ATTACHMENT OP-5b

Lost Creek Project
Order 1 Soil Survey - Access Road Corridors & Deep Well Injection Sites
February 2010

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ADDENDA

ABBREVIATIONS AND ACRONYMS

AATA	AATA International, Inc.
ABP	acid-base potential
As	arsenic
B	boron
BLM	Bureau of Land Management
Cu	copper
EC	electrical conductivity
Fe	iron
GIS	Geographic Information System
K	potassium
LQD	Land Quality Division
Mg	magnesium
Mn	manganese
Mo	molybdenum
NCSS	National Cooperative Soil Survey
NO_3-N	nitrate as nitrogen
NRCS	National Resource Conservation Service
OM	organic matter
P	phosphorus
Permit Area	Lost Creek Permit Area
Project	Lost Creek Project
QA/QC	quality assurance/quality control
SAR	sodium adsorption ratio
Se	selenium
SMU	Soil Mapping Unit
TFN	Temporary Filing Number
WDEQ	Wyoming Department of Environmental Quality
Zn	zinc

1.0 Introduction

The Lost Creek Project (Project), a proposed in-situ uranium mine, is located in Sweetwater County, on the northeastern edge of the Great Divide Basin of south-central Wyoming, approximately 38 miles northwest of Rawlins. This report describes the soils of the access road corridors and deep well injection sites of the Lost Creek Permit Area.

Soils in Sweetwater County had not been mapped as part of the National Cooperative Soil Survey (NCSS), although two empirical studies were conducted at the 1:100,000 and the 1:500,000 scales (Munn and Arneson, 1998 and 1999). AATA International, Inc. (AATA) of Fort Collins, Colorado completed an Order 3 field survey of the Permit Area in the summer of 2006. The results of the Order 3 survey were submitted to the Land Quality Division (LQD) of the Wyoming Department of Environmental Quality (WDEQ) in December 2007 as **Appendix D7** of the Lost Creek Permit application (LQD Temporary Filing Number [TFN] 4 6/269).

In accordance with LQD Guideline No. 1 (WDEQ-LQD, 1994), a more detailed Order 1 soil survey is needed for the portions of the Permit Area where mining-related surface disturbance is proposed. The Plant site is one of the first proposed surface disturbance areas of the Project; therefore, an Order 1 soil survey was conducted at the Plant site in September 2008. The results of that survey are included in **Attachment OP-5a**. Survey work was conducted concurrently at Mine Unit 1, another area of proposed disturbance, and the results were submitted to WDEQ-LQD in the Mine Unit 1 package in December 2009.

The most recent soil surveys occurred in September 2009. These included an Order 3 survey of the East and West Access Roads outside the main Permit Area, and an Order 1 survey of the deep injection well sites and access corridors within the main Permit Area. The results of the Order 3 survey are included in Appendix D - East and West Roads, and the results of the Order 1 survey are included in this attachment.

2.0 Summary of Previous Soil Surveys

As noted above, soil surveys of the general area had not been completed by either the Natural Resources Conservation Service (NRCS) or the Bureau of Land Management (BLM). However, two soil surveys were completed for the Lost Creek Project as part of the baseline characterization and permitting process.

An initial Order 3 soil survey was completed for the entire permit area in 2006 and included soils mapping, profile description, and sampling for laboratory analysis

(**Appendix D7**). Nineteen soil pits were excavated by backhoe and each soil profile was described. Soil samples from nine of the 19 pits (LCSP1, LCSP3, LCSP5, LCSP6, LCSP7, LCSP11, LCSP13, LCSP13, LCSP14, LCSP17, and LCSP19) were collected for laboratory analysis and their locations are shown on the soils map (**Figure D7-2**). Three soil map units were mapped and described although the soils were classified to the family level and not the individual soil series level. The three map units were: (1) Typic Torriorthents, loamy, mixed mesic, (2) Typic Torriorthents, fine-loamy, mixed, mesic, and (3) Typic Torriorthents, fine-loamy over sandy, mixed mesic. The soils report concluded that the three map units are roughly equally productive, and that plant growth is limited by precipitation and not by soil fertility. Suitable topsoil depths ranged from 5 to 15 inches for the Typic Torriorthent, loamy map unit, from 9 to 27 inches for the Typic Torriorthent, fine-loamy map unit, and from 10 to 15 inches for the Typic Torriorthent, fine-loamy over sandy map unit.

A detailed Order 1 soil survey was subsequently completed for the "Plant Site and Mine Unit 1", in September 2008 by Dr. Jan Cipra, Professor of Soil Science at Colorado State University in Fort Collins, Colorado. Although the projected disturbance area was anticipated to be approximately 60 acres (10 acres at the Plant Site and 50 acres at Mine Unit 1), the Order 1 survey area covered approximately 165 acres to ensure adequate coverage. Initially, soils were examined at 35 locations to a depth of 60 inches or to the "C" horizon. Subsequently, 10 representative locations were selected for profile description and soil sampling. Three soil map units were mapped and described: Pepal sandy loam, Teagulf sandy loam, and Poposhia loam. For the Pepal sandy loam map unit, comprising the largest areal extent, five locations were described and sampled. For the Teagulf sandy loam map unit, three locations were described and sampled, and for the Poposhia loam map unit, two locations were described and sampled. After examining the 10 soil profile descriptions, samples from six sites (two for each of the three map units) were selected for laboratory analysis. For the Plant Site, the sampling locations are shown on **Figure OP-5a-1** of **Attachment OP-5a,** and sampling locations and depths are listed on **Table OP-5a-2**. The Mine Unit 1sampling locations are shown on **Figure MU1 A3-1-1** of **Attachment MU1 3-1** of the Mine Unit 1 package, and sampling locations and depths are shown on **Table A3-1-1**. The survey indicated that all three map units provide a favorable medium for plant growth though the depth of topsoil varies between units.

In response to comments from WDEQ-LQD, the Permit Area was expanded to include the East and West Access Roads. The baseline information for the road corridors was incorporated into a new **Appendix D - East and West Access Roads**. An Order 3 soil survey was conducted along those corridors in September 2009 (see **Appendix D-E&W-7** and **Figures D7-E&W-1a and 1b**). The Order 3 survey was done in conjunction with the Order 1 soil survey, described in this attachment, of the access corridors and deep well sites in the main Permit Area. No new soil map units were found during the September 2009 soil work.

3.0 Methodology

The Order 1 soil survey work plan was developed based on LQD Guideline No. 1 (WDEQ-LQD, 1994). The soil survey was conducted according to protocols in the National Soil Survey Handbook, which provides the major principles and practices used in standard soil surveys (Soil Survey Staff, 1993). Information was recorded on Soil Description Field Sheets. Copies of all the original sheets are included in **Addendum OP-5b-1**.

Soils were identified and mapped at four proposed deep well sites. The deep well sites are identified as North West Pad (NW Pad), North Central Pad (NC Pad), North East Pad (NE Pad), and South East Pad (SE Pad). The location of each site, and the identification number of the deep well at each site, are listed on **Table OP-5b-1**. Mapping at each deep well site covered an area of about ¼ acre. At three of the sites (NW Pad, NC Pad, and NE Pad), the anticipated access road corridors from the sites to the main access corridor were also mapped in areas where new roads would need to be built (i.e., where existing two-tracks could probably not be used). Some lands adjacent to these areas were also included in the soils mapping. At least one profile was sampled at each of the deep well sites.

The deep well in the SW¼ of Section 25 (Well WDW1) was installed in late 2008 to provide the necessary information for the WDEQ-WQD Class I permit application. Because the well area had already been disturbed and reclaimed before 2009 and because no upgrades to the existing road to the well area are planned, no mapping was conducted. Two locations for the SE Pad (Pad and Pad2) were mapped, but SE Pad PR-1 was not sampled because the pad site was subsequently moved.

Soils were also identified and mapped along the main access corridor. This corridor extends east to west from the southwest portion of T25N, R92W, Section 16 across portions of Sections 17, 18, and 19 to the southwest corner of Section 19, Township 25 North, Range 92 West. At the east and west ends, the corridor coincides with an existing road, but a new road is planned through the central portion of the Permit Area. Soils were identified and mapped along the corridor, and eight profiles along the corridor were sampled. These profiles are identified as EW Rd PR-1 through PR-8 on **Table OP-5b-1**.

The Order 1 soil survey was completed in September 2009 by Jim Nyenhuis, Certified Professional Soil Scientist/Soil Classifier (ARCPACS 2743) with the assistance of Mr. Duncan Eccleston (AATA). The samples were delivered to Colorado State University's Soil Testing Laboratory in Fort Collins, Colorado, for standard analysis (WDEQ, 1996).

3.1 Soil Survey

Soils mapping, sampling, description, and taxonomic classification was conducted in accordance with specifications of Guideline No.1 (WDEQ, 1996), and the procedures and standards of the National Cooperative Soil Survey (Soil Survey Staff, 1993 and 1999; and Schoeneberger et al., 2002). The survey sites were mapped at the Order 1 level of intensity on 1"=400' scale, orthophoto-quad base maps with topographic contour overlay. The survey sites were initially accessed by automobile and then traversed on foot. Soil map unit boundaries were delineated by exposing soil profiles where possible using a sharpshooter and bucket auger as well as observing surface conditions, vegetation, slope gradient and slope aspect. The results of the mapping are shown on **Figures OP-5b-1** through **OP-5b-5**.

Following soils mapping, representative locations were selected for all major soils within the survey area, and these sites were fully described and sampled from backhoe pit excavations. The field notes and photographs associated with these sites are included in **Addenda OP-5b-1** and **OP-5b-2**, respectively. A total of sixty-five soil samples were collected from fifteen representative sample locations. The sampling locations are shown on **Figures OP-5b-1** through **OP-5b-5**.

3.2 Laboratory Analysis

The soil laboratory analyses included: pH; electrical conductivity (EC); saturation percent; calcium; magnesium; sodium; and potassium (in milliequivalents per liter); calculation of Sodium Adsorption Ratio (SAR); organic matter percent (Walkley Black method); soil texture (percent sand, silt, and clay); lime estimate, selenium (Se, extractable parts per million), boron (B, Hot Water milligrams per kilogram), and several macro and micronutrients including nitrate as nitrogen (NO3-N), Phosphorus (P), Potassium (K), Zinc (Zn), Iron (Fe), Manganese (Mn), and Copper (Cu). Several parameters were not analyzed because previous results were all suitable and no concerns for suitability or salvageability were noted. These parameters included Acid Potential, Lime as CaCO3, and Neutralization Potential (used for the calculation of Acid-Base Potential, ABP), as well as Arsenic (As) and Molybdenum (Mo). Some duplicate analysis was conducted for quality assurance/quality control (QA/QC) purposes. The results of the soil laboratory analysis are included in **Table OP-5b-2**, and the laboratory report is included in **Addendum OP-5b-3**.

4.0 Results and Discussion

The results of the soils field mapping and profile descriptions, and soils laboratory analysis, were used to evaluate soil suitability and generate soil salvage recommendations. The suitability evaluation and salvage recommendation was completed for all soil map units. The evaluation followed parameters and threshold values contained in Table I-2 "Criteria to establish suitability of topsoil (or topsoil substitutes)" of Guideline No.1 "Topsoil and Overburden" (WDEQ, 1996). Unsuitability threshold values include: pH <5.0 or > 9.0, EC >12; SAR >15, or SAR >12 for soils with greater than 40% clay; coarse fragment content >35%; saturation percent <25% or >80% (marginal rated); and sand, clay, or silty clay texture (marginal rated) (WDEQ, 1996).

The representative soil profile descriptions included in the text of the report include added information for each soil horizon taken from the soils laboratory data. Data values for soil reaction (pH), EC, sodicity (SAR), and organic matter content (OM%) are added to the profile descriptions to indicate whether a particular soil or individual horizons within a soil have high, moderate, or low values concerning pH, EC, SAR, and OM. A modifier phrase is also added next to these values to indicate relative status, as follows.

For pH values, modifier terms are taken from standard NRCS sources (Soil Survey Staff, 1993) as follows: Ultra Acid (<3.5), Extremely Acid (3.5-4.4), Very Strongly Acid (4.5-5.0), Strongly Acid (5.1-5.5), Moderately Acid (5.6-6.0), Slightly Acid (6.1-6.5), Neutral (6.6-7.3), Slightly Alkaline (7.4-7.8), Moderately Alkaline (7.9-8.4), Strongly Alkaline (8.5-9.0), and Very Strongly Alkaline (>9.0). For EC values, modifier terms are also taken from standard NRCS sources (Soil Survey Staff, 1993) as follows: Non Saline (0-2), Very Slightly Saline (2-4), Slightly Saline (4-8), Moderately Saline (8-16), and Strongly Saline (>16). For degrees of sodicity (SAR), modifier terms have been constructed based on a review of recent NRCS material as well as well as thirty-years experience with site-specific soils in Wyoming, as follows: Non Sodic (0-2), Slightly Sodic (2-8), Moderately Sodic (8-15), Highly Sodic (15-30), and Very Highly Sodic (>30). And for organic matter content (OM%), modifier terms have been taken from Colorado State University's Soil Testing Laboratory standards (CSU, 1976) as follows: Low (0.0-1.0%), Medium (1.1-3.0%), High (3.1-10.0%), and Very High (>10.0%).

The recommended soil salvage depths are listed and described in the soil map unit descriptions presented in the following results section. Topsoil volumes for salvaged soils are in the Operations Plan (**Section OP 2.5**).

4.1 Soil Survey

The Lost Creek Project Area is within a “frigid” soil temperature regime (average annual air temperature of about 40 to 45 degrees F.) and a “typic-aridic” to "ustic-aridic" soil moisture regime (mean annual precipitation about 8 to 12 inches). The frost free period (growing season) for a “frigid” soil temperature regime is about 85 to 110 days. Three soil map units were delineated in the September 2009 survey area, and these are the same map units that were used in the previous “Plant Site and Mine Unit 1” soil surveys. The map units are Pepal sandy loam (1 to 3 percent slopes), Teagulf sandy loam (3 to 7 percent slopes), and Poposhia loam (0 to 1 percent slopes).

Figures OP-5b-1 through **OP-5b-5** show the detailed Order 1 soils mapping of the proposed access road corridor, the four well injection sites (NW Pad, NC Pad, NE Pad, and SE Pad), and their associated short access road corridors. The mapping was completed on a 1”=400’ scale, orthophoto-quad base map with topographic contour overlay. The map legend includes a list of all soil map units. All fifteen soil profile description/sample site locations are plotted on the maps as well. Digital photographs were taken of each soil pit with sample site number and measurement tape included. The photographs are included in **Addendum OP-5b-2**.

4.1.1 Pepal Sandy Loam

Pepal sandy loam is the dominant soil on the survey area and is a deep, well drained soil developing in calcareous “coarse-loamy” alluvium. Pepal sandy loam occupies nearly level to gently sloping (one to three percent slopes) undulating uplands with dominant Wyoming Big sagebrush vegetation. Pepal sandy loam was described at ten representative locations on the survey area and sampled at nine of those: NW Pad PR-1, NW Pad PR-2, NC Pad PR-1, SE Pad2 PR-2, NE Pad PR-1, NE Pad PR-2, EW Road PR-3, EW Road PR-5, EW Road PR-6, and SE Pad PR-1. Samples from SE Pad PR-1 were not analyzed in the soils lab.

Although the entire deep profile of Pepal sandy loam is “suitable” or “marginally suitable” from a reclamation suitability perspective, only the best, most fertile, upper layers of Pepal are recommended for salvage. The upper 14 to 18 inches of Pepal sandy loam contains the “A” horizon surface layer and the underlying upper “B” horizon subsoil layer. This is the best soil material and has a combination of suitable soil texture (dominantly sandy loam or loam), soil structure, soil organic matter, and is neither saline nor sodic. As such, the upper 16 inches (the average depth of the best topsoil across the 10 sampled Pepal locations) are recommended for topsoil salvage and should be stored in protected and seeded topsoil storage piles until needed in reclamation activities.

Pepal is an established soil series of moderate extent in southwestern Wyoming and is currently classified as a "Coarse-loamy, mixed, superactive, frigid Typic Haplocalcid". The most recent "Official Soil Series Description" for Pepal, dated December 1999, is included in **Addendum OP-5b-4**. Typically, Pepal has an "A" horizon surface layer is a brown to dark brown, noncalcareous sandy loam about 3 inches thick. The underlying "Bw" cambic subsoil horizon is a yellowish brown, noncalcareous to slightly calcareous sandy loam to loam about 9 inches thick with a range of thickness from 5 to 13 inches. The underlying "BCk" calcic subsoil horizon is a pale brown to brown, highly calcareous sandy loam to a depth of about 16 to 30 inches with an average thickness of about 10 inches. The underlying "C" horizon to "Cr" paralithic material substratum is a very pale brown to brownish yellow, strongly calcareous coarse sandy loam with common thin strata of various textures to an average depth of about 52 inches.

Sample site "EW Road PR-6" was selected as typical for Pepal sandy loam and its full profile description is provided below. As stated above, the field profile descriptions for all ten Pepal sandy loam sample locations are contained in **Addendum OP-5b-1**.

Pepal sandy loam Typical Pedon "EW Road PR-6" Profile Description:
4% slope; South aspect; Wyoming big sagebrush, mixed grasses, and a few cushion plants vegetation; local alluvium; upland sideslope; stable surface with slight erosion in vicinity of sample site; described and sampled September 11, 2009.

A horizon - 0 to 3 inches; pale brown (10YR 6/3) sandy loam with 10% small gravels, brown (10YR 5/3) moist; moderate medium granular structure; soft to slightly hard dry consistence, friable moist consistence, and sticky and slightly plastic wet consistence; many fine and very fine, and few medium and coarse roots; noneffervescent; pH=7.0 (neutral), EC=0.2 (nonsaline), SAR=0.6 (nonsodic), OM=1.0% (low); clear smooth boundary.

Bw horizon - 3 to 14 inches; brown (7.5YR 5/4) sandy clay loam with 5% small gravels, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard dry consistence, firm moist consistence, sticky and slightly plastic wet consistence; many fine and very fine, and few medium and coarse roots; noneffervescent; pH=7.3 (neutral), EC=0.10 (nonsaline), SAR=1.1 (nonsodic), OM=0.6% (low); gradual wavy boundary.

BCk horizon - 14 to 28 inches; pale brown (10YR 6/3) sandy loam with 25% small gravels, brown (10YR 5/3) moist; massive structure; hard to slightly hard dry consistence, friable moist consistence, slightly sticky and nonplastic wet consistence; few coarse, medium, fine, and very fine roots; strongly effervescent; from lab data: pH=8.6 (strongly alkaline), EC=0.2 (nonsaline), SAR=1.0 (nonsodic), OM=0.5% (low); gradual wavy boundary.

C/Cr horizon - 28 to 56 inches; yellow (10YR 7/6) sandy loam with 18% small gravels, brownish yellow (10YR 6/6) moist; massive structure; slightly hard dry consistence, friable moist consistence, nonsticky and nonplastic wet consistence; few fine and very fine roots; strongly effervescent; from lab data: pH=8.3 (moderately alkaline), EC=2.1 (very slightly saline), SAR=8.9 (moderately sodic), OM=0.9% (low); gradual wavy boundary.

4.1.2 Teagulf Sandy Loam

Teagulf sandy loam is a shallow to moderately deep, well drained soil developing in calcareous "coarse-loamy" alluvium and residuum from sandstone, siltstone, mudstone, or shale. Teagulf sandy loam occupies gently sloping (three to seven percent slopes), primarily west-facing sideslopes and upland ridges of slightly dissected plains with sparse sagebrush and common cushion plants vegetation. Teagulf sandy loam was described and sampled at two representative locations on the study area: EW Road PR-2 and EW Road PR-8.

Although the entire shallow to moderately deep profile of Teagulf sandy loam is "suitable" or "marginally suitable" from a reclamation suitability perspective, only the best, most fertile, upper layers of Teagulf are recommended for salvage. The upper 6 to 15 inches of Teagulf sandy loam contains the "A" horizon surface layer and the underlying upper "B" horizon subsoil layer. This is the best soil material and has a combination of suitable soil texture (dominantly sandy loam or loam), soil structure, soil organic matter, and is neither saline nor sodic. As such, the upper 10 inches (the average depth of the best topsoil across the two sampled Teagulf locations) are recommended for Topsoil salvage and should be stored in protected and seeded topsoil storage piles until needed in reclamation activities.

Teagulf is an established soil series that is extensive in southwestern Wyoming and is currently classified as a "Coarse-loamy, mixed, superactive, frigid Typic Haplocalcid". The most recent "Official Soil Series Description" for Teagulf, dated December 1999, is included in **Addendum OP-5b-4**. Typically, Teagulf has an "A" horizon surface layer is a pale brown to brown, noncalcareous sandy loam about two to three inches thick. The underlying "Bw" cambic subsoil horizon is a brown to yellowish brown, noncalcareous sandy loam to a depth of about 7 to 9 inches. The underlying "BCk" calcic subsoil horizon is a pale brown strongly calcareous sandy loam to a depth of about 15 inches. The underlying "C" horizon substratum or "Cr" paralithic material is very pale brown, moderately calcareous coarse loamy sand to a depth of about 27 inches.

Sample site EW Road PR-2 was selected as typical for Teagulf sandy loam and its complete profile description is provided below. As stated above, the field profile descriptions for both Teagulf sample locations are contained in **Addendum OP-5b-1**.

Teagulf sandy loam Typical Pedon "EW Road PR-2" Profile Description:
4% slope; South aspect; scattered Wyoming big sagebrush and mixed grasses vegetation; local alluvium; upland convex sideslope; stable surface with slight erosion in vicinity of sample site; described and sampled September 10, 2009.

A horizon - 0 to 2 inches; very pale brown (10YR 7/3) sandy loam with 20% small gravels, pale brown (10YR 6/3) moist; weak medium platy structure; soft dry consistence, very friable moist consistence, and nonsticky and nonplastic wet consistence; many fine and very fine, and few medium and coarse roots; noneffervescent; pH=7.0 (neutral), EC=0.1 (nonsaline), SAR=0.8 (nonsodic), OM=0.7% (low); clear smooth boundary.

Bw horizon - 2 to 7 inches; brown (7.5YR 5/4) to yellowish brown (10YR 5/4) sandy loam with 30% small gravels, brown (7.5YR 4/4) to dark yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; slightly hard dry consistence, friable moist consistence, slightly sticky and slightly plastic wet consistence; many fine and very fine, and few medium and coarse roots; noneffervescent; pH=7.2 (neutral), EC=0.10 (nonsaline), SAR=1.1 (nonsodic), OM=0.9% (low); gradual wavy boundary.

BCk horizon - 7 to 14 inches; pale brown (10YR 6/3) sandy loam with 20% small gravels, brown (10YR 4/3) moist; massive structure; slightly hard dry consistence, friable moist consistence, nonsticky and nonplastic wet consistence; common medium, fine, and very fine, and few coarse roots; noneffervescent; from lab data: pH=7.4 (slightly alkaline), EC=0.2 (nonsaline), SAR=0.7 (nonsodic), OM=0.4% (low); gradual wavy boundary.

C/Cr horizon - 14 to 27 inches; very pale brown (10YR 8/3) loamy sand with much very coarse sand, very pale brown (10YR 7/3) moist; massive structure; hard dry consistence, friable moist consistence, nonsticky and nonplastic wet consistence; few fine and very fine roots; moderately effervescent; from lab data: pH=8.2 (moderately alkaline), EC=0.2 (nonsaline), SAR=1.0 (nonsodic), OM=0.2% (low); gradual wavy boundary.

R (lithic contact) – 27 to 52 inches; pink (5YR 7/4) fractured siltstone and shale bedrock; fractures into 1"x1" small shale cubes.

4.1.3 Poposhia Loam

Poposhia loam is a deep, well drained soil developing in calcareous "fine-loamy" alluvium. The soil occupies nearly level to gently sloping (zero to one percent slopes) narrow upland drainages and swales with dominant Wyoming Big sagebrush, rabbitbrush, and mixed grasses vegetation. Poposhia loam was described and sampled at three representative locations on the survey area: EW Road PR-1, EW Road PR-4, and EW Road PR-7.

Although the entire deep profile of Poposhia loam is "suitable" or "marginally suitable" from a reclamation suitability perspective, only the best, most fertile, upper layers of Poposhia are recommended for salvage. The upper 19 to 24 inches of Poposhia loam contains the "A" horizon surface layer and the underlying upper "B" horizon subsoil layer. This is the best soil material and has a combination of suitable soil texture (dominantly sandy loam or loam), soil structure, soil organic matter, and is neither saline nor sodic. As such, the upper 22 inches (the average depth of the best topsoil across the three sampled Poposhia locations) are recommended for Topsoil salvage and should be stored in protected and seeded topsoil storage piles until needed in reclamation activities.

Poposhia is an established soil series of moderate extent in southern and western Wyoming and is currently classified as a "Fine-loamy, mixed, superactive, frigid Ustic Haplocambid". The most recent "Official Soil Series Description" for Poposhia, dated June 2009, is included in **Addenda OP-5b-4**. Typically, Poposhia has an "A" horizon surface layer is a brown to dark brown, noncalcareous loam about 4 inches thick. The underlying "Bw" cambic subsoil horizon is a brown, noncalcareous loam to sandy clay loam about 18 inches thick with a range of thickness from 15 to 20 inches. The underlying "C" horizon substratum is a yellowish to brownish yellow, noncalcareous sandy loam to a depth greater than 40 inches, on average to about 47 inches.

Sample site EW Road PR-7 was selected as typical for Poposhia loam and its complete profile description is provided below. As stated above, the field profile descriptions for all three Poposhia sample locations are contained in **Addenda OP-5b-1**.

Poposhia loam Typical Pedon "EW Road PR-7" Profile Description:
2% slope; Southwest aspect; tall Wyoming big sagebrush, rabbitbrush, and mixed grasses vegetation; local streamlain alluvium; narrow, upland drainage; no erosion in vicinity of sample site; described and sampled September 11, 2009.

A horizon - 0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; soft to slightly hard dry consistence, friable moist consistence, and slightly sticky and slightly plastic wet consistence; many medium, fine and very fine, and common

coarse roots; noneffervescent; pH=6.2 (slightly acid), EC=0.3 (nonsaline), SAR=1.0 (nonsodic), OM=4.0% (high); clear smooth boundary.

Bw1 horizon - 4 to 12 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard to hard dry consistence, friable to firm moist consistence, sticky and slightly plastic wet consistence; many medium, fine and very fine, and few coarse roots; noneffervescent; pH=5.9 (moderately acid), EC=0.10 (nonsaline), SAR=0.9 (nonsodic), OM=1.6% (medium); clear wavy boundary.

Bw2 horizon - 12 to 22 inches; brown (10YR 5/3) loam to sandy clay loam, dark brown (10YR 4/3) moist; strong medium subangular blocky structure; hard dry consistence, firm moist consistence, sticky and slightly plastic wet consistence; many fine and very fine, common medium and few coarse roots; noneffervescent; pH=6.4 (slightly acid), EC=0.10 (nonsaline), SAR=1.3 (nonsodic), OM=0.8% (low); gradual wavy boundary.

C horizon - 22 to 47 inches; yellow (10YR 7/6) sandy loam with 5% small gravels, brownish yellow (10YR 6/6) moist; massive structure; hard to slightly hard dry consistence, friable to loose moist consistence, nonsticky and nonplastic wet consistence; few fine and very fine roots; noneffervescent; from lab data: pH=7.6 (slightly alkaline), EC=0.2 (nonsaline), SAR=0.5 (nonsodic), OM=0.3% (low); gradual wavy boundary.

5.0 Evaluation of Topsoil Suitability and Salvage Depths

All three soils mapped on the survey area (Pepal sandy loam, Teagulf sandy loam, and Poposhia loam) have entirely “suitable” or “marginally suitable” soil throughout the recommended topsoil depth, according to criteria and suitability threshold values listed in WDEQ-LQD’s Guideline No.1 (WDEQ, 1996). Pepal sandy loam is recommended for salvage to an average depth of 16 inches, Teagulf sandy loam to 10 inches, and Poposhia loam to about 22 inches. The topsoil of all three soils provides a favorable medium for plant growth with favorable texture, water holding capacity, and organic matter content. All three soils are both nonsaline and nonsodic and have “suitable” levels of Boron and Selenium, two elements that are routinely analyzed for in Wyoming. Based on previous laboratory results (2007), ABP values are also “suitable”. Soil material below these recommended depths generally have coarser textures, including loamy sand, with lower saturation percents and higher amounts of coarse fragments including mixed gravels.

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