., UT	Date 8/5/98 D. Larsen M. Conrad	Stop No. LC1	
Classification Ustollic Calciorthid, l-slk, mixed mesic / Ustic Haplocalcid ?			
Location Near proposed office site S 15 T16S, R14E			
N. veg. (or crop) Utah juniper and grasses		Climate Mesic, Ustic/Aridic	
Parent material Colluvium/alluvium from sandstone and shale			
Physiography Pediment			
Relief Mod. sloping	Drainage Well drained	Salt or alkali	
Elevation 5880'	Gr. water	Stoniness	
Slope 8%	Moisture		
Aspect SW	Root distrib. To 48"	% Clay *	
Erosion Mod. - slight	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability Mod./moderately rapid			

Additional notes

Surface Temp - bare soil 132°F @ 3:50 P.M.
Air 90°

This soil is like Strych but has a more clayey layer than normal near the surface. This does not appear to be an argillic horizon. Possibly local wash sediments.

Lab data varifies Calcic at 10"

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		20
Cobble 3-10"		5
Stone 10-24"		5
Boulder >24"		10
Vegetation inc. cryptograms		20
Litter		15
Bare		25

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Field/Lab Reaction	Boundary	% Rock Fragments	Root Distribution	Clay %	
1/2 - O.Cryptograms														
A1	0-3	Brown 10YR 5/3	Brown 10YR 4/3	1 sl	1fgr	so	vfr	ns-vf	Phenol red 7.1 em 7.8	cw	5 gr 5 co 5 st	mf,vf		
BW	3-10	Brown-light br. 7.5YR 5/4-6/4	Brown 7.5YR 4/4	26 scl	1m-sbk	sh	fi	s p	7.5 es 7.8	cs	8 gr 5 co 5 st	cf m	8%	no clay films noted
BK1	10-23	Pale brown + light gray 10YR 6/3 + 7/2	Brown 10YR 5/3	19 sl	0m	sh	vfi	ss sp	7.5 ev 8.2	gw	35 gr 20 co 10 st	cf-ff	21%	
BK2	23-31	Brown, pale br. light gray 10YR 5/3-6/3 + 7/2	Brown 10YR 4/3	14 sl	0m	sh	fi	ss sp	7.5 ev 8.2	cw	30 gr 15 co 15 st	cf	11%	
BC	31-48	Brown - Pale Br. 10YR 5/3-6/3	Brown 10YR 4/3	12 sl	1sbk	so	fi	ns np	7.7 ev 8.2	cw	20 gr 30 co 10 st	cf to mf		
C	48-54 +	Light yellowish brown 10YR 6/4	Yellowish brown 10YR 5/4	11 sl	0m	so	fr	ns np	7.7 es 8.0			ff		

FILE CODE SOILS-11 SOIL DESCRIPTION

MUSBG

Soil type Strych

File No.

Area Lila Canyon Emery Co., UT | Date 8/6/98 D. Larsen | Stop No. LC-2

Classification Loamy-skeletal, mixed, mesic, Ustallic Calciorthid H? Ustic Haplocalcid

Location East of proposed Shop warehouse S15, T16S, R14E

N. veg. (or crop) Juniper, grass (Salina wildrye, cheat gr. | Climate Mesic / Ustic aridic

Parent material Alluvium, coarse materials from sandstone - shale

Physiography Pediment Semiarid

Relief slight draw | Drainage Well drained | Salt or alkali

Elevation 5900' | Gr. water | Stoniness

Slope 8% ↓ 15% ↑ small break | Moisture

Aspect SW | Root distrib. Mostly upper 48" | % Clay *

Erosion Slight | % Coarse fragments * | % Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth "	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Field Reaction	Boundary	% Rock Fragments	Root Distribution
O	1/2-0	Discontinuous										
A1	0-3 1/2	Brown 10YR 5/3	Brown 10YR 4/3	fsl - lfs	1 Tpl 1/3 1fgr 2/3	so	vfr	ns np	cs 8.0	cs	10 gr 10 co 5 ST	mf dvf
Bw	3 1/2-11	Brown 7.5YR 5/3	Brown 7.5YR 4/4	fsl	1Tpl 1fsbk	so-sf	fr	ns np	cs 7.8-8.0	cw	10 gr 10 co 10 ST	cf cm
BK	11-36	Pale brown - light gray 10YR 6/3 + 7/2	Brown 10YR 4/3-5/3	sl	[illegible]	h	fr	ss sp	Thymol Blue cv 8.2	gw	10 gr 10 co 15 ST	ff fm
BKC	36-48	Pale brown 10YR 6/3	Brown 10YR 4/3-5/3	sl	[illegible]	so	fr	ss sp	8.2	gw	25 gr 25 co 10 ST	cf
C	48-66	Yellowish brown 10YR 5/4	Brown 10YR 4/3-5/3	sl	[illegible]	1	vfr	ns np	8.0		30 gr 30 co 10 ST	ff

Note 3-4 FT dia [illegible] 1-5 [illegible]

FILE CODE SOILS-11

MU DSH

SOIL DESCRIPTION

Soil type

File No.

Area Lila Canyon Emery Co., UT		Date 8/6/98 D. Larsen	Stop No. LC3
Classification Coarse-loamy, mixed, mesic			
Location Near north edge of proposed equip. + supply storage S15, T16S, R14E			
N. veg. (or crop) Grass, few juniper + saltbush		Climate Mesic, Ustic/Aridic Semiarid	
Parent material Alluvium			
Physiography Pediment		EC<1.0 0-48"	
Relief Smooth slope	Drainage Well drained	Salt or alkali EC 2.5 at 48"	
Elevation 5920'	Gr. water	Stoniness	
Slope 10%	Moisture		
Aspect SW	Root distrib. Good to 48"	% Clay *	
Erosion Slight	% Coarse fragments * 25	% Coarser than V.F.S. *	
Permeability Moderately rapid			

Additional notes

Less rock fragments than over most of the area.

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		5
Cobble 3-10"		3
Stone 10-24"		2
Boulder >24"		2
Vegetation		35
Litter		15
Bare		38

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Lab. Reaction	Boundary	% Rock Fragments	Root Distribution	$CaCO_3$ %
									phenol red				
1/2-0	cry	fragments +	loose om										
A1	0-3	Brown 10YR 5/3	Brown 10YR 4/3	25 lfs	1fgr	so-1	vfr	ns np	7.4 8.0	cs	5gr	mvf f	
Bw	3-9	Brown 7.5YR 5/3	Brown 7.5YR 5/4-4/4	25 lfs	1mgsk-om	sh	fr	ns np	7.6 8.0	cs	5gr	cf m	4
BK1	9-24	very pale brown - light yellowish br. 10YR 7/3 + 6/4	Brown 10YR 5/3	15 sl	om	h	fi	ss sp	cv 8.0 8.2	gw	15gr 2co	cf m	9
BK2	24-48	Pale brown 10YR 6/3	Brown 10YR 4/3	15 sl	om	h	fi	ss sp	8.6 cv 8.2	cw	10gr 5co 10gr Boulder	ff fm	3
C	48-55	Light yellowish Brown 10YR 6/4	Brown 10YR 5/3	10 sl	om	sh-so	fi	ns np	7.3 8.0		10gr 10co 10	ff	

FILE CODE SOILS-11

SOIL DESCRIPTION

MU DSH

Soil type

File No.

Area Lila Canyon Emery Co, UT	Date 5/6/98 D. Larsen EIS	Stop No. LC 4	
Classification			
Location Equipment & Supplies area S15 T16S R14E			
N. veg. (or crop) Saltbush present & grasses		Climate Mesic, Ustic/Aridic	
Parent material Alluvium (local)			
Physiography Slight depression receiving sediments and drainage/pediment surface			
Relief Nearly level	Drainage Well drained	Salt or alkali	
Elevation 5920	Gr. water	Stoniness	
Slope 5-8	Moisture moist at 6-36"		
Aspect S	Root distrib.	% Clay *	
Erosion Slight - Collects sed.	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability Moderately rapid			

Additional notes

Surface on exposed soil 130° F

@ 20" moist (6-36) 65°

@ 11:30 A.M

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		5
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		25
Litter		50
Bare		20

* Control section average

Horizon	Depth	Color Dry	Color Moist	% C Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Lab. Reaction Field	Boundary	% Rock Fragments	Root Distribution	% $CaCO_3$
0	1-0	dead grass											
A1	0-5	Brown 10YR 5/3	Dark untyish brown 10YR 4/2	8 SL	2 fgr some platy	so	vfr	ns np	es 7.3 8.0	cw	<5 gr	cvf f	7
AC	5-26	Pale brown 10YR 6/3	Yellowish brown to dark yellowish br 10YR 5/4-4/4	9 FSL	sgr	so	vfr	ns np	es 7.5 8.0	cw	5 gr pockets 5 co	mf	9
C1	26-80	light yellowish brown 10YR 6/4	Dark yellowish brown - brown 10YR 4/4 to 7.5YR 4/4	SL-8 LS	om	sh	fi	ns np	es 7.7 8.0	gw	25 gr 10 co 10 ST	ff	8
C2	50-60+	light yellowish brown 10YR 6/4	10YR 4/4	LS	om. sg	l-h	fi l	ns np	es 8.0		30 gr 25 co 10 ST	vff	
						pockets of sand.							

FILE CODE SOILS-11

SOIL DESCRIPTION

MU_VBJ

Soil type Scryck

File No.

Area Lila Canyon, Emery Co., UT

Date 8/6/98 D. Larsen EIS

Stop No. LC 5

Classification Loamy-skeletal, mixed, mesic, Ustollic Calciorthid / Ustic Haplocalcid ?

Location Storage pile A, proposed site 515, T16S, R14E

N. veg. (or crop) Bunchgrass, Juniper

Climate Mesic, Ustic/Aridic Semiarid

Parent material Alluvium from sandstone + shale

Physiography Slight depression on bench, pediment surface

Relief Smooth slopes	Drainage Well drained	Salt or alkali
Elevation 5880	Gr. water	Stoniness
Slope 10-12 %	Moisture	
Aspect SW	Root distrib. To about 30" Dense zone limits roots	% Clay *
Erosion Slight	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes

29" to very dense calcic
no roots below this Cim

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		10
Cobble 3-10"		5
Stone 10-24"		5
Boulder >24"		5
Vegetation		20
Litter		20
Bare		35

* Control section average

Horizon	Depth	Color Dry	Color Moist	% c Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Lab. Reaction	Boundary	% Rock Fragments	Root Distribution	% CaCO3
	1-0	[illegible] crypt-grass											
A1	0-3	light brown 7.5YR 6/3	Brown 7.5YR 4/3	fsl 7	1fgr	l-so	vfr	nS BP	em 7.4	cs	10gr 5co	mf	
AB	3-9	Brown 7.5YR 5/4	Brown 10YR 4/4 to 7.5YR 4/4	fsl 12	1fsbk	so	fr	nS nP	es 7.5	cs	10gr 10co 5cb	mf	
BK1	9-29	pale brown 10YR 6/3 crushed	Brown 10YR 5/3	sl 12	0m	h	fi	S P	ev 7.5	cs	20gr 20co 10s	ff, m	12
BK2	29-40	very pale br. 10YR 7/3 crushed	yellowish brown 10YR 5/4	sl	0m	vh	vfi	S P	ev 7.8	gw	30gr 25co 10st	vff	21
BK3	40-58	pale br/ light gray 10YR 6/3 + 10YR 7/2	10YR 5/4	sl 15	0m	h	fi	S P	ev 8.2	cw	50gr 10co 1st	vfc	13
C	58-62	light yellowish brown 10YR 6/4	10YR 5/4-5/3	sl	0m	h- loose packed	fr	SS SP	es		"	"	

FILE CODE SOILS-11 SOIL DESCRIPTION

MU VBU

Soil type Strych

File No.

Area Lila Canyon Emery Co, UT | Date 8/6/98 D. Larsen M. Coonrod | Stop No. LC6

Classification Loamy-skeletal, mixed, mesic, Ustollic Calciorthid (Ustic Haplocalcid ?)

Location Stockpile B site S15, T16S, R14E

N. veg. (or crop) Juniper / grass prickly pear | Climate Mesic, Ustic/Aridic Semiarid

Parent material Stony, bouldery alluvium

Physiography Upper part of a pediment, getting near mountain toeslope

Relief rel. straight single slope | Drainage Well drained | Salt or alkali

Elevation 5910' | Gr. water | Stoniness

Slope 5-7% | Moisture

Aspect Southwest | Root distrib. | % Clay *

Erosion Slight | % Coarse fragments * | % Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes

Salvag. up to 20"

Air 98° @ 1:40PM

Soil Surface 145° F

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		20
Cobble 3-10"		10
Stone 10-24"		5
Boulder >24"		10
Vegetation		15
Litter		10
Bare		30

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture (Suc)	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution	% Cor CO3
O	1-0	Discontinuous litter											
A1	0-5	Slightly toward 7.5YR 10YR 5/3	Brown 10YR 4/3	13 sl	1-fgr	so-1	vfr	ns np	7.5 7.8 em	cs	10 gr 10 co 5 st	cf,	11
BK1	5-18	10YR 6/3-7/3	10YR 5/3	13 sl	om	so-1	fr	ss sp	7.5 8.0 es	cw	25 gr 20 co 10 st	cf, m, 1	20
BK2	18-36	10YR 6/3	10YR 5/4	sl	om	h	vfi	ss sp	8.2 ev	gw	20 gr 30 co 15 st	ff, m	
BK3	36-47	10YR 6/3	10YR 5/4	sl	om	h	fi	ss sp	8.2 es	gw	"	f.f	
C	47-60	10YR 6/4	10YR 5/4	sl-ls	sgr-om	sh-1	fr	ns np	8.0 e		"	-	

FILE CODE SOILS-11 SOIL DESCRIPTION

MU XBS

Soil type Strych

File No.

Area Lila Canyon Emery Co., UT		Date 8/6/98 D. Larsen	Stop No. LC7
Classification Loamy-skeletal, mixed, mesic Ustollic Calciorthid (or Ustic Haplocalcid)			
Location Near storage site C		S15 T16S, R14E	
N. veg. (or crop) Pinyon - juniper		Climate Mesic, Ustic	
Parent material Alluvium ? some colluvial		Semiarid Aridic	
Physiography Pediment			
Relief Sloping	Drainage Well drained	Salt or alkali	
Elevation 5935'	Gr. water	Stoniness	
Slope 15%	Moisture		
Aspect SW	Root distrib.	% Clay *	
Erosion Slight	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability Moderately rapid			

Additional notes

Salvage ht. 12" up to 18in spots

Extremely bouldery surface

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		10
Cobble 3-10"		10
Stone 10-24"		10
Boulder >24"		25
Vegetation		15
Litter		15
Bare		15

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
AB	0-6	— slightly darker at 0-1" 7.5YR 5/3	7.5YR 4/4	ls - sl	1, 1fgr, 1fsbk	l - sh	l - fr	ns np	8.0 es	cw	15 g 10 c 5 s	cf, m		
BK1	6-12	10YR 5/3 - 6/3	10YR 4/3 - 5/3	loam	om	h	fi	ss sp	8.2 es	cw	20 g 15 c 5 s	cf, m, fl		
BK2	12-36	10YR 6/3	10YR 5/4	loam	om	vh	fi	ss sp	8.2 ev	gw	30 g 20 c 15 s	ff, m		
BK3	36-60	10YR 6/3	10YR 5/4	loam	om	h	fi	ss sp	8.2 ev	gw	40 g 15 c 10 s 15 s	vff		
C	60-80	10YR 6/2	10YR 5/3	sl	om	h-	fi-	ns np	8.0 es		"	-		

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

MU XBS

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Soil type Strych

File No.

Area Lila Canyon Emery Co. UT | Date 8/6/98 D Larsen GIS | Stop No. LC 8

Classification Loamy-skeletal, mixed, mesic Ustollic Calciorthid (or Ustic Haplocalcid)

Location Near sediment pond site S15 T16S R14E

N. veg. (or crop) Pinyon-juniper, grass | Climate Mesic Ustic/Aridic Semiarid

Parent material

Physiography Pediment, edge of a wash (dissected)

Relief Steep	Drainage Well drained	Salt or alkali
Elevation 5850	Gr. water	Stoniness
Slope 25%	Moisture	
Aspect NW	Root distrib.	% Clay *
Erosion Moderate	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes

Very difficult to get the backhoe around in this unit

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		20
Cobble 3-10"		10
Stone 10-24"		10
Boulder >24"		20
Vegetation		15
Litter		10
Bare		15

* Control section average

Horizon	Depth inches	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction (Phenol red)	Boundary	% Rock Fragments	Root Distribution		
A1	0-6	7.5YR 5/3	10YR 4/3	sl	2fgr	s	vfr	ss sp	7.8	cw	10 gr 5 co 5 st 5 b	mf mm		
BK1	6-11	10YR 6/3	10YR 5/4-6/4	sl	2 fsbk, 1fpl	h	fi	s sp	7.9	cw	15 gr 10 co 10 s	cf cm		
BK2	11-35	10YR 6/4-6/3	10YR 5/4	sl	om	vh	vfi	s sp	8.0	cs	15 gr 20 co 15 st	ff		
BK3	35-60	10YR 6/4	Slightly redder than above 10YR 5/4	sl	om	h	fi	ss sp	8.0	gw	20 gr 10 co 10 st	ff		
C	60-70	10YR 6/4	10YR 5/4	sl	om	sh	fr	ss sp	8.0		20 gr 15 co 15 st	—		

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

MU, VBJ

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Soil type Strych

File No.

Area Lila Canyon Emery Co UT | Date 8/7/78 D. Larsen | Stop No. LC 9

Classification Loamy-skeletal, mixed, mesic Ustollic Calciorthid (or Ustic Haplocambid)

Location Conveyor location at road cut S15 T16S R14E

N. veg. (or crop) Pinyon - juniper | Climate Mesic, Ustic Semiarid Aridic

Parent material Alluvium

Physiography Pediment

Relief Smooth, straight slope | Drainage Well drained | Salt or alkali

Elevation 5865' | Gr. water | Stoniness

Slope 10% | Moisture

Aspect SW | Root distrib. | % Clay *

Erosion Slight | % Coarse fragments * | % Coarser than V.F.S. *

Permeability Moderately rapid

Additional notes

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		10
Cobble 3-10"		5
Stone 10-24"		10
Boulder >24"		15
Vegetation		20
Litter		15
Bare		25

* Control section average

Horizon	Depth Inches	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A1	0-4	Brown 7.5YR 5/3	Brown 7.5YR 4/2	sl	1fgr-1fpl	so	vfr	ns np	7.8	cs	5g	cf cm		
AB	4-13	Brown 7.5YR 5/4	Brown 7.5YR 4/4	sl	1fgr-1fsbk	so	vfr	ns np	7.8	cs	5g 5c 5s	cf cm		
BK1	13-19	10YR 6/3	10YR 5/4-6/4	sl	om	h	fi	ss sp	8.0	gw	20g 15c 10s	ff		
BK2	19-36	10YR 6/3	10YR 5/4-6/4	sl	om	vh	vfi	ss sp	8.0	gw	15g 20c 30s	fc		
BK3	36-49	10YR 6/3-6/4	10YR 5/4	sl	om	h	fi	ss sp	8.0	gw	20g 25c 15s	ff		
C	49+	10YR 6/4												

SCS-SOILS-232G
REV. 12-70
FILE CODE SOILS-11

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Soil type Gerst | File No.

Area Lila Canyon Emery Co. | Date 8/7/98 DL | Stop No. LC10

Classification Loamy, mixed (calc), mesic shallow Ustic Torriorthents

Location SE corner of study area, mouth of canyon slope, near 12% road stake

N. veg. (or crop) Pinyon - juniper | Climate Mesic, Ustic (Arid) Semiarid

Parent material Shale & sandstone

Physiography Mountain slope, Tac

Relief V-steep	Drainage Well drained	Salt or alkali
Elevation 6050'	Gr. water	Stoniness
Slope 55%	Moisture	
Aspect 260° SW	Root distrib.	% Clay *
Erosion Severe	% Coarse fragments *	% Coarser than V.F.S. *

Permeability slow

Additional notes Shallow over shale

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth in	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A1	0-1	2.5Y 6/4	10YR 5/4	sil	1 fgr 1 pl	sh	fr	ss sp	7.5	cs	3 dgr			
AC	1-6	"	"	sil	1 fgr	s	fr	ss sp	7.5	gs	30 gr			
C	6-9	2.5Y 7/8	2.5Y 3/2	sil	mostly shale rock structure	sh	fr	–			65 shale	freq.		
Cr.	9-15			–							80 shale	freq.		
Cr2	15+	Harder, more blocky shale												

Notes

Lila Canyon
Mine facilities site

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T/L
Page No. 1

County Emery | Soil Mapping Unit SBG
Transect No. 1L | Direction 90° (E) | Boring Interval 50' | Length
Starting Location NW Corner of parking lot
Date 9-8-98 | Photo | By D. Larsen
Remarks Start at NW corner of parking lot

Profile No. 1
Percent Slope 10% | Aspect 260° SW | Erosion slight
Position on Slope slight drainage dip on fan

Surface 10 radius
Surface 40% gr 2% boulders

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-3	pale br	sl	1 fgr	sr		30% gr	—	≈ 8.2
AB	3-10	light yellowish br	gr sl	-	sr		35% gr	—	
BK1	10		sl						

Additional Notes Rabbitbrush / grass

Series Strych

Classification

Profile No. 2
Percent Slope 12% | Aspect SW | Erosion slight
Position on Slope edge of slight draw

5% boulders
5 stone
5 co
10 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-5	pale br	sl	sr	vfr		15-5 sl 15 gr 5 co	—	≈ 8.0
AB	5-11	brown	fs	1	vfr		"	—	
BK1	carbonates		sl-1		sh				

Additional Notes Saltbrush / grass

Series Strych

Classification

Profile No. 3
Percent Slope 10 | Aspect SW | Erosion
Position on Slope edge of slight draw

5% stone
20 gravel
5 co

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-2		sl				20 gr	—	
AB	2-8	slight reddish	sl					-	
BK1	8-12	br							
BK2	12-	Light color of carbonate (calcic)							

Additional Notes

Series Strych

Classification

OVER

Lila Canyon

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

L1
Page No. 2

L1
1 2

County Emery | Soil Mapping Unit SBG
Transect No. 1L | Direction E | Boring Interval 50' | Length 500'
Starting Location NW Corner of parking lot
Date 9-8-98 | Photo | By D. Larsen
Remarks

Profile No. 4
Percent Slope 10% | Aspect SW | Erosion slight
Position on Slope

Surface
15% stone
1 boulder
2 co
5 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-5	brown	sl	1fgr	so		5 gr 5 co 5 ST	—	≈ 8.0
Bt	5-12	reddish br	scl	1fsbk	sh			—	
BK1	12-15	pale brown	l		sh		10 gr 15 co 5 ST		8.2

Additional Notes
Strych like with a thin BT near surface
Series
Classification

Profile No. 5
Percent Slope 9% | Aspect SW | Erosion sl
Position on Slope slight depression

5% ST
5 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-4	p.b.	ls	1fgr					
Bw	4-10	r.br	l	1sbk					

Additional Notes
Series Strych
Classification

Profile No. 6
Percent Slope 11 | Aspect SW | Erosion slight
Position on Slope slight rise

15% boulder
10 co
5 ST
10 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-5	p.b	sl	1fgr	so				
Bw	5-12	b	l		sh				
BK1	12	p b			sh				

Additional Notes
Series
Classification

OVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T1L

Page No. 3

County	Soil Mapping Unit		
Transect No. T1	Direction E	Boring Interval 60'	Length 500'
Starting Location			
Date 9-8-98	Photo	By D. LARSEN	
Remarks			

Profile No. 7

Percent Slope 10% | Aspect South | Erosion mod.

Position on Slope

8% Boulders
2% Stones
2 cc
1 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments (shelly, sph)	Clay Films	pH
A1	0-3	br	1	1 fgr	so		5g	—	
BK1	3-10	[illegible]	1	om	h		[illegible]	—	
carbonate zone at 3"									
some reddish brown pockets									

Additional Notes eroded surface

Series

Classification

Profile No. 8

Percent Slope 15% | Aspect S | Erosion mod.

Position on Slope

10 bo
2 st
1 cc
10 gr

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1/AB	0-4	br	1	1 fgr	so fr				7.0
BK1	4-12	br [illegible]	1	om	sh-h				
		[illegible]							

[illegible] bare ground

Additional Notes

Series

Classification

Profile No. 9

Percent Slope 15 | Aspect S | Erosion mod.

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A	0-5	br	1	1 fgr			25.9 150		
BK	5-12	br	1	om					

5 [illegible]
10 [illegible]
20 cc
10 g

Additional Notes

Near NE corner of shop

Series

Classification

OVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T1L

Page No. 4

County Emery | Soil Mapping Unit SBG

Transect No. 1L | Direction | Boring Interval | Length

Starting Location

Date 9-8-98 | Photo | By D. L.

Remarks

Profile No. 10

Percent Slope 12 % | Aspect SW | Erosion Mod

Position on Slope edge of [illegible] on [illegible]

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
AB	0-5	p. br	1	1 Frg	sh		V Co.		
BK	5-10T	br	1	om	h		V Co.		

1 bo
15 sh
10 co
15 9

Additional Notes

Series Strich

Classification

Profile No.

Percent Slope | Aspect | Erosion

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH

Additional Notes

Series

Classification

Profile No.

Percent Slope | Aspect | Erosion

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH

Additional Notes

Series

Classification

OVER

Lila

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T2L

Page No. 1

County Emery | Soil Mapping Unit 20 steps

Transect No. 2L | Direction 130° | Boring Interval 60' | Length 600'

Starting Location SW Corner of parking lot

Date 9-8-98 | Photo | By D. Larsen

Remarks

Profile No. 1

Percent Slope 10% | Aspect 310° SW | Erosion Mod.

Position on Slope slight side slope to a draw on a fan

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-4		sl-l	1fgr	so		15 gr 5 co		8.0
BK1	4-10	light carbonate		om	sh-h		10 gr 5 co		8.2
		accumulation	1						

Surface

125 surface

8 bo
5 ST
15 co

Additional Notes Juniper stand, prickly pear, sparse grass

Series Strych

Classification

Profile No. 2

Percent Slope 10 | Aspect SW | Erosion

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-5	[illegible]	sl		s				
BK1	5-12	p. br	1		h				

10 bo
10 ST
15 co
15 gr

Additional Notes

Series Strych

Classification

Profile No. 3

Percent Slope 7% | Aspect SW | Erosion mod / slight

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-4	br	1	2fgr	vfr		Very cobbly		
AB bw	4-8	br	1	1fgr	vfr-so				
BK1	8-12	p. br	1	om	h				

15% b dia
3-10

10 ST
10 co
15 gr
1 bare
10 gr lit
10 gr
unpt grant

Additional Notes

Abundant roots in upper 4"

Series

Classification

OVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T2L

Page No. 2

County Emery | Soil Mapping Unit VBJ

Transect No. 2L | Direction 130° | Boring Interval 60' | Length

Starting Location SW Corner of parking lot

Date 9-8-98 | Photo | By D. Larsen

Remarks

Profile No. 4

Percent Slope 6% | Aspect S | Erosion slight

Position on Slope fan

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-6	br	sl-l	1fgr	so		10gr 5co		
AB	6-12	reddish br.	l	"	so-1 vfr				
BK1	12-	pale br	l	"					

% 10 bo 10 ST 10 co 15 gr

5 compaction 20 sand 20L 10 vg

all 8.0-8.2

Additional Notes S. edge of stockpile A site

Series Strych

Classification

Profile No. 5

Percent Slope 10% | Aspect slight E + S | Erosion mod

Position on Slope edge of slight draw on a fan

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-4	p.br-br	sl-l	1fgr-1fpl	so				
BK	4-8+	lgt gr br.	l	om	sh-h				

% 3 bo 15 ST 10 co 20 gr

Additional Notes 10YR 6/3 - 5/3 dry A1 Edge of more grassy site

Series Strych

Classification

Profile No. 6

Percent Slope 6% | Aspect SW | Erosion slight

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-6	10YR 5/3 br	sl	1fgr	so		10gr		
AB	6-15	10YR 5/4 y.br	sl	1fgr	so		10gr		
BK1	15-20+	10YR 6/3 p.br	l	om	sh		15gr 5co		

10 bo 5 ST 5 co 5 gr

Additional Notes Grassy opening with boulders in Juniper
S. edge of stockpile A few (saltbush)
Deeper to calcium than 1-5

Series Strych

Classification

OVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL TRANSECT DATA SHEET

T2L
Page No. 3

County Emery | Soil Mapping Unit VBU
Transect No. 2L | Direction 130° SE | Boring Interval 60' | Length
Starting Location
Date 9-8-98 | Photo | By D. Larsen
Remarks

Profile No. 7
Percent Slope | Aspect SW | Erosion mod.
Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-6		sl-l						
BK1									

Additional Notes Evidence of old burn
Grassy with dead juniper
Series Strych
Classification

Profile No. 8
Percent Slope | Aspect | Erosion
Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH

Additional Notes
Series
Classification

Profile No. 9
Percent Slope 8% | Aspect SW | Erosion Slight
Position on Slope Flat position on fan

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A1	0-5	br	sl		so				
Bw	5-14	y. br	sl		h				
BK	14"	p br	l						

Additional Notes
Many cryptograms
Series Strych
Classification

OVER

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

L11a

SOIL TRANSECT DATA SHEET

T2L

Page No. 4

County Emery | Soil Mapping Unit VBJ / XBS

Transect No. 2L | Direction E | Boring Interval 6 | Length 600'

Starting Location SW Corner of parking lot

Date 9-8-98 | Photo | By D. Larsen

Remarks

Profile No. 10

Percent Slope 10% breaking to 40% | Aspect SW + SE | Erosion mod

Position on Slope Edge of draw at edge of fan

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH
A	0-4	ur	sl	1fgrd	so			—	
BK	4-12+	pale br. carbonates	l	1fpl bm	sh			—	8.2

40 bo
15 st
10 co
10 or

Additional Notes edge of draw above sediment pond location
Juniper, grass few pinyon

Series Very boulder Stryck

Classification

Profile No.

Percent Slope | Aspect | Erosion

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH

Additional Notes

Series

Classification

Profile No.

Percent Slope | Aspect | Erosion

Position on Slope

Horizon	Depth	Color	Texture	Structure	Consistence	Mottles	Fragments	Clay Films	pH

Additional Notes

Series

Classification

OVER

APPENDIX E

SOIL AND LANDSCAPE PHOTOGRAPHS

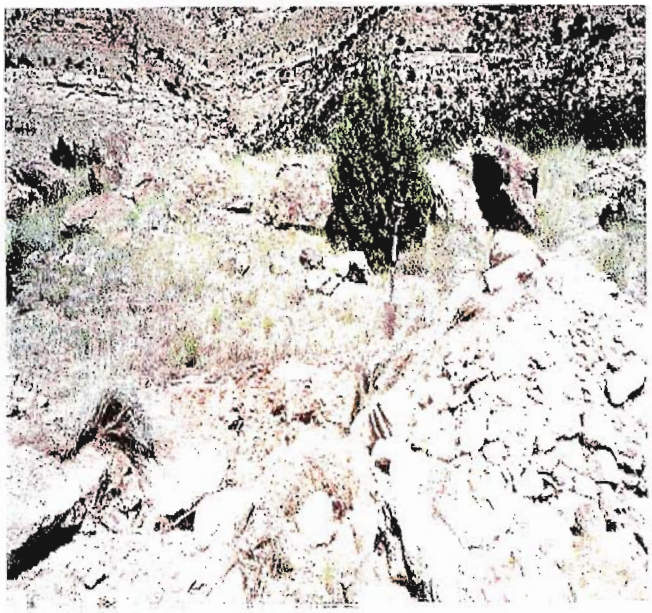


Figure E-1a

Figure E-1b (unit of measure is in feet)

Soil profile LC1 and pit site location near the proposed office and bathhouse. The soil is of the Strych series in soil map unit SBG. The unit of measure, in this appendix, is in feet.

Figure E-2a

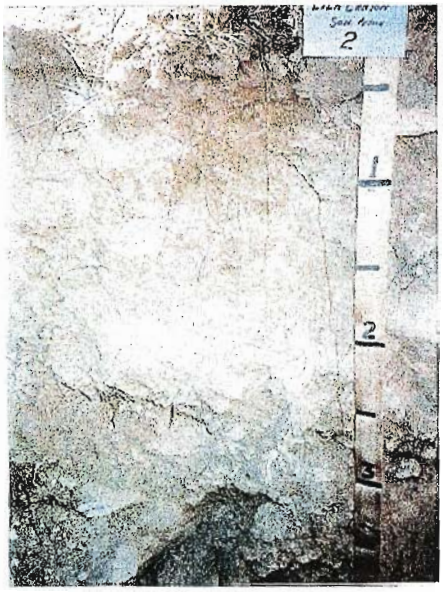


Figure E -2b

Soil profile LC2 and pit site location near the southeast corner of the proposed shop warehouse. The soil is of the Strych series in soil map unit SBG.

Figure E-3a

Figure E-3b

Soil profile LC3 and pit site location North of the proposed equipment and supplies storage area. The soil is in soil map unit DSH. The soil has fewer rock fragments in the surface than found over most of the area.

Figure E-4a

Figure E-4b

Soil profile LC4 and pit site location within the proposed equipment and supplies storage area. This is a local sediment deposition site.

Figure E-5a

Figure E-5b

Soil profile LC5 and pit site location near the proposed product A storage area.

Figure E-6a

Figure E-6b

Soil profile LC6 and pit site location near the proposed product B storage area.

Figure E-7a

Figure E-7b

Soil profile LC7 and pit site location near the proposed product C storage area. A Strych soil in soil map unit XBS.

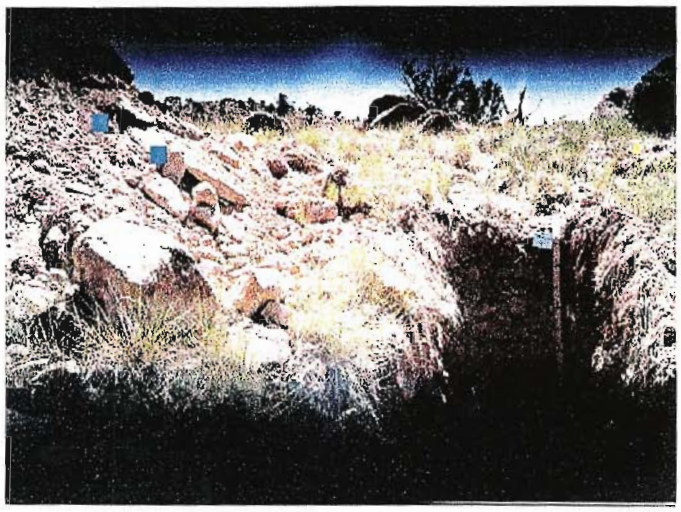


Figure E-8a

Figure E-8b

Soil profile LC8 and pit site location near the proposed sediment pond at the southeast corner of the study area.

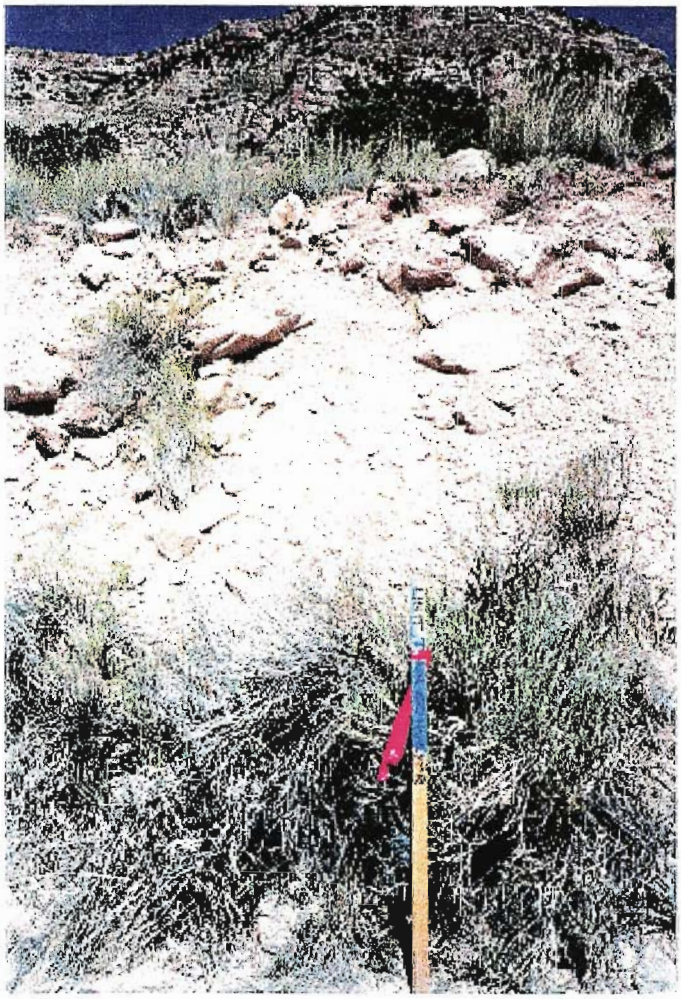


Figure E-9a

Road cut at soil profile LC9 description site along the proposed unit train conveyor location.

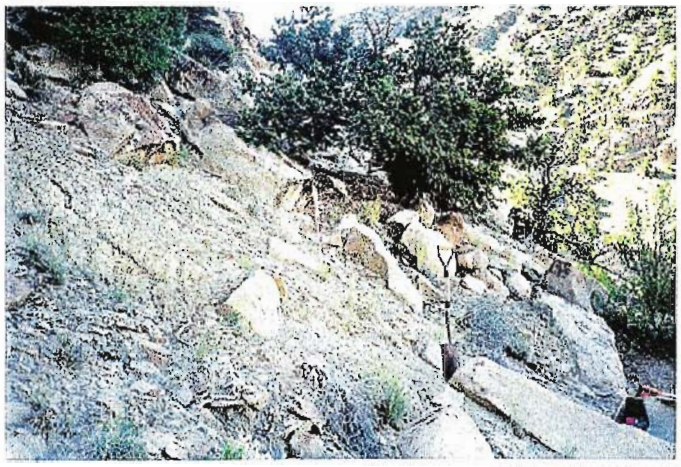


Figure E-10a

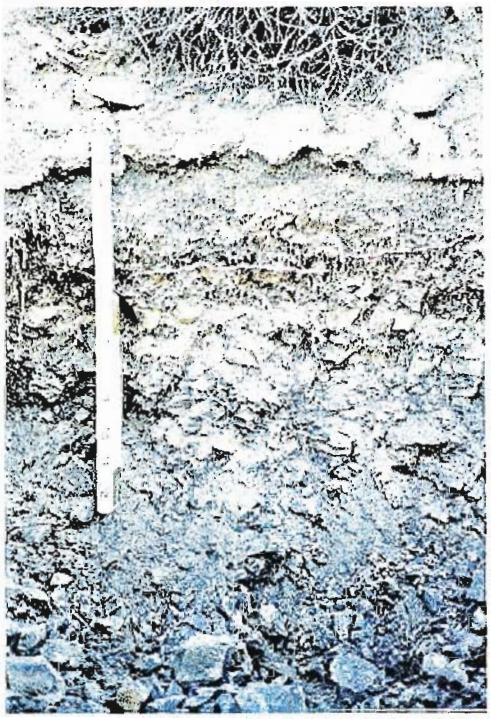


Figure E-10b

Soil profile LC10 and pit site location near the upper end of the study area in soil map unit GRS.

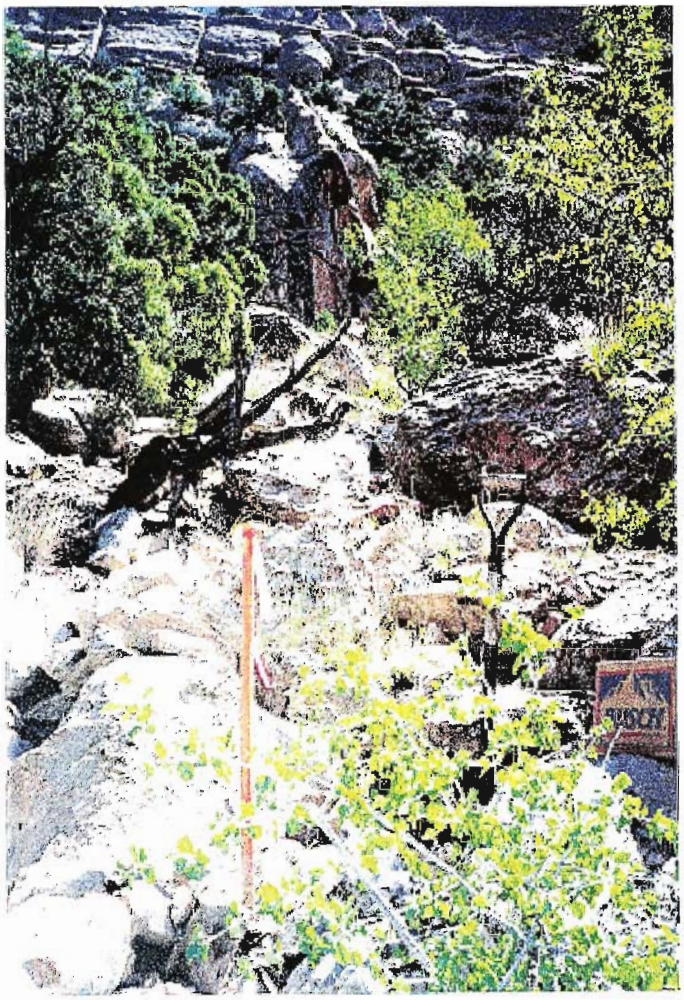


Figure E-11a

A site within map unit RBL, Rubbleland. This site is too bouldery to dig a soil pit.

APPENDIX F

SOIL SERIES DESCRIPTIONS

Strych Series

The Strych series consists of very deep, well drained, moderately rapidly permeable soils on outwash plains, alluvial fans, toe slopes, fan terraces, and the sides of benches. These soils formed in colluvium, alluvium, and glacial outwash derived dominantly from sandstone and shale. Slope is 3 to 70 percent. Elevation is 5,300 to 7,500 feet. Average annual precipitation ranges from 8 to 14 inches, and average annual air temperature ranges from 45 to 47 degrees F.

These soils are loamy-skeletal, mixed, mesic Ustollic Calciorthids.

Typical pedon of Strych very stony loam, 3 to 15 percent slopes, about 2.5 miles southeast of Hiawatha, about 1,900 feet south and 2,300 feet west of the northeast corner of sec. 1, T. 16 S., R. 8 E.

A1 - 0 to 5 inches; pinkish gray (7.5YR 6.2) very stony loam, dark brown (7.5YR 4/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and many coarse roots; common very fine and few fine pores; 20 percent pebbles, 10 percent cobbles, and 15 percent stones; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); gradual wavy boundary.

C1ca- 5 to 17 inches; light gray (10YR 7/2) very stony loam, grayish brown (10YR 5/2) moist; massive, hard, friable, slightly sticky and slightly plastic; common fine and many coarse roots; few very fine 10 percent pebbles, 15 percent cobbles, and 10 percent stones; strongly calcareous; veins of calcium carbonate; strongly alkaline (pH 8.6); gradual wavy boundary.

C2ca- 17-47 inches; very pale brown (10YR 7/3) very stony loam, brown (10YR 5.3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and few fine pores; 15 percent pebbles, 25 percent cobbles, and 20 percent stones; strongly calcareous; powdery soft masses of calcium carbonate; strongly alkaline (pH 8.8); gradual wavy boundary.

C3- 47 to 60 inches; very pale brown (10YR 8/4) very cobbly sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; few fine roots; few fine pores; 20 percent pebbles, 20 percent cobbles, and 5 percent stones; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.8).

Secondary calcium carbonate is at a depth of 5 to 15 inches.

A horizon: Hue is 10YR or 7.5YR, can chroma is 2 to 4. Texture is very bouldery fine sandy loam, gravelly loam, or very stony loam. Calcium carbonate equivalent is 15 to 20 percent. Reaction is moderately alkaline or strongly alkaline.

Cca horizon: Value is 6 or 7 when dry, and chroma is 2 to 4. Texture is very stony sandy loam or very stony loam. Calcium carbonate equivalent is 25 to 40 percent.

C horizon: Hue is 7.5YR or 10YR, value is 6 to 8 when dry and 4 to 6 when moist, and chroma is 2 to 4. Texture is very cobbly sandy loam or very stony sandy loam. Calcium carbonate equivalent is 16 to 20 percent. Reaction is moderately alkaline or strongly alkaline.

Gerst Series

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

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Gerst extremely stony loam in an area of Gerst-Strych-Badland complex, 50 to 70 percent slopes, about 5 miles north west of East Carbon City, about 2,400 feet south and 1,200 feet west of the northeast corner of sec. 16, T. 14 S., R. 13 E.

A1- 0 to 7 inches; light brownish gray (10YR 6/2) extremely stony loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, few fine, and many coarse roots; many fine and few medium pores; 30 percent pebbles, 10 percent cobbles, and 30 percent stones and boulders; strongly calcareous; disseminated calcium carbonate; moderately alkaline (pH 8.2); clear smooth boundary.

C1- 7 to 16 inches; gray (10YR 6/1) channery silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, sticky and plastic; common very fine roots and few medium and coarse roots; 15 percent shale fragments; strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); clear smooth boundary.

C2- 16 to 19 inches; light brownish gray (10YR 6/2) channery silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and plastic; few strongly calcareous; disseminated calcium carbonate; strongly alkaline (pH 8.6); clear smooth boundary.

Cr- 19 inches; partly weathered shale.

Para lithic contact is at a depth of 8 to 20 inches.

A horizon: Value is 4 to 5 when moist, and chroma is 2 or 3. Texture is very channery loam, cobbly loam, or extremely stony loam. Reaction is moderately alkaline or strongly alkaline.

C horizon: Hue is 10YR or 2.5Y, value is 4 or 5 when moist, and chroma is 1 or 2. Texture is channery loam, channery silt loam, or channery clay loam. Clay content is 18 to 32 percent. Rock fragment content is 15 to 25 percent.

Travessilla Series

The Travessilla series consists of shallow, well drained, moderately permeable and moderately rapidly permeable soils on mesas, benches, canyonsides, mountain slopes, and foot slopes. These soils formed in residuum and colluvium derived dominantly from sandstone and interbedded shale. Slope is 1 to 80 percent. Elevation is 5,000 to 8,700 feet but is dominantly 5,500 to 6,500 feet. Average annual precipitation is 10 to 14 inches, and average annual air temperature is 45 to 50 degrees F.

These soils are loamy, mixed (calcareous), mesic Lithic Ustic Torriorthents.

Typical pedon of a Travessilla fine sandy loam in an area of Travessilla-Rock outcrop complex, about 5 miles west of Price, about 2,400 feet north and 2,500 feet east of the southwest corner of sec. 15, T. 14 S., R. 9 E.

A1- 0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak thick platy structure; soft, very friable; few fine and medium roots; few fine pores; slightly calcareous; mildly alkaline (pH 7.6); clear smooth boundary.

C1- 2 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable; few fine and medium roots; few fine pores; 15 percent channers; mildly alkaline (pH 7.5); clear smooth boundary.

C2- 5 to 10 inches; brown (10YR 5/3) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable; few fine and medium roots; few fine and medium pores; 15 percent channers; moderately calcareous; mildly alkaline (pH 7.6); abrupt wavy boundary.

R- 10 inches; sandstone.

Bedrock is at a depth of 7 to 20 inches.

A horizon: Hue is 7.5YR or 10YR, value is 5 or 6 when dry and 3 or 4 when moist, and chroma is 3 or 4. Texture is sandy loam, very gravelly fine sandy loam, fine sandy loam, or extremely bouldery loam. Reaction is mildly alkaline or moderately alkaline.

C horizon: Hue is 7.5YR or 10YR, value is 5 to 7 when dry and 4 to 6 when moist, and chroma is 3 or 4. Texture is sandy loam, fine sandy loam, very fine sandy loam, or loam. Rock fragment content is 0 to 15 percent. Reaction is mildly alkaline or moderately alkaline.

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Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Plant and Animal Science Department

SOIL TEST REPORT
AND
RECOMMENDATIONS

Name Utah American Energy, Inc.
Street P.O. Box 986
Price UT 84501
City State Zip

Date: 12-May-03
Time: 01:53 PM
Telephone: 637-5032 ext. 724

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
SBG 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.16	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	4.99	X					apply 2.1 lbs of P2O5/1000 sq ft
Potassium ppm K	44.80		X				apply 0.9 lbs of K2O/1000 sq ft

Notes:

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Time: 01:53 PM
Telephone: 637-5032 ext. 724

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
XBS 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.07	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	4.00	X					apply 2.1 lbs of P2O5/1000 sq ft
assium ppm K	4.80	X					apply 1.4 lbs of K2O/1000 sq ft

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RBL 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	1.06	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	5.17	X					apply 2.1 lbs of P2O5/1000 sq ft
'assium ppm K	3.20	X					apply 1.4 lbs of K2O/1000 sq ft

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Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
VBJ 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	1.86	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	5.53	X					apply 2.1 lbs of P2O5/1000 sq ft
Potassium ppm K	28.80		X				apply 0.9 lbs of K2O/1000 sq ft

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Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Mix XBS/VBJ 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.28	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	7.34		X				apply 1.4 lbs of P2O5/1000 sq ft
Potassium ppm K	6.40	X					apply 1.4 lbs of K2O/1000 sq ft

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SBG 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.16	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	4.99	X					apply 2.1 lbs of P2O5/1000 sq ft
Potassium ppm K	44.80		X				apply 0.9 lbs of K2O/1000 sq ft

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XBS 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.07	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	4.00	X					apply 2.1 lbs of P2O5/1000 sq ft
ıssium ppm K	4.80	X					apply 1.4 lbs of K2O/1000 sq ft

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Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
RBL 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	1.06	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	5.17	X					apply 2.1 lbs of P2O5/1000 sq ft
ıssium ppm K	3.20	X					apply 1.4 lbs of K2O/1000 sq ft

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Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
VBJ 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	1.86	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	5.53	X					apply 2.1 lbs of P2O5/1000 sq ft
assium ppm K	28.80		X				apply 0.9 lbs of K2O/1000 sq ft

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Date: 12-May-03
Time: 01:53 PM
Telephone: 637-5032 ext. 724

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Mix XBS/VBJ 5/1/03	Turf							

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recomendations
Nitrate-Nitrogen ppm N	2.28	X					apply 2.8 lbs of N/1000 sq ft
Phosphorus ppm P	7.34		X				apply 1.4 lbs of P2O5/1000 sq ft
Potassium ppm K	6.40	X					apply 1.4 lbs of K2O/1000 sq ft

Notes: