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DIVISION OF OIL, GAS AND MINING

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May 12, 1999

TO: File

THRU: Joe Helfrich, Permit Supervisor

THRU: Daron Haddock, Permit Supervisor

FROM: Robert Davidson, Soils Reclamation Specialist RAD

RE: Soils Technical Analysis of the Permit Application Package, Lila Canyon Mine, Utah American Energy Corporation, Horse Canyon Mine, ACT/007/013-SR98-1, File #2, Carbon County, Utah

SUMMARY:

The PAP submittal for the Lila Canyon Mine received on February 11, 1999, was determined administratively complete on February 19, 1999. This Technical Analysis for soils is in response to the first submittal.

TECHNICAL ANALYSIS:

ENVIRONMENTAL RESOURCE INFORMATION

SOILS RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.21, 817.200(c); R645-301-220, -301-411.

Analysis:

Chapter 2, Soils, Sections 210 through 224, discusses the soil resources within the proposed Lila Canyon Mine. Relevant soils information includes prime farmland investigation, current and published soil surveys, soil characterizations, and substitute topsoil identification. The Analysis section discusses resource information as follows:

- Prime Farmland Investigation
- Soil Survey Information
- Soil Characterization

- Substitute Topsoil

Prime Farmland Investigation

A Prime Farmland site investigation was performed by the Natural Resources Conservation Service (NRCS). A determination was made that no Prime Farmland or farmland of statewide importance were found within the proposed Lila Canyon coal lease area and support facilities area because there is no developed irrigation system on arid soils. The determination letter from the NRCS dated June 8, 1998, was sent to Environmental Industrial Services and is included in Appendix 2-1.

Soil Survey Information

The soil survey information contains both general and site specific surveys as follows:

(1) General, Third Order Soil Survey

Appendix 2-2 and Soils Map 2-1 make up the general Order 3 soil survey. The unpublished Order 3 soil survey for Emery County is currently in progress by the U. S. Department of Agriculture , Natural Resource Conservation Service (NRCS). Portions of the Order 3 soil survey relevant to the Lila Canyon Mine project has been provided by the NRCS. The soil map (Plate 2-1) is scaled at 1:24,000 and includes map unit descriptions.

The Order 3 soil survey information provided by the NRCS identifies four soil map units at the mine surface facilities area as:

- BNE2 Strych very bouldery, fine sandy loam, 3 to 20 % slopes
- BMD Strych very stony fine sandy loam, 3 to 30 % slopes
- NGG2 Gerst-Strych-Badland complex, 30 to 70 % slopes
- R2H Travessilla family-rock outcrop family

In addition to the above soils, the Order 3 soil survey (Appendix 2-2) and soil map (Plate 2-1) provide identities and information on the following soils as located within the transportation and utility corridors:

- BL2 Badland
- NXC Travessilla sandy loam, 1 to 8 % slopes
- RR Senchert loam, 3 to 15 % slopes

Appendix 2-2 also provides typical soil pedon and soil descriptions for:

- Soil series - Strych, Gerst, Travessilla and Senchert
- Soil families - Travessilla and Senchert.

Additional soil map units are shown on the general Order 3 soil map 2-1 as located within the Permit Area "B" for Lila Canyon boundary. These include DHG2, DSG2, HUG, KXH, MHE, MRG, MSC, MUE, NVF2, RWG, UMF2, VMF2, and VOH. Soil names, soil descriptions, and soil pedon descriptions are not provide for these soil units, either on map 2-1 or in Appendix 2-2.

(2) Site specific, First Order Soil Surveys

In August 1998, a site specific Order 1 soil survey for the surface facilities area was performed and prepared by Mr. Daniel Larsen, Soil Scientist, Environmental Industrial Services (Appendix 2-3). The survey contains soil descriptions, soil pedon descriptions, soil salvage suitability analysis, laboratory soil testing data, field soil profile descriptions, soil and landscape photographs, soils map, and salvageable soils map. The detailed soil survey of the surface facilities site identifies six soil map units as follows:

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

All mapping and soil survey work were performed according to the standards of the National Cooperative Soil Survey. *However, the Order 1 soil survey map has discontinuous contour lines, for both 25 and 5 feet contour intervals.* Based on the site-specific soil descriptions, and laboratory data, each of the soils were classified according to current, unpublished NRCS soil taxonomy, and correlated to specific soil series names, as best could be determined since the NRCS Order 3 survey is unpublished and unfinished.

Soil productivity of existing soils was determined by Mr. George Cook from the Natural Resources Conservation Services and results are shown in Appendix 3-7.

Soil Characterization

Soil pedons were characterized by the soil horizons at each sampling location. All profile descriptions were recorded on standard NRCS forms and are provided in Appendix D within Appendix 2-3. The soil horizons at each sampling location were sampled and characterized according to the State of Utah Division of Oil, Gas and Mining (DOGM) guidelines for topsoil

and overburden[1]. Sampled parameters included: soil texture; pH; organic matter percent; saturation percent; electrical conductivity; $CaCO_3$; soluble potassium, magnesium, calcium and sodium; sodium absorption ratio, and extractable selenium and boron. Available water capacity, alkalinity, total nitrogen and available phosphorus were not analyzed at this time; these parameters can be tested at reclamation time. Organic matter percent was substituted for organic carbon. Soil texture by hand-texture method, rock fragment content (% by volume), and Munsell color were determined in the field by Mr Larsen. Generalized soil properties are summarized as follows, which includes percent surface stones and boulders for the Lila Canyon facilities site is for each soil type:

Map Unit	%Surface Stones & boulders	Soil Depth	% Slope	Permeability	Water Erosion Potential
SBG	3-8	Very Deep >60"	5-15	Moderate to Moderately rapid	Moderate low
VBJ	8-20	Very Deep >60"	5-15	Moderately rapid	Moderate low
XBS	20-40	Very Deep >60"	10-45	Moderately rapid	Low to moderate
DSH	<2	Very Deep >60"	3-8	Moderately rapid	Moderate
RBL	>50	Shallow to Deep	20-70	Slow to moderately rapid	Severe on shale, Low on rock
RBT	>50	Shallow	30-100	Slow to moderately rapid	Severe to Low

Soil samples were sent to Inter-Mountain Laboratories, Inc. for analysis. Appendix C of Appendix 2-3 contains the laboratory data sheets for all analysis on the 22 samples and duplicate analysis. Overall, soil laboratory test results show a good rating for soil materials, except as noted below:

[1]Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

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

- **Electrical Conductivity** and **SAR** were high in samples LC3 48-55" and LC5 40-58". For sample LC3 48-55", the SAR was 18 with an EC of 2.48. Since the SAR is greater than 15, soil materials below 48 inches are considered unacceptable. For sample LC5 40-58", the SAR measured 15 with an EC value of 8.89 mmhos/cm. The SAR is rated unacceptable for coarse textured soils and the EC is rated poor; therefore, soil materials below 40 inches are considered marginal at best.

  Sample LC10 0-4" had an EC of 2.58 mmhos/cm which has a rating of fair. All other samples had EC values ranging from 0.29 to 4.0 mmhos/cm, 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.

- **Available water holding capacity** values ranged from good to poor. The majority of samples were rated as fair; with LC1 0-3" rated poor; and LC1 10-23", LC5 29-40", LC5 40-58", and LC6 5-18" rated good.

- **Soluble boron** tested at less than 5.0 mg/kg on all samples, resulting in a good rating.

- **Extractable selenium** content tested at 0.2 mg/kg or less, which is considered good since all readings are less than 0.10 mg/kg.

- **Organic matter** content is relatively low in these soils. Generally, the surface soils ranged between 1.0 to 1.5 percent organic matter and the subsoils were about 0.5 percent.

- A **calcic horizon** was verified in soil pedons LC1, LC5 and LC6 with $CaCO_3$ ranging between 20 to 21 percent. Pedons LC3 and LC4 have some $CaCO_3$ accumulation in the subsoil but is less than the 15 percent needed to be classified as a calcic horizon.

- **Soluble magnesium** exceeded soluble calcium below depths of 30 inches. In general for these samples, the soluble calcium decreases and magnesium increases with depth.

  Normally, higher ratios of calcium to magnesium is desirable for plant growth. Magnesium usually tends to be leached from soil less readily than calcium, which often results with the total amount of calcium in soils exceeding that of magnesium. However, this is not the general rule, particularly for soils of humid region. The magnesium content

varies from negligible amounts in highly leached, sandy soils to as much as several percent in calcareous soils. Magnesium is supplied to plants primarily from exchangeable and soluble forms. Too high a proportion of exchangeable magnesium has an adverse effect on other exchangeable nutrient cations, thus, soils containing excess exchangeable magnesium tend to result in nutrient deficiencies for other cations.

- The **percent rock content** within the mine site disturbance or proposed facilities area is the main obvious deterrent for soil suitability based on the current DOGM guidelines. Although DOGM 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, the recent trend by DOGM is to salvage "**native soils**" with "**intrinsic or indigenous rock content.**" Appendix 2-3 reports that native soils can be salvaged containing a higher rock content than the DOGM guidelines deems acceptable. Ultimate site reclaimability using these rocky soils enhances reclamation success by providing an environment similar to native conditions. Higher rock content soils provide for a more stable reclaimed surface, aid in water harvesting and ultimate water holding capacity of interstitial soils, and create wildlife habitat and niches on the surface were surface boulders and larger cobble sized rocks are placed.

Substitute Topsoil

The PAP does not propose any borrow as a source for substitute topsoil.

Findings:

Information provided in the application is not considered adequate to meet the requirements of this section of the regulations. The applicant must provide the following in accordance with:

R645-301-222 through R645-301-222.300, Additional soil map units are shown on the general Order 3 soil map 2-1 as located within the Permit Area "B" for Lila Canyon boundary. These include DHG2, DSG2, HUG, KXH, MHE, MRG, MSC, MUE, NVF2, RWG, UMF2, VMF2, and VOH. For each map symbol provide soil name, soil description, and soil pedon description.

R645-301-141, The Order 1 soil survey map, both in Appendix 2-3 and on Plate 2-2, and the Salvageable Soils Map, Appendix A2 of Appendix 2-3, have discontinuous contour lines, for both 25 and 5 feet contour intervals. Present this map with continuous contour lines.

R645-301-222, Provide site specific information for soils located at the fan portal site. The Order 1 soil survey needs a soil pit, soil characterization and description.

OPERATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-230.

Analysis:

Chapter 2, Soils, Sections 230 through 234, discusses the soil's operation plan for the proposed Lila Canyon Mine. Topsoil protection incorporates traditional methods of salvaging/stockpiling. The Analysis section discusses operation information as follows:

- Topsoil and Subsoil Removal
- Topsoil Substitutes and Supplements
- Topsoil Storage

Topsoil and Subsoil Removal

Based on UDOGM guidelines and the Order 1 soil survey, Topsoil is suitable for reclamation has been identified and quantified as discussed and summarized in Appendix 2-3. As summarized in the PAP, topsoil salvage estimates are broken down according to soil survey map units. Although the Order 1 soil survey identified a maximum of about 157,600 cubic yards of soil for salvage from approximately 47.9 acres, the PAP estimates show that 140,789 cubic yards of soil is available for salvage from 38.95 acres. Accordingly, the following table shows salvage areas, acreage, depth of salvage and available volumes:

Topsoil Areas and Available Salvage Volumes			
Map Unit	**Salvage (inches)**	**Acres**	**Volume (yd^3)**
SBG	48	11.08	71,501
VBJ	30	9.51	38,336
XBS	12	8.89	14,307
DSH	40	1.56	8,373
RBL	8	7.01	7,543
RBT	6	0.90	729
Total		38.95	140,789

Potential salvage depths were generated for each map unit based on evaluations of all field and laboratory data. Topsoil salvage areas are broken down by soil survey map units and are identified on the Salvageable Soils Map, Appendix A2 of Appendix 2-3, Order 1 Soil Survey. The Salvageable Soils Map shows each soil survey map unit, soil description sites, and potential salvage depths.

The PAP defines "Topsoil" as suitable soil for plant growth, generally, the upper 6 to 12 inches that consist of both the A and B horizon materials. For the Lila Canyon site, below this depth, there is generally an increase in carbonates and rock fragments. The PAP states that Topsoil will be removed from surface disturbance areas where material will be excavated in order to achieve final yard configuration. Topsoil salvage will occur under the supervision of a soil scientist.

Soil Salvage Practices

Section 232.100 of the PAP concludes that actual topsoil salvage will average 8 inches over the 38 acres of disturbed area, which would result in a total volume of about 40,900 cubic yards of soil. Plate 2-3 shows an average of 8 inches being salvaged across the site. In addition, Sections 231.300 and 232.100 give reference to protecting soils in-place. Section 232.100 states that after topsoil removal, underlying soil materials will be used as fill or left in place.

State regulations R645-301-200 are specific in requiring that all soil be removed from the area to be disturbed. Therefore, all identified soils suitable for reclamation and available for salvage must be salvaged and protected for reclamation. Since the topsoil is less than six inches, salvage must include both the surface topsoil and suitable subsoils identified in the Order 1 soil

survey. The disparity between the 140,789 cubic yards of available topsoil salvage and the projected 40,900 cubic yards of topsoil salvage, leaves a deficit of nearly 100,000 cubic yards of topsoil that will presumably be left in-place. No soil may be used as fill or left in place. Leaving soils in-place is not a permitted practice for protecting topsoil resources according to the R645-301-200 regulations. All soil resources must be protected and preserved for reclamation and may not be used as construction fills or for any other construction purpose.

Sections 232.400 through 232.420 give reference to Section 232.600. Section 232.600 simply states that topsoil will be removed from excavation areas and stockpiled prior to construction activity; vegetation and boulders that might interfere with topsoil salvage would be removed previously. *The PAP needs to show and discuss areas of minor disturbance where soil salvage will not occur. If these areas don't exist, then the PAP needs to state that no such minor disturbance areas exist and that soil salvage will occur in every instance where surface disturbance will occur.*

Soil Segregation

Section 232.500 states that no subsoil segregation is necessary. Section 231.100 states that the upper 6 to 12 inches of soil is suitable for salvage with carbonates increasing with depth. The Order 1 soil survey shows that a **calcic horizon** is verified in soil pedons LC1, LC5 and LC6 with $CaCO_3$ ranging between 20 to 21 percent. Pedons LC3 and LC4 have some $CaCO_3$ accumulation in the subsoil but is less than the 15 percent needed to be classified as a calcic horizon. Based on soil suitability, salvageable soil is identified by depth for the entire site according to the Order 1 soil survey. *Salvageable subsoils that contain a calcic horizon need to be salvaged, segregated out from other subsoil horizons, stockpiled, and redistributed as calcic subsoil.*

According to R645-301-232.100 and R645-301-341, the Division strongly recommends the following: (1) Each of the different soils (e.g., SBG) need to salvaged separately, segregated, and stockpiled according to each of the seven soil types ; and (2) Segregated soil types need to be redistributed in a manner that will allow achievement of the vegetation performance standards of diversity and erosion control. Soil types strongly influence the biology performance standards of vegetation diversity and erosion control. The application indicates soils would be stored in a single storage pile and redistributed to a uniform thickness of eight inches. The soils on the slopes tend to be coarser and more resistant to erosion than those in flatter areas. Mixing the finer textured soils with the coarser textured soils would lead to more erosion on the slopes. Also, the reclaimed area would not have the same diversity of soils as presently exists, so there would be less diversity of habitats for plants and a less diverse plant community.

Adverse Conditions

Sections 232.700 and 232.710 state that topsoil can be salvaged on areas to be disturbed. Local exceptions may exist where topsoil can not be salvaged because of rockiness and steep slopes. *The PAP needs to discuss specific areas and identify those non-salvageable areas on the soil salvage map where conditions exist where soil can not be salvaged due to rockiness and steep slopes. On steep slopes accessible to construction machinery for constructing cutslopes, soils are expected to be salvaged. Either steep, rocky surface slopes are safe for constructing cut slopes and likewise soil salvage, or they're not safe for either activity. If steep, rocky slopes surface materials render themselves suitable for constructing purposes using conventional construction equipment, (e.g., cutslopes, sediment pond basins, and pad fill), then these same indigenous soil and rock material from the unconsolidated steep, rocky surfaces can likewise be salvaged and stockpiled for later reclamation use.*

There is no clear and obvious presentation in the PAP where cut and fill slopes will occur as described in the text. The PAP needs to provide a cut and fill contour map and correlate discussion from both operations and reclamation with the map.

Fan Portal Site

Section 232.100 gives reference to the exhaust fan site and soil salvage. The exhaust fan site could not be located on any map within the PAP. The text states that the fan site is located at the coal outcrop and that salvaged soil would be stored in a sperate topsoil stockpile at the fan site. The following are needed in the PAP:

- *The plan needs site specific soil resource information (Order 1 Soil Survey) for soils at the fan site.*
- *Locate the exhaust fan portal site on the PAP maps.*
- *The size and extent of the engineered fan site need to be appropriately scaled on the maps to ensure that the proposed disturbance area takes into account the extent of disturbance and the resulting volume of soils that will be salvaged.*

Rocks - Boulders and Large Stones

The PAP appendix 2-3 states that surface stones and boulders in the soil that are present during salvage operations, could be removed to a rock pile on site and held there until replacement. Protection of topsoil resources include salvaging "**native soils**" with "**intrinsic or indigenous rock content.**" Section 232.100 states that removal of large stones and boulders would be considered in volume estimates. However, Section 232.100 also states that boulders

and large stones will be used as fill materials. The following need clarification in the PAP:

- *Designate a "topsoil" rock stockpile on maps where salvaged rock will be stored for reclamation use.*

- *"Topsoil" rock stockpiles need to be appropriately signed and protected during life of mine.*

- *Or, include rock with soil salvage and store with soil in topsoil stockpile.*

- *Indigenous "topsoil" boulders, and large stones have intrinsic value for reclamation success and soil protection during reclamation and, therefore, must be salvaged and protected. This indigenous rock may not be used as fill materials during operations.*

PAP Inconsistencies

The PAP contains inconsistencies within Chapter Two and between other appendices and chapters. The following inconsistencies need to be corrected:

- *Section 231.100 references Section 232.300 for further discussion. Section 232.300 does not contain any discussion and references Section 231.100 for further discussion.*

- *Section 231.100 references Chapter 5 for review with the comment that Chapter 5 contains an "in-depth discussion of the construction plan" and that "Chapter 5 should be reviewed and thoroughly understood prior to continuing with the review of 231.100 section." No pertinent correlation could be identified between Section 231.100 and Chapter 5 for soil removal and stockpiling.*

Topsoil Substitutes and Supplements

Sections 224, 231.200, 232.720, 233, and 233.100 thru 233.400 state that "Studies show" no substitute topsoil is needed. *The plan needs to provide specific relevant information concerning the referenced studies.*

Rock Slope Material

Using R645-100, the rock slope material is by definition Underground Development Waste which is by definition Coal Mine Waste. All Coal Mine Waste must be properly disposed of in a Refuse Pile. A Refuse Pile means a surface deposit of coal mine waste that does not impound water, slurry, or other liquid or semi-liquid material. Underground Development Waste

is Defined by R645-100 as waste-rock mixtures of coal, shale, claystone, siltstone, sandstone, limestone, or related materials that are excavated, moved and disposed of from underground workings in connection with Underground Coal Mining and Reclamation Activities. *Therefore, the rock slope waste material must be identified as Underground Development Waste and disposed of properly in a Refuse Pile. If used as pad fill, The Pad fill must be permitted as a Refuse Pile.*

Refuse Piles

The PAP states that the refuse pile will be covered with 24 inches of soil. *Since this is a new mine with a known refuse pile anticipated, there is no reason not have 48 inches of the soil cover during reclamation to meet the requirements of R645-301-533.252. Therefore, enough substitute topsoil and soil supplements need to be salvaged and stockpiled to meet the 4 feet cover requirement for both the rock-slope refuse pile and the main refuse pile. The PAP needs to show where these substitute soils will be salvaged from and where they will be stockpiled. R645-301-232.720 states that all available substitute material must be made available. The RBL area has only an average of 8 inches of suitable soil, therefore, additional substitute soils need to be located and utilized elsewhere in the site where subsoils are much deeper. If no available substitute material can be made suitable for achieving the revegetation standards of R645-301-356, then the PAP needs to identify suitable substitute topsoil borrow. If substitute topsoil borrow is identified, then the permit application must provide the necessary environmental resource information and meet all other applicable regulations to permit a borrow site.*

Topsoil Storage

The application states that the stockpiled soil will be loosely piled and have an irregular, pitted surface or contour furrows. The following are needed:

- *Compaction - soil scrappers have been emphatically shown to induce soil compaction. The application needs to show how compaction will be alleviated, not only on the surface of the stockpile, but in the interior as well. Compaction must either be avoided by using other construction methods, or be alleviated as the pile is constructed.*

- *Surface roughening - contour furrows and constructing an irregular, pitted surface are not compatible practices. The application must commit to using one or the other exclusively. If contour furrows are used, the performance standard for eliminating erosion must be met. All proposed contour furrow work must be properly engineered for furrow placement, slope, and size to control erosion. For contour furrows, the application must contain design, maps, and cross sections.*

The application contains some information concerning topsoil pile size and dimensions. However, additional information is needed as follows:

- *Topsoil Stockpile - the topsoil stockpile needs to be sized to store 140,000 CY topsoil and segregated calcareous subsoil.*

- *Substitute Topsoil Stockpile - location, placement, storage and protection of salvaged substitute topsoil for reclaiming the refuse and waste piles.*

- *Stockpiles - Engineered drawings of projected stockpiles scale, sizing and placement. Drawings need to show engineered size, exact placement, and final configuration of each stockpile. In addition, the stockpile drawings need to show cross sections. Details are needed for the following stockpiles:*

  - topsoil stockpile,
  - calcareous subsoil stockpile,
  - substitute topsoil stockpile, and
  - "topsoil" rock (boulders and large stones) stockpile.

Findings:

Information provided in the application is not considered adequate to meet the requirements of this section of the regulations. The applicant must provide the following in accordance with:

R645-301-232.100 through R645-301-232.300, Salvage and protect all identified topsoil and subsoils suitable for reclamation. Since the topsoil is less than six inches, salvage must include both the surface topsoil and suitable subsoils identified in the Order 1 soil survey. No soil may be left in place and/or used as fill. Leaving soils in-place is not a permitted practice for protecting topsoil resources. All soil resources must be protected and preserved for reclamation and may not be used as construction fills or for any other construction purpose.

R645-301-232.400 through R645-301-232.420, Show and discuss areas of minor disturbance where soil salvage will not occur. If these areas do not exist, then state that no such minor disturbance areas exist and that soil salvage will occur in every instance where surface disturbance will occur.

R645-301-232.500, Salvageable subsoils that contain a calcic horizon need to be salvaged, segregated out from topsoil and other subsoil horizons, stockpiled, and

redistributed as calcic subsoil.

R645-301-232.700 and R645-301-232.710, Identify specific areas inaccessible for construction machinery where soils can not be salvaged due to adverse, unsafe or impractical conditions. All soils must be salvaged on steep slopes and/or rocky areas accessible to construction machinery for the purpose of constructing cutslopes or grading flat areas.

R645-301-120 and R645-301-140, Clearly identify, locate, and present where cut and fill slopes will occur as described in the text. Provide a cut and fill contour map correlated with discussions from both the operations and reclamation sections.

R645-301-140, Locate the exhaust fan portal site on the PAP maps. The size and extent of the engineered fan site need to be appropriately scaled to ensure that the proposed disturbance area takes into account the extent of disturbance and the resulting volume of soils that will be salvaged.

R645-301-231.100 through R645-301-232.300, and R645-301-234.100 through R645-301-234.240, The Order 1 soil survey identifies indigenous rock present on the surface of the soil and within each of the soil horizons. Indigenous "topsoil" boulders, and large stones have intrinsic value for reclamation success and soil protection during reclamation and, therefore, must be salvaged and protected. This indigenous "topsoil" rock may not be used as fill materials during operations.

- Designate a "topsoil" rock stockpile on maps where salvaged rock will be stored for reclamation use.

- Appropriately sign and protect "topsoil" rock stockpiles during life of mine.

- Or, include rock with soil salvage and store with soil in topsoil stockpile.

R645-301-120, Correct the following inconsistencies:

- Section 231.100 references Section 232.300 for further discussion. Section 232.300 does not contain any discussion and references Section 231.100 for further discussion.

- Section 231.100 references Chapter 5 for review with the comment that Chapter 5 contains an "in-depth discussion of the construction plan" and that "Chapter 5 should be reviewed and thoroughly understood prior to continuing with the review of 231.100 section." No pertinent correlation could be identified between Section 231.100 and Chapter 5 for soil removal and stockpiling.

R645-301-120, R645-301-224, R645-301-231.200, R645-301-232.720, and R645-301-233 through R645-301-233.400, Chapter Sections 224, 231.200, 232.720, 233, and 233.100 thru 233.400 state that "Studies show" no substitute topsoil is needed. The plan needs to provide specific relevant information concerning the referenced studies.

R645-301-100 (Underground Development Waste, Coal Mine Waste, Refuse Pile), R645-301-528.200 through R645-301-528.322, and R645-301-536 through R645-301-536.900, The rock-slope waste material must be identified as Underground Development Waste. Place and properly dispose of all Underground Development Waste in a Refuse Pile. If Underground Development Waste is used as pad fill, then the pad fill must meet the permit requirements for an approved disposal area.

R645-301-553.252, The PAP states that the refuse pile will be covered with 24 inches of soil. Correct the PAP so that the refuse pile, upon final grading is covered with a minimum of four feet of the best available, nontoxic and noncombustible material.

R645-301-233, and R645-301-242.100 through R645-301-242.110, Locate additional substitute topsoil resources to meet reclamation requirements to cover the refuse pile areas with 4 feet of suitable material. The refuse pile is located in the RBL soil unit. Salvageable soils within the RBL soil unit average only 8 inches of suitable material. The following are needed:

- Identify, salvage and stockpile additional substitute topsoil resources to meet the excess requirement for 4 feet of cover on the refuse pile.

- If no additional substitute material is available to achieve the 4 feet of cover and for achieving the revegetation standards of R645-301-356 on the reclaimed refuse pile areas, then the PAP must identify and permit a suitable substitute topsoil borrow area.

R645-301-234.220 through R645-301-234.230, The application states that the stockpiled soil will be loosely piled and have an irregular, pitted surface or contour furrows. The following are needed:

- Compaction - soil scrappers have been emphatically shown to induce soil compaction. The application needs to show how compaction will be alleviated, not only on the surface of the stockpile, but in the interior as well. Compaction must either be avoided by using other construction methods, or be alleviated as the pile is constructed.

- Surface roughening - contour furrows and constructing an irregular, pitted surface are not compatible practices. The application must commit to using one or the other

exclusively. If contour furrows are used, the performance standard for eliminating erosion must be met. All proposed contour furrow work must be properly engineered for furrow placement, slope, and size to control erosion. For contour furrows, the application must contain design, maps, and cross sections

R645-301-234.200 through R645-301-234.240, R645-301-521.160, R645-301-521.165, The application contains some information concerning topsoil pile size and dimensions. However, additional information is needed as follows:

- Topsoil Stockpile - the topsoil stockpile needs to be sized to store 140,000 CY topsoil and segregated calcareous subsoil.

- Substitute Topsoil Stockpile - location, placement, storage and protection of salvaged substitute topsoil for reclaiming the refuse and waste piles.

- Stockpiles - Engineered drawings of projected stockpiles scale, sizing and placement. Drawings need to show engineered size, exact placement, and final configuration of each stockpile. In addition, the stockpile drawings need to show cross sections. Details are needed for the following stockpiles:
  - topsoil stockpile,
  - calcareous subsoil stockpile,
  - substitute topsoil stockpile, and
  - "topsoil" rock (boulders and large stones) stockpile.

Recommendation:

R645-301-232.100 and R645-301-341, the Division strongly recommends the following: (1) Each of the different soils (e.g., SBG) need to salvaged separately, segregated, and stockpiled according to each of the seven soil types ; and (2) Segregated soil types need to be redistributed in a manner that will allow achievement of the vegetation performance standards of diversity and erosion control.

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-240.

Analysis:

Chapter 2, Soils, Sections 240 through 244, discusses the soil's reclamation plan for the proposed Lila Canyon Mine. The Analysis section discusses reclamation information as follows:

- Soil Redistribution
- Soil Nutrients and Amendments
- Soil Stabilization

Soil Redistribution

Section 241 references Appendix 5-8 for an in-depth discussion of the reclamation plan for the Lila Canyon Mine. Appendix 5-8 states that 47.9 acres will be reclaimed. Chapter 2 Soils states that 38.95 acres will be disturbed. *The plan needs to be in agreement between amount of disturbance and reclamation acreage.*

Reclamation will begin once all surface facilities and structures have been demolished and removed. Cut areas will be restored to approximate original contour. Cut areas will be backfilled and regraded using fill material taken from adjacent pad areas. Reclamation of slopes will take place in vertical increments (lifts) simultaneously with the reclamation of the pad area in corresponding lifts. The adjacent hillside will be reclaimed and revegetated. Furthermore, the plan states that much of the revegetation efforts on these slopes can be accomplished by using the adjacent pad fill areas as a work platform for equipment and materials. *The following are needed:*

- *It is not obvious or clear in the PAP where cut and fill slopes will occur as described. Therefore, the PAP needs a cut and fill contour map to correlate discussion concerning backfilling cut slopes from adjacent pad areas.*

- *Clarification is needed for illustrating where adjacent pad areas are located within the disturbed area that will be used as work platforms for backfilling cut slopes and newly exposed hillsides.*

- *The statement that the adjacent reclamation pad area will be reclaimed in corresponding lifts is unclear since the pad is being removed, not built up.*

Section 242 states that after approximate original contour (AOC) is achieved, the surface will be prepared. Pocking will be the primary method for roughening the AOC surface. Pocking is described as imprinting the soil surface with a pattern of depressions measuring approximately 18 inches by 24 inches by 8 inches deep. This would be an absolute minimum for pock size. The best available technology will be used for enhancing the ability of the soil to absorb moisture. *Clarification is needed as follows:*

- *Describe if Pocking will occur before or after topsoil placement.*
- *Describe the density of pock placement on the soil surface.*

Section 242.100 states that previously stockpiled topsoil will be redistributed on the same areas in a uniform thickness of approximately 8 inches on the scarified, postming regraded fill surface. On flat areas, soil will be reapplied using road grader and/or crawler tractor. On steep slope areas, soil will be reapplied using a front-end loader, crawler tractor, and/or trackhoe. Soil will be applied in horizontal lifts. Boulders will be replaced to achieve a near natural surface condition. Alleviating or minimizing soil compaction is not discussed. *The following are needed:*

- *Describe methods for minimizing and alleviating fill and replaced subsoil and topsoil compaction.*
- *Describe methods for reducing soil slippage between the fill and soil interface.*
- ***At best** to allow achievement of the vegetation performance standards of diversity and erosion control, segregated soil types need to be redistributed in the same area and at the same depth they were salvaged from. Soil types strongly influence the biology performance standards of vegetation diversity and erosion control. **At worst**, mixed soils should be redistributed at the same depth in those areas where they were salvaged.*
- *Salvaged and stockpiled "topsoil" rock (boulders and large stones) need to be reincorporated with the redistributed topsoil, and replaced on the ground surface.*
- *Sections 242.300 through 242.320 reference Section 242.100. Section 242.100 does not address Sections 242.300 through 242.320. The plan needs to address R645-301-242.300 through R645-301-242.320.*

Soil Nutrients and Amendments

Sections 231.300 and 243 state that topsoil will be sampled, as it is hauled from the

storage piles, and tested for nitrogen, phosphorus and potassium content. One grab samples will be taken from each truck load. Field measurements will be used for pH and EC parameters to allow immediate identification of salinity problems and acid problems. If problems are identified in the field, additional sampling will better define the extent and nature of the problem. *Sections 231.300 and 243 give reference to topsoil field sampling and testing. All sampling, testing and result interpretation must be done by a qualified soil scientist. The soil scientist must be shown to be qualified to sample, test and interpret data results. An amendment attesting the soil scientist qualifications must be filed with the Division to obtain approval prior to sampling and testing of the topsoil material.*

Section 243 states that based on laboratory analyses, nutrients and soil amendments will be added to make the redistributed soil similar to the undisturbed soils and aid in establishment of vegetation cover. The plan states that the nutrients and amendments can be added by hydroseeding, broadcasting, or by drilling. If the nutrients and amendments are broadcast to the ground surface, they will be intermixed with the soil by discing or raking. *Drilling, discing or raking are not compatible with extreme rocky soils, rocky surfaces, or with surfaces that have been deep gouged or pocked. Correct the plan to indicate surface preparation practices that are compatible with the rocky soil and surfaces, and that are consistent with other reclamation practices (e.g., pocking).*

Soil Stabilization

Section 244.100 states that vegetation will be the primary method for controlling erosion and fugitive dust. Other measures that will help in erosion control and soil stabilization is pocking and rock placement.

Section 244.200 states that pocking will be the primary method used to roughen the soil surface. In addition, wood fiber mulch will be applied at a rate of 2,000 pounds per acre to the reclaimed areas that have been regraded and covered by topsoil or substitute topsoil. The wood fiber mulch will be tacked to the surface with a tackifier. *The Division recommends using composted sewage sludge as a soil treatment. Past experience has shown that composted sewage sludge has been very effective in helping alleviate soil crusting, reducing soil bulk density, and improving water infiltration. In addition, as with other organic matter amendments, the use of composted sewage sludge builds soil structure which improves water retention and helps control erosion.*

Findings:

Information provided in the application is not considered adequate to meet the requirements of this section of the regulations. The applicant must provide the following in accordance with:

R645-301-120, The following items are needed to help add clarity and eliminate discrepancies in the plan:

- Appendix 5-8 states that 47.9 acres will be reclaimed. Chapter 2 Soils states that 38.95 acres will be disturbed. The plan needs to be in agreement between amount of disturbance and reclamation acreage.

- It is not obvious or clear in the PAP where cut and fill slopes will occur as described. Therefore, the PAP needs a cut and fill contour map to correlate discussion concerning backfilling cut slopes from adjacent pad areas.

- Clarification is needed for illustrating where adjacent pad areas are located within the disturbed area that will be used as work platforms for backfilling cut slopes and newly exposed hillsides.

- The statement that the adjacent reclamation pad area will be reclaimed in corresponding lifts is unclear since the pad is being removed, not built up.

R645-301-242, R645-301-244, The following are needed to help clarify and describe soil redistribution, placement, and stabilization:

- Describe whether Pocking will occur before or after topsoil placement. Describe the density of pock placement on the soil surface.

- Describe methods for minimizing and alleviating fill and replaced subsoil and topsoil compaction.

- Describe methods for reducing soil slippage between the fill and soil interface.

- **At best** to allow achievement of the vegetation performance standards of diversity and erosion control, segregated soil types need to be redistributed in the same area and at the same depth they were salvaged from. Soil types strongly influence the biology performance standards of vegetation diversity and erosion control. **At worst,** mixed soils should be redistributed at the same depth in those areas where they were salvaged.

- Salvaged and stockpiled "topsoil" rock (boulders and large stones) need to be reincorporated with the redistributed topsoil, and replaced on the ground surface.

- Drilling, discing or raking are not compatible with extreme rocky soils, rocky surfaces, or with surfaces that have been deep gouged or pocked. Correct the plan to

indicate surface preparation practices that are compatible with the rocky soil and surfaces, and that are consistent with other reclamation practices (e.g., pocking).

R645-301-242.300 through 242.320, Sections 242.300 through 242.320 reference Section 242.100. Section 242.100 does not address Sections 242.300 through 242.320. The plan needs to address R645-301-242.300 through R645-301-242.320.

R645-301-130, Sections 231.300 and 243 give reference to topsoil field sampling and testing. All sampling, testing and result interpretation must be done by a qualified soil scientist. The soil scientist must be shown to be qualified to sample, test and interpret data results. An amendment attesting the soil scientist qualifications must be filed with the Division to obtain approval prior to sampling and testing of the topsoil material.

Recommendation:

R645-301-232.100 and R645-301-341, the Division recommends using composted sewage sludge as a soil treatment. Past experience has shown that composted sewage sludge has been very effective in helping alleviate soil crusting, reducing soil bulk density, and improving water infiltration. In addition, as with other organic matter amendments, the use of composted sewage sludge builds soil structure which improves water retention and helps control erosion.