APPENDIX 2-6

SOIL SURVEY REPORT
PROPOSED PHASE TWO EXPANSION AREA
(SOUTH PORTALS)
JAMES NYENHUIS

4/05/2003

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SOIL SURVEY REPORT
PROPOSED PHASE TWO EXPANSION AREA
CRANDALL CANYON MINE

for

GENWALL RESOURCES, INC.
Huntington, Utah

Submitted to:
ANDALEX RESOURCES, INC.
Price, Utah

Submitted by:

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1.0 INTRODUCTION

This report is prepared subsequent to a field study performed to characterize the soil resources and determine the potential soil salvage depths of the proposed expansion area at the Genwall Resources, Inc. Crandall Canyon Mine located northwest of Huntington in Emery County, Utah.

1.1 OBJECTIVES

The basic objectives of the field investigation were to map and describe the soils of the study area in sufficient detail to characterize their physical and chemical properties, and depths to which they may be salvaged as a source of topsoil for reclamation purposes. Thus, the site-specific characteristics of the soil that may influence soil salvage, stockpiling, and redistribution were inventoried. A detailed Order 1 soil survey, including mapping, sampling, description, laboratory analysis, suitability evaluation, and report preparation was needed to generate the required information. The general objectives relating to the soil survey are as follows:

- Satisfy soils requirements as found in UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Mining" (Leatherwood and Duce 1988);

- Collect, review, and evaluate all existing soils, vegetation, geologic, hydrologic, and climatic information to gain a basic understanding of the soils and related disciplines on the site prior to initiation of field work;

- Describe, sample, evaluate, and report site-specific soils data;

- Prepare a soils report, including recommended soil salvage depths, to aid in the completion of the reclamation planning documents needed for permit approval.

2.0 METHODS - SCOPE OF WORK

2.1 EXISTING DATA REVIEW AND EVALUATION

All existing soils and related discipline information for the general study area was compiled and reviewed prior to initiation of the soils field work. This review included soils information for the site taken from: (1) Appendix 2-3B, Supplemental Soils Inventory for the Crandall Canyon Proposed Culvert Expansion (revised 6-19-97), (2) previous USFS mapping in the area and their map unit and taxonomic unit descriptions on file (Manti-LaSal National Forest 1995), and (3) the "Soil Survey of Parts of the Price River and Huntington River Watersheds" (Swenson et. al. 1983). Project maps and air photos were also reviewed.

It should be noted that all methods for soil survey work performed as part of this project are standard methods for detailed Order 1 soil surveys. All procedures and methods were in accordance with current Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) and UDOGM soil survey methods for coal mining projects. Furthermore, all technical specifications were in accordance with current standards and procedures of the USDA-NRCS National Cooperative Soil Survey Program.

2.2 SOIL MAPPING

Mr. James Nyenhuis, a Certified Professional Soil Scientist/Soil Classifier (ARCPACS 2753), mapped soils at the Order 1 level of intensity for the proposed expansion area. The mapping and sampling activities were conducted on August 19 and October 30, 1998. The field mapping was done utilizing the Crandall Canyon Mine Surface Facility (Topographic) Map at a scale of 1"=50'.

All standards and procedures for soil mapping and profile description were in accordance with current NRCS methods, as described in the Soil Survey Manual (Soil Survey Staff 1993); National Soils Handbook, as currently amended (Soil Survey Staff 1997); Keys to Soil Taxonomy, eighth edition (Soil Survey Staff 1998), Field Book for Describing and Sampling Soils (Schoeneberger et.al. 1998), and applicable UDOGM topsoil and overburden guidelines (Leatherwood and Duce 1988).

Upon initiation of soils field work, traverses were walked to determine overall soil and landscape characteristics. Each major soil/landscape unit was tentatively located on the ground and delineated on the base maps. Based on these preliminary observations, representative sample sites were selected for detailed soil pedon description and sampling. Backhoe pits were dug at some of the sample sites; other sites were hand-dug.

2.3 SOIL SAMPLING AND PROFILE DESCRIPTION

Each typical soil pedon was described and sampled according to current methods and standards of the National Cooperative Soil Survey. The following parameters were described, by horizon, for each soil pedon: horizon symbol, depth, and boundary; color; texture; structure; consistence; coarse fragment content; effervescence; clay films if present; soil mottles if present; and the amount, size, and depth of major roots. In addition, general site information was recorded at each sampling site including: existing dominant vegetation, physiography-landform, slope, aspect, erosion condition, drainage class, and depth to a saturated zone or ground water if encountered.

Samples were collected in the field and analyzed at Inter-Mountain Laboratories (IML) in Farmington, New Mexico for standard soil parameters. The soil analyzes included pH; electrical conductivity (EC); saturation percent; calcium, magnesium, and sodium (meq/l); sodium adsorption ratio (SAR), texture including sand, very fine sand, silt, and clay; calcium carbonate percent; Boron (ppm); Selenium (ppm); Total Kjeldahl Nitrogen (TKN) percent; Nitrate Nitrogen (mg/L); Total Organic Carbon (TOC) percent; Organic Matter percent; and 1/3 bar and 15 bar water capacity.

Table 1 is list of "Parameters and Analytical Procedures for Soil Analysis" and is taken from IML's standard methods and procedures. These methods are consistent with those recommended by UDOGM (Leatherwood and Duce 1988).

The sampling site locations and numbers were plotted on the field map as accurately as possible. All sample locations were flagged and numbered in the field. Samples were collected from fresh backhoe pits or hand-dug pits. The sampled soil material was placed in clean, labeled, polyethylene plastic bags, and kept cool and as dry as possible to limit chemical changes. The upper horizons of many profiles were moist upon sampling, and were air dried prior to shipment to IML for analysis. Each sample was split at the laboratory with one portion being used for analysis and an archival portion retained for additional tests, if necessary.

2.4 EVALUATION OF SOIL SUITABILITY

Criteria to establish suitability of soil (topsoil) or soil substitute material were largely those contained in the UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" Table 2 "Overburden Evaluation for Vegetative Root Zone" (Leatherwood and Duce 1988). This information is presented as Table 2, "Soil Suitability Criteria".

One exception to criteria presented in Table 2 was utilized. Although Table 2 considers >30 percent rock fragments (for both gravels, 2mm to 3" in size; and cobbles, 3" to 10" in size) to be

unacceptable; and >10 percent stones and boulders (>10" in size) to also be unacceptable, recent discussion with UDOGM soil scientist Mr. Robert Davidson, and experience on similar projects, supports a rationale for salvaging and reclaiming with soils which have a higher rock fragment content (Davidson 1998). Although higher unacceptable thresholds were not set, the revised practice is to salvage suitable soil with higher amounts of rock content, perhaps as high as 50 to 60 percent for gravels and cobbles, and up to 35 percent for 10" to 24" stones, and up to 20 percent for small boulders.

All field and laboratory data have been analyzed and evaluated using standard soil suitability, interpretation, and classification criteria. Soils were classified according to current Soil Taxonomy criteria as stated in eighth edition of Keys to Soil Taxonomy (Soil Survey Staff 1998), and then correlated to NRCS soil series as possible.

Correlation of site-specific soils to NRCS soil series, if possible, allows use of established NRCS soil interpretation values such as hydrologic group number (for runoff evaluation), "K" factors (for use in water erosion hazard evaluations), and "WEG" group number (wind erodibility group status for wind erosion hazard evaluation) for the site-specific soils. In addition, one may quantitatively determine the "K" factor and "WEG" from use of the field and laboratory data and appropriate nomographs.

3.0 RESULTS AND DISCUSSION

3.1 REVIEW OF EXISTING SOILS INFORMATION

The soils within the Crandall Canyon Mine Disturbed Area Boundary have been previously inventoried. A general mapping of the soils in Crandall Canyon, at a scale of 1"=2000', was completed by the Forest Service as part of their soil survey in progress (Manti-LaSal National Forest 1995). This information is contained in the soil survey file at the Forest Service office in Price, Utah, and is also on file at the Andalex Resources office in Price.

Three map units were delineated by the Forest Service in the area: Map Unit 20 (Strych-Pathead-Podo Families-Rubbleland Complex, 30 to 80% slopes), Map Unit 107 (Curecanti-Elwood-Duchesne Families Complex, 20 to 70% slopes), and Map Unit 711 (Bundo-Lucky Star-Adel Families Complex, 30 to 70% slopes). Descriptions for these units are contained in the Crandall Canyon Mine PAP (Appendix 2-7, Soil Survey Information, Genwall Resources, Inc. - Crandall Canyon Mine, Mill Fork Lease Tract, Crandall/Huntington Canyon Areas).

In addition to the Forest Service soils information, portions of the proposed disturbed area were also mapped, sampled, and described by Mr. Randy Gainer, Mr. Chris Hansen, and Mr. David Steed (Crandall Canyon Mine, Proposed Culvert Expansion, Supplemental Soil Inventory, Appendix 2-3B, Revised 6-19-97). Most of this field work was conducted within the Proposed Culvert Disturbed Area with Map Units A and B delineated along two narrow stream terrace benches. The soils in Map Units A and B were described in the field and soil samples were analyzed by Inter-Mountain Laboratories in Farmington, New Mexico, but were not classified and correlated to soil series names. This work is depicted on the soils map previously presented as Plate 2-4 of the Crandall Canyon Mine PAP.

Only one sample site (TH-2) was located on the north-facing slope located on the south side of Crandall Creek within the Disturbed Area Boundary. No sample sites were located on the south-facing slope located north of Crandall Creek nor on the stream terrace located just west of the permit boundary. These areas (the north and south-facing slopes above Crandall Creek) retained the map unit numbers used in the Forest Service mapping (Map Units 107 and 711 for the north-facing slope; and Map Unit 20 for the south-facing slope). The stream terrace located just west of the permit boundary was included in Map Unit 711.

3.2 SOIL SURVEY MAP

As part of the current survey, a detailed soils map was completed in the field, at a scale of 1"= 50', on a topographic base map of the study area. The soils map is attached to this report. The legend on the map includes all map unit symbols and names, as well as the soil sample locations and site numbers.

Six map units were delineated within the current study area and will be described below. The map units are:

- Map Unit C, Pathead gravelly sandy loam, 40 to 70% slopes
- Map Unit D, Datino gravelly sandy loam, 20 to 35% slopes
- Map Unit RL-RO, Rubbleland-Rock Outcrop
- Map Unit REC, Reclaimed Land
- Map Unit E, Lucky Star loam, 40 to 80% slopes
- Map Unit F, Becks Family, 2 to 6% slopes

3.3 SOIL LABORATORY RESULTS

The soil laboratory data for the 15 sample locations is presented as Appendix A. A total of 28 soil samples were analyzed by Inter-Mountain Laboratories of Farmington, New Mexico. Six of the profiles (CC1 through CC6) fully sampled by major horizon. For all nine sample sites on the north-facing slope (GW-1 through GW-9), a composite sample of the upper two feet was collected for analysis.

The soil samples were analyzed by Inter-Mountain Laboratories (IML) in Farmington, New Mexico, and the results meet quality assurance and quality control (QA/QC) specifications. The results of a standard 10 percent rerun are very similar to the original results, and are included with the laboratory data in Appendix A.

3.4 SOIL MAP UNIT DESCRIPTIONS

The current study was conducted in order to obtain more site-specific data in the three areas mentioned above: (1) the south-facing slope on the north side of Crandall Creek, (2) the north-facing slope on the south side of Crandall Creek, and (3) the stream terrace just south of Crandall Creek located immediately west of the Disturbed Area Boundary at the Crandall Canyon Mine. The six map units are grouped according to the slope or terrace on which they appear. Map Units C, D, RO-RL, and REC are located on the south-facing slope. Map Unit E is located on the north-facing slope, and Map Unit F is located on the stream terrace of Crandall Creek just west of the Disturbed Area Boundary.

3.4.1 South-Facing Slope

The first area is the south-facing slope located upslope from the existing mine shop and the Forest Service trailhead parking area. Both the mine shop and the trailhead parking area are located on the extended upper pad at the mine. Elevations range from approximately 7870 to 7925 feet and are similar to those for the north-facing slope. Native vegetation is a mixture of Utah juniper, aspen, sagebrush, Douglas fir, wild rose, and grasses. Four hand-dug pits were described and sampled on this slope (CC-1, CC-2, CC-3, and CC-4). The "CC" prefix is for "Crandall Canyon".

3.4.1.1 Map Unit C, Pathead gravelly sandy loam, 40 to 70% slopes

Map Unit C is the largest and most dominant map unit on this south-facing slope. Three sample sites (CC-2, CC-3, and CC-4) are located in Map Unit C, and the soil correlates to the Pathead soil series. Pathead is well drained and is forming in residuum and colluvium from sandstone and shale. It classifies as a "Loamy-skeletal, mixed (calcareous) frigid Typic Ustorthent". Although usually a soil series is included in only one depth category, Pathead can range from moderately deep to deep (Manti-LaSal National Forest 1995).

Pathead has moderate permeability and available water capacity, and rapid runoff. Hydrologic group status is B or C. Rock fragments on the surface and in the surface layer average about 15 percent gravels, 13 percent cobbles, and 6 percent stones and boulders. The major rooting depth was observed to range from 20 to 29 inches. Soil erodibility is moderate, and the erosion hazard of exposed soil is moderate to high. Map Unit C is limited primarily by steep slopes and a moderate to high percentage of rock fragments throughout the Pathead soil profile.

3.4.1.2 Map Unit D, Datino gravelly sandy loam, 20 to 35% slopes

Map Unit D is located on a small fan-toeslope just above the trailhead parking area. Sample site CC-1 is located in Map Unit D, and the soil correlates to the Datino soil series. Datino is well drained and is forming in slopewash alluvium and colluvium from sandstone and shale. It was previously classified as a "Loamy-skeletal, mixed Typic Haploboroll" (Jensen and Borchert 1988), but due to recent changes in soil taxonomy, it now classifies as a "Loamy-skeletal, mixed Typic Haplustoll" (Soil Survey Staff 1998).

Datino is moderately permeable and has moderate to high available water capacity. The major rooting depth was observed to be 26 inches. The organic matter content of the surface layer was 3.6 percent. Hydrologic group status is B, runoff is rapid and the hazard of water erosion is high.

3.4.1.3 Map Unit RL-RO, Rubbleland-Rock Outcrop

Map Unit RL-RO occupies a small area on the west side of a drainage channel that exists upslope between the trailhead parking area and the mine shop. Rubbleland has many scattered surface stones and boulders. Rock outcrop is exposed sandstone. Small inclusions of the Pathead soil are intermingled throughout the unit. Pathead inclusions constitute about 15 percent of the unit.

3.4.1.4 Map Unit REC, Reclaimed Land

Map Unit REC (Reclaimed Land) is located on a narrow linear area in which a culvert was placed on the slope adjacent to the above-mentioned drainage. Soil was reapplied above the culvert and revegetation is present. No soil samples were taken of this reapplied topsoil. It is estimated that approximately six inches of soil was reapplied to this small area.

3.4.2 North-Facing Slope

The second part of the current study area is a very steep north-facing slope located on the south side of Crandall Canyon just above the lower and extended upper pads at the mine. Elevation ranges from approximately 7870 to 7960 feet. Native vegetation primarily is a mixture of Douglas fir and White fir communities.

Six backhoe pits (GW-1 through GW-6) were dug across the slope in an area where the slope had been cleared. The trees had been previously cut off at about one-foot height above the ground surface although the surface itself had not been disturbed. Three additional sample sites (GW-7, GW-8, and GW-9) were located and hand-dug in an adjacent forested area on the slope above the coal storage pile. As mentioned above, one previous soil sample site (TH-2) was also located on this north-facing slope.

3.4.2.1 Map Unit E, Lucky Star loam, 40 to 80% slopes

Map Unit E was designated for soils on this north-facing slope. Most of this slope was previously designated as Map Unit 711. The small portion of the slope previously mapped as Map Unit 107 was not part of the current survey and remains as Map Unit 107. Lucky Star was previously classified as a "Loamy-skeletal, mixed Boralfic Cryoboroll" (Manti-LaSal National Forest 1995), but due to recent changes in soil taxonomy it now classifies as a "Loamy-skeletal, mixed Ustic Haplocryoll" (Soil Survey Staff 1998).

Although Lucky Star is a deep soil, it ranges from moderately deep (20 to 40 inches to bedrock) to deep (40 to 60 inches to bedrock) on the study area. Permeability and available water capacity are both moderate, runoff is slow to medium, and hydrologic group status is B. Rock

fragment content of the surface layer averages about 13 percent and is equally divided among gravels, cobbles, and stones and boulders. The major rooting depth was observed to be 24 inches. Soil erodibility is low, and the erosion hazard of exposed soil is moderate to high. Map Unit E is limited by steep slopes.

3.4.3 Crandall Creek Stream Terrace

The third part of the current study area is a stream terrace located on the south side of Crandall Creek and just west of the mine permit area boundary. Elevation ranges from approximately 7890 to 7910 feet. Native vegetation includes Douglas fir, aspen, and mixed grasses. A portion of this bench appears to have been slightly disturbed at some time in the past, perhaps for a turn-around at the end of an old two-track road or to pile timber or slash, and it has been naturally somewhat revegetated with sparse young aspen.

Although the dominant soil on this terrace appears to be similar to those previously described and sampled as Map Units A and B, a separate unit (Map Unit F) was designated for soils on this particular stream terrace located just outside the mine permit area boundary. Two sample sites (CC-5 and CC-6) were located on this terrace.

3.4.3.1 Map Unit F, Becks Family, 2 to 6% slopes

Map Unit F is composed of one dominant soil, Becks Family, 2 to 6 percent slopes. Becks Family was previously classified as a "Loamy-skeletal, mixed Aquic Cryoboroll" (Manti-LaSal National Forest 1995), but due to recent changes in soil taxonomy it now classifies as a "Loamy-skeletal, mixed Fluvaquentic Haplocryoll" (Soil Survey Staff 1998).

In the study area, Becks Family is a deep, somewhat poorly drained soil with moderately rapid permeability, slow runoff, high available water supply but moderately low available water capacity, and hydrologic group status D. Rock fragment content of the surface layer is about 15 percent and is mainly gravels. The major rooting depth was observed to be between 17 and 26 inches. Soil erodibility and erosion hazard of the exposed soil is moderate.

3.5 SOIL PROFILE DESCRIPTIONS

Fifteen soil profiles (numbered GW-1 through GW-9 for soils on the north-facing slope, and CC-1 through CC-6 for soils on the south-facing slope and on the Crandall Creek stream terrace) were described and sampled at representative locations within Map Units C, D, E, and F in the study area. The soil profile descriptions are presented in field-notation tabular format in Table 3 of this report. A brief description of the profiles of the four major soils contained in the study area map units follows. The four soils are: Pathead gravelly sandy loam (Map Unit C), Datino gravelly

sandy loam (Map Unit D), Lucky Star loam (Map Unit E), and Becks Family gravelly sandy loam (Map Unit F).

3.5.1 Pathead gravelly sandy loam (Map Unit C)

As stated above, Pathead is classified as a "Loamy-skeletal, mixed (calcareous) frigid Typic Ustorthent". Typically, the "A" horizon surface layer is a brown (10YR 5/3, dry) gravelly sandy loam about 8 inches thick. For purposes of this project, the surface layer includes the true "A" horizon and a similar, immediately underlying, thin transition horizon to the soil substratum. Both of these horizons are grouped together as the "A" horizon. The surface layer has moderate, medium granular structure and neutral to mildly alkaline reaction (pH 7.3 to 7.7). Gravel content is about 15 to 20 percent. Cobbles, stones, and boulders account for an additional 15 to 27 percent.

The underlying "C" horizon substratum is divided into an upper ("C1") and lower ("C2") part. The "C1" upper substratum horizon begins at about 8 inches and ranges in depth from 15 to 29 inches with an average lower depth of 23 inches. Typically, the "C1" horizon is a brown (10YR 5/3, dry) very gravelly sandy loam to sandy clay loam with moderate, medium subangular blocky structure. It has mildly alkaline reaction (pH 7.4 to 7.8). Rock fragment content averages about 32 to 40 percent with about 20 percent gravel, 10 percent cobbles, and 2 to 10 percent stones and boulders.

The "C2" lower substratum horizon begins at the base of the "C1" horizon and generally extends to a depth of 40 inches or more. Typically, the "C2" horizon is a light brownish gray (10YR 6/2, dry) to brown (10YR 5/3. dry) very gravelly sandy clay loam to sandy loam with massive structure. It has mildly to moderately alkaline reaction (pH 7.8 to 8.2). Rock fragment content averages about 55 to 70 percent with 20 to 45 percent gravels, 15 percent cobbles, and 10 to 25 percent stones and boulders.

3.5.2 Datino gravelly sandy loam (Map Unit D)

The Datino soil is classified as a "Loamy-skeletal, mixed Typic Haplustoll". Typically, the surface layer is about 10 inches thick and is composed of an upper ("A1") and lower part ("A2"). It is a very dark grayish brown (10YR 3/2, dry), very dark brown (10YR 2/2, moist) gravelly sandy loam with moderate, medium granular structure and mildly alkaline reaction (pH 7.6 to 7.8). The surface layer meets criteria for a mollic epipedon. Gravel content averages about 15 percent. Cobbles average about 3 to 5 percent, and stones and boulders on the soil surface average about 10 percent.

A cambic "Bw" subsoil horizon underlies the surface layer. For sample site CC1 it extends from 10 to 26 inches in depth and is a yellowish brown (10YR 5/4, dry) sandy clay loam with moderate

medium subangular blocky structure and moderately alkaline reaction (pH 8.2). Total rock fragment content averages about 45 percent with 30 percent gravel, 10 percent cobbles, and 5 percent stones and boulders.

A substratum "C" horizon underlies the subsoil and extends to a depth of 40 inches or greater. It is a brown (10YR 5/3, dry) sandy clay loam with massive structure and moderately alkaline reaction (pH 8.3). Total rock fragment content averages about 45 percent with 30 percent gravels, 10 percent cobbles, and 5 percent stones and boulders.

3.5.3 Lucky Star loam (Map Unit E)

The Lucky Star soil is now classified as a "Loamy-skeletal, mixed Ustic Haplocryoll". Typically, the "A" horizon surface layer is a dark brown (10YR 4/3, dry) loam about 7 inches thick with moderate, medium granular structure and neutral reaction (pH 7.2). Rock fragment content averages about 12 percent with 5 percent gravels, 2 percent cobbles, and 5 percent stones and boulders. The surface layer meets criteria for a mollic epipedon. Along the north-facing slope, the surface layer is overlain by about 1.5 to 2 inches of semi-decomposed needles and twigs comprising an "Oe" horizon.

A cambic "Bw" subsoil horizon often underlies the surface layer and is a yellowish brown (10YR 5/4, dry) loam with moderate, medium subangular blocky structure and neutral reaction. It extends from the base of the surface layer to a depth ranging between 18 and 26 inches [illegible] a similar rock fragment content as the surface layer. Remnants of a thin eluvial "E" horizon are often found mixed in with the upper part of the "Bw" horizon.

A "C" horizon substratum layer underlies the subsoil and extends to a depth ranging between 30 and 60 inches or more. Along the north-facing slope, weathered coal is often encountered at the base of the soil substratum. The "C" horizon is old colluvial material that has slide downslope and covered the coal layer. The "C" horizon is a light brownish gray (10YR 6/2, dry) very stony sandy loam to sandy clay loam with massive structure. Rock fragment content averages 50 to 75 percent with about 15 percent gravels, 10 percent cobbles, and 35 to 50 percent stones and boulders.

3.5.4 Becks Family gravelly sandy loam (Map Unit F)

The Becks Family soil is now classified as a "Loamy-skeletal, mixed Fluvaquentic Haplocryoll". Typically, the surface layer is a dark grayish brown (10YR 4/2, dry) gravelly sandy loam about 7 to 10 inches thick. It has moderate medium granular structure and neutral to mildly alkaline reaction (pH 6.9 to 7.4). Rock fragment content of the surface layer is only about 15 percent and is 10 percent gravels, 2 to 3 percent cobbles, and 1 to 2 percent stones and boulders. The surface layer meets criteria of a mollic epipedon.

A "BC" subsoil horizon or an upper "C" horizon substratum layer underlies the surface layer. Typically, it is a grayish brown (10YR 5/2, dry) to light yellowish brown (10YR 6/4, dry) very gravelly sand to gravelly sandy loam that extends from the base of the surface layer to a depth of 17 to 26 inches. It has single grain to massive structure and neutral to mildly alkaline reaction (pH 7.2 to 7.8). Rock fragment content varies across the terrace and can range from 18 to 67 percent based on data from the CC5 and CC6 sample sites. Gravel can range from 15 to 55 percent; cobbles from 2 to 10 percent; and stones and boulders from 1 to 2 percent.

The underlying "C" horizon, or lower "C" horizon, substratum extends from the base of the overlying horizon to a depth of 40 inches or more. Typically, it is a very gravelly light brownish gray (10YR 6/2, dry) to dark gray (10YR 4/1, dry) sandy loam with massive structure and mildly alkaline reaction (pH 7.5 to 7.8). The dark gray color of at sample site CC5 is a "low chroma" redoximorphic feature which is consistent with a fluctuating water table beneath this stream terrace. Alluvial groundwater was estimated at the time of sampling to be at about 26 and 30 inches, respectively, for sample sites CC5 and CC6. Rock fragment content ranges from 45 to 55 percent with 30 to 40 percent gravels, 10 percent cobbles, and 5 percent stones and boulders.

3.6 SOIL SUITABILITY, RECOMMENDED SALVAGE DEPTHS, AND SOIL VOLUMES

A reclamation potential suitability evaluation for each soil profile in all study area Map Units was performed based on comparison of site-specific field and laboratory data with criteria and threshold values contained in the UDOGM table "Overburden Evaluation for Vegetative Root Zone" (Leatherwood and Duce 1988). As previously noted, the UDOGM table is included as Table 2 in this report. The results of the suitability evaluation indicate the following.

3.6.1 Map Unit C, Pathead gravelly sandy loam, 40 to 70% slopes

The entire Pathead profile is both non-saline (EC< 1.9) and non-sodic (SAR< 1.1). Calcium carbonate content averages about 25 percent and ranges from 16 to 33 percent. Clay content averages 17 percent and ranges from 11 to 21 percent. Rock fragment content ranges from about 30 to nearly 50 percent for the surface layer, from about 32 to 40 percent for the upper "C" horizon substratum layer, and from about 55 to 70 percent for the lower "C" horizon substratum layer. Organic matter percent averages about 2.6 percent for the surface layer, just under 2 percent for the upper substratum "C1" layer, and about 1.1 percent for the lower substratum "C2" layer. Both Boron and Selenium contents are very low, less than 0.5 mg/Kg (ppm) and 0.02 mg/Kg (ppm) respectively.

In terms of soil suitability, the surface and upper substratum layers, to an average depth of 23 inches, is entirely "good" or "fair" rated assuming that its' 30 to 50 percent rock fragments,

3.6.4 Map Unit REC, Reclaimed Land

If Map Unit REC were to be re-disturbed, it is estimated that approximately 6 inches of suitable soil material may be available for salvage from above the drainage culvert. Soil volume can be calculated subsequent to finalization of expansion plans.

3.6.5 Map Unit E, Lucky Star loam, 40 to 80% slopes

The Lucky Star profile is both non-saline and non-sodic. Organic matter content of the upper 2 feet averages 4.1 percent and ranges from 3.1 to 4.9 percent. Calcium carbonate content of the upper 2 feet averages 12.6 percent and ranges from 6 to 18 percent. Clay content of the upper 2 feet averages 21.8 percent and ranges from 18 to 30 percent. Rock fragment content averages about 12 percent for the upper 2 feet, and about 50 to 75 percent from 2 feet until bedrock is encountered with 35 to 50 percent of these lower rock fragments being stones and boulders. Both Boron and Selenium content are very low with less than 0.5 mg/Kg (ppm) and 0.02 mg/Kg (ppm) respectively.

In terms of soil suitability, the approximate upper 2 feet is entirely suitable for salvage assuming equipment can operate on this very steep slope. Rock fragment content, particularly stones and boulders, are limiting below 2 feet, and water erosion and landslide hazard would increase with deeper salvage. As a result, up to 2 feet of suitable soil is available for salvage from Map Unit E. Soil volumes could be calculated subsequent to finalization of expansion plans.

3.6.6 Map Unit F, Becks Family gravelly sandy loam, 2 to 6% slopes

The entire Becks Family profile is both non-saline (EC< 1.7) and non-sodic (SAR< 0.9). Calcium carbonate content averages about 13 percent, and ranges from 11 to 16 percent. Clay content averages about 13 percent, and ranges from 5 to 17 percent. Rock fragment content of the surface layer averages about 15 percent, and is mainly gravels. It increases with depth from 18 to nearly 70 percent, again mainly gravels. Organic matter content of the surface layer ranges from 2.4 to 3.2 percent. It varies irregularly with depth and ranges from 0.3 to 3.8 percent beneath the surface layer. Both Boron and Selenium contents are very low, less than 0.4 mg/Kg (ppm) and 0.02 mg/Kg (ppm) respectively.

In terms of soil suitability, the surface layer, on average about 8.5 inches thick, is entirely suitable for salvage. The underlying "BC" or upper "C" horizon, to a depth of 17 to 26 inches, can have very gravelly sand texture which is rated unnacceptable, and in addition, has poor rated available water capacity. A fluctuating water table is encountered at the base of this "BC" or upper "C" horizon, on average at about 21 inches. As a result, only the upper 8.5 inches of soil is available for salvage should this stream terrace be proposed for disturbance. Soil volumes could be calculated subsequent to finalization of expansion plans.

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TABLE 1

Parameters and Analytical Procedures for Soil Analysis

Taken from UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining (Leatherwood and Duce 1988), and Inter-Mountain Laboratories, Inc., Standard Methods and Procedures

Parameter-Units	Procedure-Reference
Sample Preparation	Samples were air dried at less than 35°C. Clods were broken up prior to grinding and sieving the sample. Large rock fragments were removed and weighed. Sample material was sieved. Remaining rock fragments left on the 10 mesh (2 mm) sieve were removed and weighed. Remaining soil clods left on the 10 mesh screen were ground until the sample just passed the screen. Excessive grinding of sample material was avoided during the entire sample preparation procedure.
Subsampling less than 2 mm fraction	U.S. Salinity Lab (1969), Method 1.
Rock fragment content percent by volume	SCS Soil Survey Investigation Report No. 1, Method 3B, page 18.
Preparation of saturation extract and saturation percentage determination	ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 10-2.3.1, page 169.
pH (determination using saturated paste)	ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 10-3.2, page 171. pH performed on saturation paste, method 10-2.3.1, page 169.
Conductivity of saturation extract in mmhos/cm at 25°C	ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 10-3.3, pages 172-173. Use saturation paste extract.
soluble calcium, magnesium, and sodium in meq/l	ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 10-3.4. pages 173-174.
Sodium Adsorption Ratio	U.S. Salinity Lab (1969), p. 26.
Selenium (ppm)	Extraction: ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 25-9.1. Analysis: Hydride AA, ASTM D3859-93. 1993.
Boron (ppm)	Extraction: ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 25-9.1. Analysis: by ICP, EPA Method 200.7.
Organic Matter in percent	For OM <7.0%: CSU Tech Bulletin LT B88-2 (1988); For OM > 7.0%: Storer (1984)
Carbonate in percent	ASA Mono. No. 9, Part 2, (2 ed). 1982. Method 11-2.4, pages 188-191.
Particle size analysis in percent sand, silt, and clay	Hydrometer method. Black et al. 1965. Methods of soil analysis. ASA Mono No. 9, Part 1, method 43-5, pages 562-566.
Textural classification	USDA (1951), p. 209.
Sand Fractionation (very fine sand)	ASA Mono. No. 9, Part 1, (2 ed). 1986. Method 15-5.2.4, Pages 405 and 406.

TABLE 2

SOIL SUITABILITY CRITERIA

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	<4.5 >9.0
EC mmhos/cm 25°C	0 - 2	2 - 8	8 - 15	>15
Saturation %	25% - 80%		<25% >80%	
Texture	sl, l, sil, scl, vfsl, fsl	c, sicl, sc, ls, lfs	sic, 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			>0.1 mg/kg
Boron	less than 5.0 mg/kg			>5.0 mg/kg
Acid/Base Potential	> -5 tons $CaCO^3$ per 1,000 tons material			< -5 tons $CaCO^3$ per 1,000 tons material
% Coal fines	undetermined at this time			
Available water capacity (in/in)	>0.10	0.05 - 0.10	<0.05	
Rock Fragments (% volume)				
<3 inches diameter	0 - 15	15 - 25	25 - 30	>30
3 - 10 inches	0 - 15	15 - 25	25 - 30	>30
>10 inches	0 - 3	3 - 7	7 - 10	>10

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

TABLE 3

SOIL PROFILE DESCRIPTIONS

Horizon[2]	Depth Inches[3]	Texture[3]	Color[4] Dry	Color[4] Moist	Structure[5]	Consistence[6] Dry	Consistence[6] Moist	Consistence[6] Wet	Roots[7]	Rock Fragments[8] %	Reaction[9]	Boundary[10]	Additional Features and Comments
CC4 Pathead, Map Unit C													
A	0-8	Sandy Loam	10YR 5/3	10YR 4/3	M M GR	SO	VFR	SS/SP	Many M, F, VF and Com CO	20 GR, 25 CB, 2 S/B	ES	CS	
C1	8-25	Sandy Loam	10YR 5/2	10YR 4/2	M M SBK	SH	VFR	SS/SP	Many M, F, VF and Com CO	20 GR, 10 CB, 2 S/B	ES	GW	
C2	25-43+	Sandy Loam	10YR 5/3	10YR 4/3	Massive	H	FR	S/SP	Few CO, M, F, VF	45 GR, 15 CB, 10 S/B	ES	--	
	stopped by rocks												
CC5 Becks Family, Map Unit F													
A	0-10	SL	10YR 4/2	10YR 3/2	M M GR	SO	VFR	SS/SP	Many M, F, VF Few CO	10 GR, 3 CB, 2 S/B	EM	CW	
C1	10-26	LS, Sand	10YR 6/4	10YR 5/4	Massive	LO	LO	NS/NP	Many M, F, VF Few CO	55 sub-rounded gravel, 10 CB, 2 S/B	ES	CW	
C2g	26-44	SL	10YR 4/1	10YR 3/1	Massive	H	FI	S/SP		30 GR, 10 CB, 5 S/B	ES	--	
	stopped by rocks												

TABLE 3

SOIL PROFILE DESCRIPTIONS FOOTNOTES

[1] Soil Series, and Soil Classification according to current NRCS information and criteria. Soil classification based on Keys to Soil Taxonomy, eighth edition (Soil Survey Staff 1998).

[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
W Weak	VF Very Fine	PL Platy
M Moderate	F Fine	GR Granular
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.

[8] Rock Fragments: All coarse fragment percentages (% by volume) are taken from the field soil profile descriptions. Lithologic 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).

APPENDIX A

SOIL LABORATORY DATA

Inter-Mountain Laboratories, Inc.

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

Andalex Resources, Inc.

Price, UT

Client Project ID: Genwal/Himonas

IML Project #0398S04914

Date Received: 08/26/98

Report Date: 09/18/98

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	CaCO3
		Feet	s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0398S04914	GW-1	0 - 2	7.2	0.582	45	4.4	1.3	0.43	0.26	46	35	19	L	6.0
0398S04915	GW-2	0 - 2	7.1	0.464	44	3.5	1.2	0.53	0.34	36	38	26	L	16
0398S04916	GW-3	0 - 2	7.2	0.507	50	3.5	1.6	0.46	0.29	34	36	30	CL	12
0398S04917	GW-4	0 - 2	7.0	0.561	42	4.1	1.5	0.40	0.24	44	35	21	L	17
0398S04918	GW-5	0 - 2	7.3	0.550	53	4.5	1.1	0.33	0.20	42	38	20	L	18
0398S04919	GW-6	0 - 2	7.1	0.550	52	4.3	1.5	0.37	0.22	38	37	25	L	11
0398S04920	GW-7	0 - 2	7.3	0.485	41	4.0	1.1	0.37	0.24	50	32	18	L	9.2
0398S04921	GW-8	0 - 2	7.3	0.518	44	4.5	1.3	0.28	0.16	48	33	19	L	15
0398S04922	GW-9	0 - 2	7.2	0.485	37	3.9	1.2	0.37	0.23	52	30	18	SL	8.8

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

Andalex Resources, Inc.
Price, UT

Client Project ID: Genwal/Himonas
Date Received: 08/26/98

IML Project #0398S04914
Report Date: 09/18/98

Lab Id	Sample Id	Depths Feet	Boron Soluble mg/Kg	Selenium AB-DTPA mg/Kg	TKN %	Nitrogen Nitrate mg/L	TOC %	Organic Matter %	Exch. Sodium %	1/3 bar water %	15 bar water %
0398S04914	GW-1	0 - 2	0.3	<0.01	0.15	0.7	2.2	3.8		24.2	10.8
0398S04915	GW-2	0 - 2	0.3	<0.01	0.13	0.5	2.2	3.8		21.0	13.3
0398S04916	GW-3	0 - 2	0.4	<0.01	0.20	0.7	2.7	4.7		24.0	16.7
0398S04917	GW-4	0 - 2	0.3	<0.01	0.14	0.5	2.5	4.3		21.9	11.4
0398S04918	GW-5	0 - 2	0.5	<0.01	0.23	2.6	2.9	4.9		27.9	15.5
0398S04919	GW-6	0 - 2	0.2	<0.01	0.21	0.7	2.9	4.9		27.2	16.7
0398S04920	GW-7	0 - 2	<0.2	<0.01	0.12	2.0	2.2	3.8		22.1	9.9
0398S04921	GW-8	0 - 2	0.3	<0.01	0.15	0.6	2.3	3.9		23.5	10.1
0398S04922	GW-9	0 - 2	0.2	0.02	0.10	1.0	1.8	3.1		19.6	8.4

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

Andalex Resources, Inc.

Price, UT

Crandall Canyon Mine

Client Project ID: Genwal Resources

Date Received: 11/05/98

IML Project #0398S06538

Report Date: 11/30/98

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	Very Fine Sand
		inch	s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0398S06536	CC1	0 - 5	7.6	1.05	40	3.9	2.0	7.5	4.4	54	29	17	SL	15
0398S06537	CC1	5 - 10	7.8	1.64	31	3.3	1.2	19	13	66	26	18	SL	16
0398S06538	CC1	10 - 26	8.2	0.94	28	9.0	1.3	12	5.5	52	25	23	SCL	13
0398S06539	CC1	26 - 45	8.3	0.80	28	7.7	1.4	10	4.9	54	25	21	SCL	14
0398S06540	CC2	0 - 8	7.8	0.66	33	5.7	1.3	0.78	0.42	66	25	19	SL	12
0398S06541	CC2	8 - 15	7.7	0.55	35	4.7	1.2	0.71	0.42	66	24	20	SCL	11
0398S06542	CC2	15 - 40	7.8	1.90	36	12	6.6	3.2	1.1	68	21	21	SCL	9
0398S06543	CC3	0 - 9	7.7	0.62	38	6.5	1.0	0.60	0.28	66	27	17	SL	14
0398S06544	CC3	9 - 29	7.8	0.57	39	4.7	0.97	0.70	0.42	54	27	19	SL	11
0398S06545	CC3	29 - 54	8.2	0.56	26	1.9	4.1	1.4	0.80	52	37	11	SL	18
0398S06546	CC4	0 - 8	7.3	0.72	34	6.2	1.2	0.80	0.26	62	25	13	SL	14
0398S06547	CC4	8 - 25	7.4	0.72	35	6.9	1.4	0.63	0.31	60	23	17	SL	14
0398S06548	CC4	25 - 43	7.7	0.44	33	4.6	1.3	0.82	0.48	58	25	17	SL	14
0398S06549	CC5	0 - 10	7.4	0.84	36	6.4	0.69	0.39	0.21	68	21	11	SL	12
0398S06550	CC5	10 - 26	7.8	0.36	26	3.1	0.72	0.48	0.35	88	7	5	S	3
0398S06551	CC5	26 - 44	7.8	0.40	33	3.1	1.4	0.87	0.58	64	19	17	SL	11
0398S06552	CC6	0 - 7	8.9	1.06	41	12	1.6	0.51	0.20	66	19	13	SL	13
0398S06553	CC6	7 - 17	7.2	0.93	48	10	1.5	0.55	0.23	64	21	15	SL	14
0398S06554	CC6	17 - 42	7.5	1.68	34	13	5.6	2.9	0.94	68	17	15	SL	14

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

Andalex Resources, Inc.
Price, UT
Crandall Canyon Mine

Client Project ID: Genwal Resources
Date Received: 11/05/98

IML Project #0398S06536
Report Date: 11/30/98

Lab Id	Sample Id	Depths inch	CaCO3 %	Boron Soluble mg/Kg	Selenium AB-DTPA mg/Kg	TKN %	Nitrogen Nitrate mg/L	TOC %	Organic Matter %	1/3 bar water %	15 bar water %
0398S06536	CC1	0 - 5	15	1.0	<0.01	0.24	<0.2	2.1	3.6	21.8	12.5
0398S06537	CC1	5 - 10	15	0.8	<0.01	0.15	<0.2	1.6	2.7	21.3	11.2
0398S06538	CC1	10 - 26	17	<0.4	<0.01	0.09	<0.2	1.1	1.9	21.6	11.9
0398S06539	CC1	26 - 46	17	<0.4	<0.01	0.08	<0.2	0.9	1.6	20.8	11.6
0398S06540	CC2	0 - 8	26	0.5	<0.01	0.13	1.2	1.6	2.8	17.3	9.3
0398S06541	CC2	8 - 15	23	<0.4	<0.01	0.11	1.2	1.2	2.1	16.7	9.8
0398S06542	CC2	15 - 40	33	<0.4	<0.01	0.07	<0.2	0.7	1.3	18.1	10.6
0398S06543	CC3	0 - 9	24	0.4	<0.01	0.14	<0.2	1.3	2.2	18.9	10.0
0398S06544	CC3	9 - 29	25	<0.4	<0.01	0.10	1.1	1.1	1.8	17.7	11.0
0398S06545	CC3	29 - 54	31	0.4	<0.01	0.02	1.4	0.2	0.3	14.6	5.1
0398S06546	CC4	0 - 8	16	<0.4	<0.01	0.14	1.3	1.6	2.7	16.3	6.8
0398S06547	CC4	8 - 25	22	<0.4	0.02	0.12	1.6	1.2	2.0	17.1	8.1
0398S06548	CC4	25 - 43	25	<0.4	0.02	0.09	1.1	1.0	1.7	14.5	7.3
0398S06549	CC5	0 - 10	13	<0.4	0.02	0.10	1.6	1.4	2.4	15.9	7.1
0398S06550	CC5	10 - 28	16	<0.4	0.01	0.02	<0.2	0.2	0.3	6.2	2.1
0398S06551	CC5	28 - 44	14	<0.4	<0.01	0.07	1.0	0.7	1.3	16.5	6.6
0398S06552	CC6	0 - 7	11	<0.4	0.01	0.16	1.2	1.8	3.2	18.4	10.2
0398S06553	CC6	7 - 17	12	<0.4	<0.01	0.19	1.4	2.2	3.8	23.1	13.4
0398S06554	CC6	17 - 42	11	<0.4	<0.01	0.07	1.0	1.1	1.8	18.3	7.2

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Price, UT

Crandall Canyon Mine

Client Project ID: Genwal Resources

Date Received: 11/05/98

IML Project #0398S06536

Report Date: 11/30/98

Lab Id	Sample Id	Depths	pH	EC	Saturation	Ca	Mg	Na	SAR	Sand	Silt	Clay	Texture USDA	Very Fine Sand
		inch	s.u.	mmhos/cm	%	meq/L	meq/L	meq/L		%	%	%		%
0398S06539	CC1	26 - 45	8.3	0.80	28	7.7	1.4	10	4.9	54	25	21	SCL	14
0398S06539D	CC1	26 - 45	8.3	0.80	32	7.8	1.4	11	5.0	54	25	21	SCL	13
0398S06551	CC5	26 - 44	7.8	0.40	33	3.1	1.4	0.87	0.58	64	19	17	SL	11
0398S06551D	CC5	26 - 44	7.8	0.41	33	3.1	1.4	0.93	0.62	64	20	16	SL	11

Inter-Mountain Laboratories, Inc.
2506 West Main Street
Farmington, New Mexico 87401
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Andalex Resources, Inc.

Price, UT

Crandall Canyon Mine

Client Project ID: Genwal Resources

Date Received: 11/05/98

IML Project #0398S06536

Report Date: 11/30/98

Lab Id	Sample Id	Depths	CaCO3	Boron Soluble	Selenium AB-DTPA	TKN	Nitrogen Nitrate	TOC	Organic Matter	1/3 bar water	15 bar water
		Inch	%	mg/Kg	mg/Kg	%	mg/L	%	%	%	%
0398S06539	CC1	26 - 45	17	<0.4	<0.01	0.08	<0.2	0.9	1.6	20.8	11.6
0398S06539D	CC1	26 - 45	17	<0.4	<0.01	0.08	<0.2	0.9	1.6	21.3	11.4
0398S06551	CC5	26 - 44	14	<0.4	<0.01	0.07	1.0	0.7	1.3	16.6	6.6
0398S06551D	CC5	26 - 44	13	<0.4	<0.01	0.07	1.0	0.6	1.3	15.9	6.5

Fax Cover Sheet

kinko's

226 East Harmony Road
Fort Collins, Colorado 80525
Tel: (970) 223-3915
Fax: (970) 223-3519

Date: 3-1-02

To: DAVE SHAVER

Company: WEST RIDGE RESOURCES

Fax: 435 564 4002

From: JIM NYENHUIS

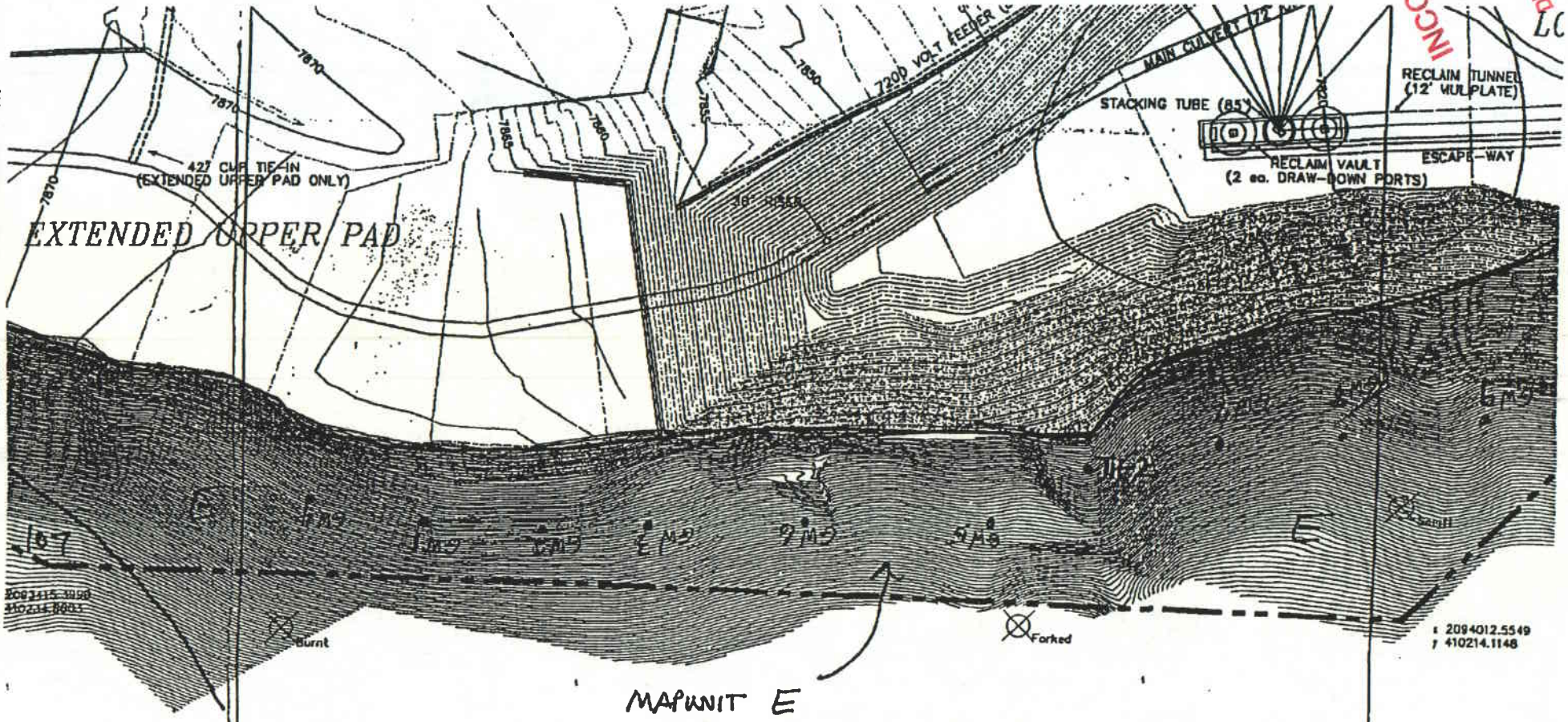
Company: SOIL SCIENTIST

Tel: 970 204 9167

Number of pages including this one: _____

Comments:

north slope
Crandal Canyon
soils



LEGEND:

JERSEY BARRIER

EXISTING ROAD LIMITS

Fax Cover Sheet

kinko's
226 East Harmony Road
Fort Collins, Colorado 80525
Tel: (970) 223-3915
Fax: (970) 223-3519

Date: 3-2-02

To: DAVE SHAVER

Company: WEST RIDGE RESOURCE

Fax: 435 564 4002

From: JIM NYENHUIS

Company: SOIL SCIENTIST

Tel: 970 204 9167

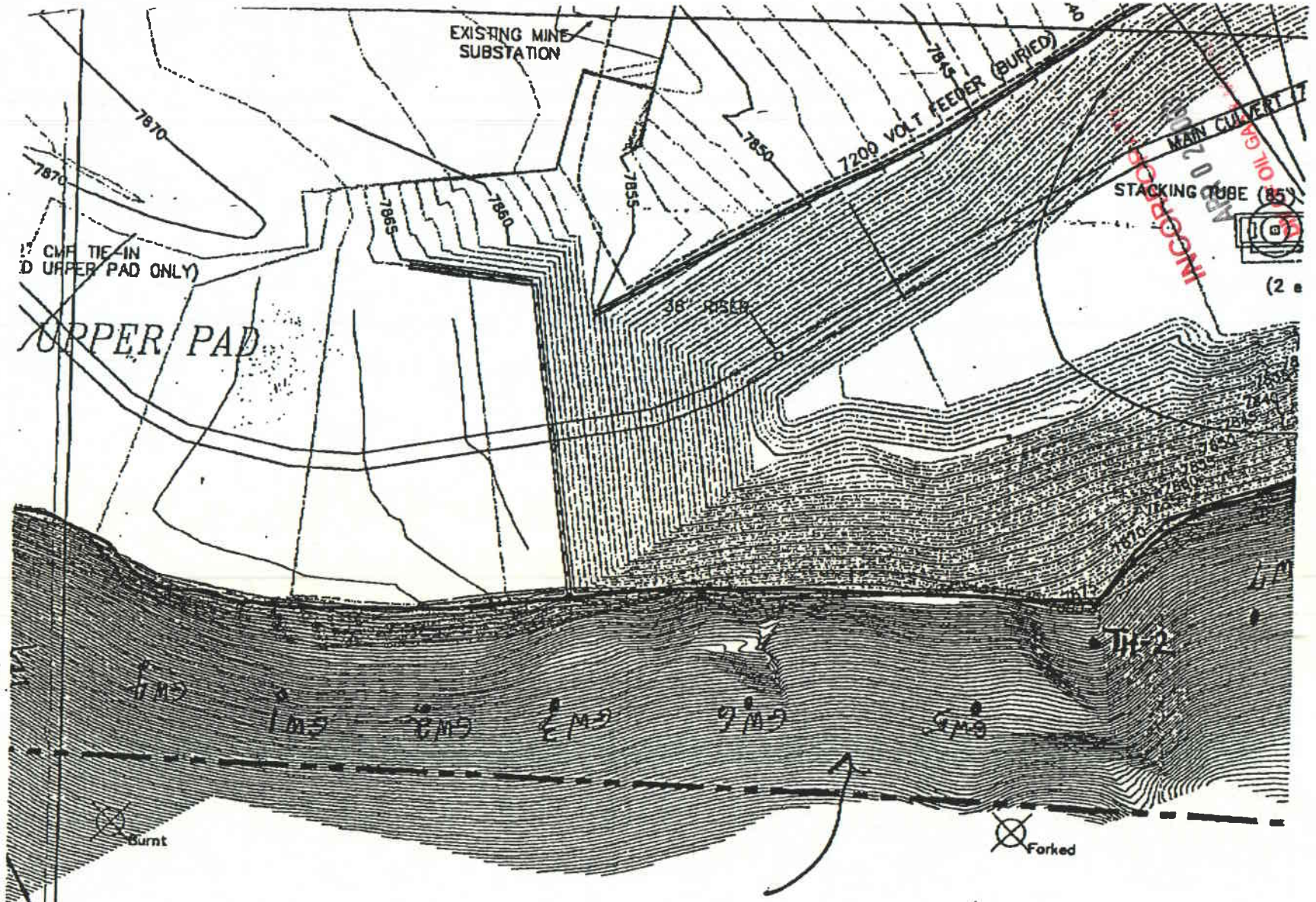
Number of pages including this one: _____

Comments:

I am refaxing the map in 2 parts to make sure you get it all.

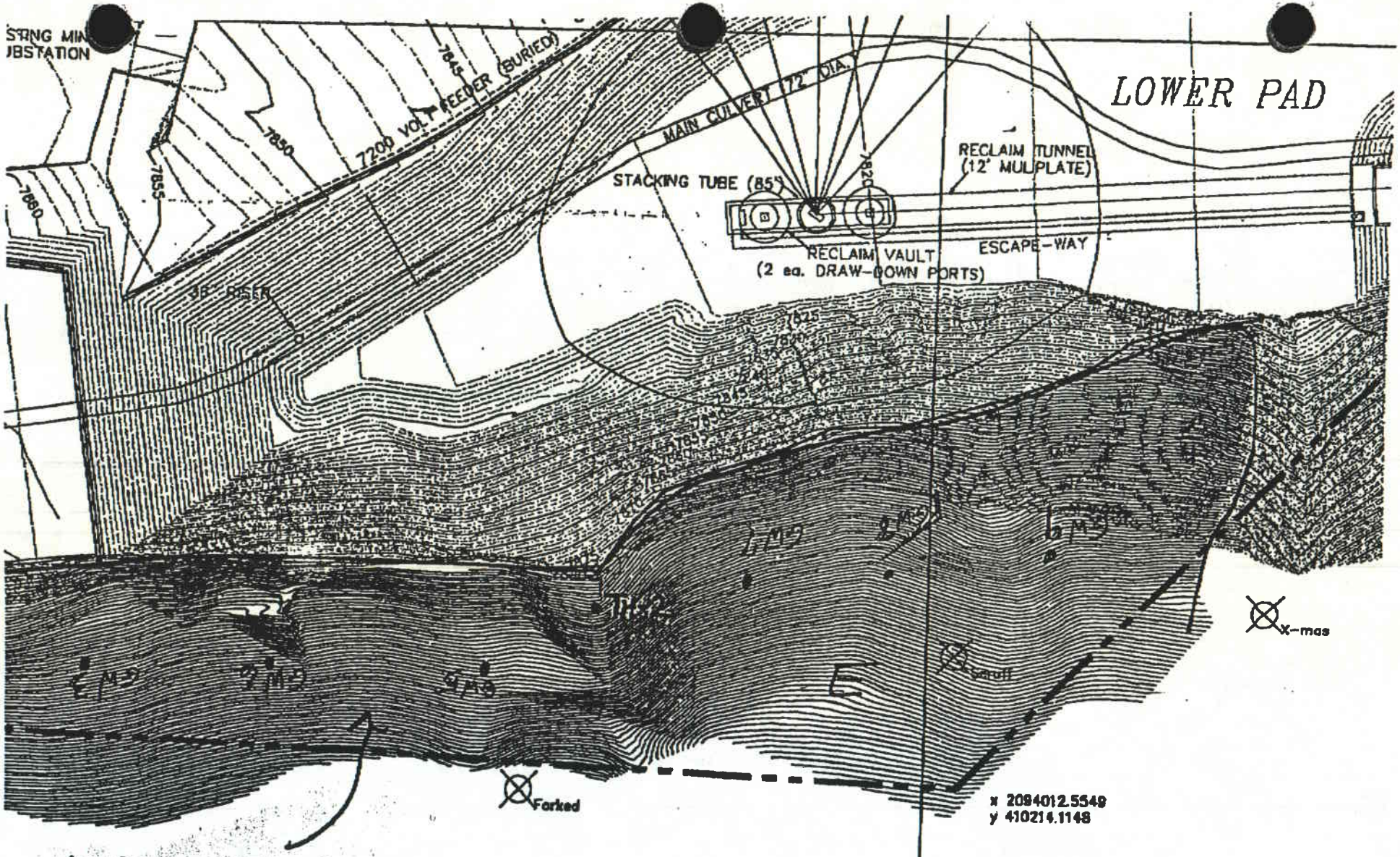
Jim N.

Call if you need to.



LEGEND:

JERSEY BARRIER



MAP UNIT E

END:

ERSEY BARRIER