Canyon Fuel Company, LLC
A Subsidiary of Bowie Resource Holdings, LLC

C/007/0005
Received 2/10/2016
Task ID #4935

Skyline Mine
Gregg A. Galecki, Environmental Engineer
HC35, Box 380
Helper, Utah 84526
(435) 448-2636
Fax (435) 448-2632

February 5, 2016

Mr. Daron R. Haddock
Division of Oil, Gas, and Mining
1594 West North Temple
Salt Lake City, Utah 84114-5801

RE: Swens Canyon Ventilation Facility (SCVF), Canyon Fuel Company, LLC, Skyline Mine, C/007/0005, Task ID 4935

Dear Daron:

Attached to this letter is a complete re-submittal of information to construction the Swens Canyon Ventilation Facility. Also submitted and included with this letter is a four (4) page document titled, "Technical Analysis Response to Task ID 4935 - Swens Canyon Ventilation Facility", which outlines how and where the deficiencies outlined in Task ID #4935 were addressed.

Also attached to this cover letter are completed C1 and C2 (two pages) forms. In addition, a total of twenty-three (23) files have been uploaded to the Division Google Drive (Amendment12302015) containing redline/strikeout text of the M&RP modified information, numerous plates and independent reports providing support for the proposed permit amendment.

If you have any questions regarding this information, please give or me a call at (435) 448-2636.

Sincerely:

Gregg A. Galecki

Gregg Galecki
Environmental Engineer
Canyon Fuel Company, LLC.
Environmental Engineer – Skyline Mines

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Swens Canyon Ventilation Facility
Description, Include reason for application and timing required to implement:
Installation of new ventilation facility in Swens Canyon to ventilate SW Reserves. Response to Task 4935

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 14.50 Disturbed Area: _____ ☒ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☒ Yes ☐ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☒ Yes ☐ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: ____________________
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☒ Yes ☐ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Corey Heaps — Print Name

Corey Heaps, GM, 2-5-16 — Sign Name, General Manager, Date

Subscribed and sworn to before me this 5th day of Feb, 2016

Kathleen Atwood
Notary Public
My commission Expires: 12-02, 2019
Attest: State of Utah } ss:
County of Carbon

KATHLEEN ATWOOD
NOTARY PUBLIC • STATE OF UTAH
COMMISSION# 686430
COMM. EXP. 12-02-2019

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

Form DOGM- C1 (Revised March 12, 2002)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Swens Canyon Ventilation Facility - Page 1 of 2 TASK ID: 4935

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Chapter 1 Legal, Financial Compliance Information Pages 1-24d, 1-26, 1-34(a), 1-35, 1-36, 1-37, 1-38
☐ Add	☒ Replace	☐ Remove	Chapter 1, Appendix 118-A -Public Notice
☐ Add	☒ Replace	☐ Remove	Chapter 1, Plates 1.6-3, and 1.6-3(A)
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.1 General Environmental Resources Summary: 2-4c2
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.2 Geology and Geotechnical: Page 2-21(b)
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.5 Hydrologic Impacts of Mining Activities: Pages 2-49, 2-51, 2-51a, 2-51d, 2-51e
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.7 Vegetation: Page 2-63a
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.8 Aquatic Wildlife Resources: Page 2-68, REPLACE Chapter 2, Plate 2.3.6-1_Rev16
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.9 Terrestrial Wildlife: Pages 2-104l and 2-104m
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.10 Raptors: Page 2-111, Figure 2.10-1
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.11 Soils: Pages 2-120(l) and 2-120(m)
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.12 Landuse: Pages 2-126, 2-127, 2-128, 2-129, 2-131, 2-132
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.14 Prime Farmland Investigation: Page 2-161
☒ Add	☒ Replace	☐ Remove	Chapter 3, Section 3.2 Components of Operation: Pages 3-21, 3-22, 3-23(a), 3-23(a1), 3-ADD 31(c) and 3-31(d), 3-44, 3-58, 3-72(c) , Section 3.3 Timing of Operation: Page 3-81
☒ Add	☐ Replace	☐ Remove	Chapter 3, Plates 3.2.4-4A through 3.2.4-4F
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.2 Reclamation Timetable: Page 4-6 Table 4.2-1
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.3 Reclamation Bond; Reclamation Cost Estimate Summary Table, Demolition summaryTable, Earthwork Summary Table, Revegetation Summary Table, Winter Quarters Vent Facility15 Earthwork Sheet
☒ Add	☐ Replace	☐ Remove	Chapter 4, Section 4.3, Swens Canyon 43 - Demolition sheet, Swens Canyon 16 - Earthwork Sheet
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.4 Backfill, Soil Stabilization, Compaction, Contouring, Grading; page 4-29
☒ Add	☐ Replace	☐ Remove	Chapter 4, Section 4.4 Backfill, Soil Stabilization, Compaction, Contouring, Grading; Plates 4.4.2-4A and 4.4.2-4B
☒ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.6 Topsoil/Subsoil Handling Plan: Page 4-34(b) ADD 4-34(c), Page 4-38 (d) - Table 4.6-4, page 4-41(e)
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.7 Revegetation Plan: Pages 4-50, 4-50 (a), and Tables 4.7-1 thru 4.7-6A, 4.7-8A thru -8D
☒ Add	☐ Replace	☐ Remove	Chapter 4, Section 4.7 Revegetation Plan: Tables 4.7-11A and 4.7-11B
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.9 Opening and Sealing Plan: Page 4-62(a)
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.9 Opening and Sealing Plan: Figure 4.9-D
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.11 Protection of Hydrological Balance: Page 4-72
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.12 Postmning Land Uses:Table 4.12-1(page 4-75), Page 4-78(a)
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.13 Sedimentation Ponds: Page 4-83
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.17 Subsidence: Page 4-94 and 49-4(a) REPLACE Plate 4.17.3-1A_Rev9

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Swens Canyon Ventilation Facility 2 of 2 TASK ID: 4935

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.18 Fish and Wildlife Plan: Page 4-103B
☐ Add	☒ Replace	☐ Remove	Chapter 4, Section 4.20 Transportation Facilities: Page 4-114(a)
☒ Add	☐ Replace	☐ Remove	Appendix A-2, Volume 2: Vegetation of the Powerline Corridor & Swens Canyon Pad 2014; Mt Nebo Scientific, Inc., December 2014 (file name: Canyon14.Skyline.Power.Report.final)
☒ Add	☐ Replace	☐ Remove	Appendix A-2 Volume 2: Order 2 Soil Survey of the Powerline Corridor Swens Pad Ventilation and Escape Shafts Coal Pile Expansion at the Skyline Mine; Long Resources Consultants, Inc., December 4, 2014 (file name: Powerline Corridor Soil Survey Report Dec 4 2014.pdf)
☒ Add	☐ Replace	☐ Remove	Appendix A-2 Volume 2: NRCS_PrimeFarmLandDetermination; Armstrong-Dyer email correspondence, June 2014 (NRCS_PrimeFarmLandDetermination.pdf)
☒ Add	☐ Replace	☐ Remove	Appendix A-2, Volume 2: Wildlife Survey Report - Power Line, Ventilation Hole, Access Road, Analysis Area, Subsidence Area, and Spring Survey, 2013; Alpine Ecological, 08.09.2013 (file name: 2013 Wildlife Survey Report 8.9.13_complete.pdf)
☒ Add	☐ Replace	☐ Remove	Appendix A-2, Volume 2: 2014 Wildlife Survey Report - Power Line And Ventilation Pad; Alpine Ecological, 11.16.2014 (file name: 2014 Powerline and Vent Report 11.16.14)
☒ Add	☐ Replace	☐ Remove	Appendix A-4, Hole Log 95-28-1_G
☒ Add	☐ Replace	☐ Remove	Appendix A-4, Volume 2: CONFIDENTIAL FILE - A Cultural Resources Inventory for the Skyline Mine Expansion and Transmission Line Construction Project, Carbon and Emery Counties, Utah; Environment Planning Group, LLC., October 7, 2014 (file name: Bowie-Skyline Expansion Report_EPG.pdf)
☒ Add	☐ Replace	☐ Remove	Appendix A-5 Engineering Calculations, Section 24: Swens Canyon Ventilation Shaft Pad Design Report; Earthfax Engineering Group, LLC., December 2014 (file name: Swens Vent Pad Design Report_Efax_12-14.pdf)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.3 Groundwater Hydrology: Page 2-35a, Table 2.3.7-1 (page 2-36), and Table 2.3.7-3
☐ Add	☒ Replace	☐ Remove	Chapter 2, Section 2.4 Surface Water Hydrology: Page 2-44a
☒ Add	☐ Replace	☐ Remove	Chapter 4, Section 4.1 Reclamation Plan: Page 4-3(b)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining
Information has been submitted electronically. Two (2) paper copies of the information will be submitted at final approval.	

Technical Analysis Response to Task ID 4935

Swens Canyon Ventilation Facility

The following is are in response to Technical Analysis Task ID 4935 for incorporation of the Swens Canyon Ventilation Facility into the Skyline M&RP. Responses to specific requests are listed by the DOGM-cited regulation.

Violation Information R645-301-113: (pb) Table 1-2 was updated in October 2015 to include the Skyline violation that was vacated. The Gordon Creek violation was inadvertently not included. As outlined in General Chapter 1-2, Canyon Fuel Company is committed to updating Table 1-2 and any other changes within the chapter no later than April 2016.

Legal Description R645-301-141: (pb) The table located in Chapter 1, page 1-37 has been modified to outline the 4.8 acres occupying the powerline will not be reclaimed and the 9.7 acres of the pad will be reclaimed.

Public Notice and Comment R645-301-120, -117.200: (pb) An affidavit of publication of the public notice has been included in Appendix 118-A. The public notice ran in both the Emery County Progress and the Sun Advocate on October 27, and November 3, 10, 17, respectively.

Reporting of Technical Data R645-301-212.200: (pb) The escape shaft will be approximately 8-feet diameter as measured from the outside. Section 2.2, page 2-21b and Section 3.2 page 3-31(b) are now consistent.

Fish and Wildlife Information R645-301-322: (lr) As stated in the current technical analysis, multiple analysis of T&E lists have been submitted with other submittals currently or recently under review (Flat Canyon – Southwest Reserve and the North of Graben Bleeder Shaft, respectively). Both studies and a comprehensive table/list compiled by Alpine Ecological have been re-submitted for this application include documentation on the Western Toad, Greater Sage-grouse (determined as non-habitat by DWR), American three-toed woodpecker, and the Southwestern flycatcher. Three (3) reports have been added since the last submittal: 2014 Western Toad Memo 8.25.14; 2015 Powerling and Vent Report 8.16.15; Species by County List Review 10.6.2015, respectively.

Soils Resource Information R645-301-200: (pb) Section 2.11 pages 2-120 (l) and 2-120(m) reflect the following: The buried section of power line will not be disturbed because the operational plan is to set up a drill on the Swens pad and bore the length under Huntington creek to the east side of the valley. Minimal soil will be disturbed as the boring 'daylights' and the cable is pulled through to the surface. Once the boring daylights, a small area will be cleared and the topsoil salvaged if necessary. An analysis of NPK will be collected of any topsoil.

Land Use Resource Information R645-301-411: (lr) Table 2.12.2-1 was updated as part of the NOG Bleeder shaft amendment. The currently incorporated version of Table 2.12.2-1 indicates 11.3 Total AUM's for the 9.7 acres of the Swens Canyon.

Geologic Resource Information R645-301-623: (dh) As stated in Section 2.2, page 2-21(b), the lithologic log for hole 95-28-1, located approximately ½ mile west of the shaft location is included in the application to be included in Appendix A-4. Also, as stated in Section 2.2.13, Skyline intends on drilling a pilot hole at the location of the shaft in 2016.

Probably Hydrologic Consequences Determination R645-301-728.300-335: (ad) In Section 2.5 page 2-51a a specific statement has been added indicating minimal to no adverse effect to the hydrologic balance will occur with the Swens Canyon Ventilation facility.

Air Pollution Control Plan R645-301-422: (lr) The Skyline Mine 2015 Air Quality permit Approval Order DAQE-AN100920001-15 was incorporated into the M&RP in October 2015 as part of the NOG Bleeder Shaft amendment.

Fish and Wildlife Protection and Enhancement Plan R645-301-333: (lr) Section 2.10 Raptors Page 2-111 has been modified to include potential of additional raptor monitoring and mitigation if necessary. Vehicle and Figure 2.10-1 has been added to the chapter to illustrate avian protection on the power poles. Section 2.9, pages 2-104(l) and 2-104(m) has been modified to include the Western boreal Toad survey conducted in 2014 confirming no boreal toads are present in the Swens Canyon.

Topsoil and Subsoil R645-301-121.200, -232.300, -234.230, -243, -232.400, -242.200: (pb) Plate 3.2.5-4F was modified to illustrate the amount of topsoil and subsoil removal totals. In general, approximately 1.0-ft of topsoil from the Swens Pad area, (~8,750 cu-yd) and subsoil removal (6,350 cu-yd) totaling approximately 15,100 cu-yd of storage. More detail has been added to page 2-120(m) to describe the protection of the topsoil/subsoil. The two piles will be separated on the pile using orange construction fabric. Table 4.7-11B has been modified to add a nitrogen fixing legume. Section 4.6 Topsoil/Subsoil handling plan has been modified to be consistent with Section 2.11.

Road System Plans and Drawings R645-301-521.170, -534.150: (cp) Additional discussion has been added to Section 3.2, page 3-31(c) describing the specifications of the road (width, gradient, surface material), ditches, drainage, and pad details describing which plates contain the information.

Hydro Surface Water Monitoring R645-301-731.220: (ad) Section 2.3 Groundwater Hydrology, Tables 2.3.7-1 and 2.3.7-3 have been modified to include CS-28. Section 2.4 Surface Water Hydrology page 2-44a has been modified to include a discussion of CS-28/CS-16 in Swens Canyon. Monitoring on CS-16 has been modified to include lab analysis to have identical analysis to CS-28. The lab analysis of TDS, TSS, and Oil & Grease is monitored to illustrate that no impact to Swens Creek is occurring due to the vent facility. Another column was added to table 2.3.7-1 to accommodate the analysis. MD-1 was also modified to show the same analysis, since the mine discharge (UPDES parameters) no longer includes total phosphorus. Page 2-35a was modified to document this change. NOTE: these page modifications are listed on Page 2 of 2 of the C2 form.

Hydrologic Discharge Into an Underground Mine R645-301-731.500: (ad) A discussion has been added to Section 3.2 page 3-31c describing how stormwater is prevented from going into the shaft. The pad is sloped to the south, away from the shaft(s). The collar elevation of the shaft(s) is designed to be 2-feet above the elevation of pad which allows approximately 1.5 feet of freeboard on the shaft(s).

Hydrologic Stream Buffer Zones R645-301-731.600: (ad) A discussion has been added to Section 3.2 page 3-31c describing how the re-alignment of USFS road 0228 does not impact the stream buffer zone. The re-alignment is constructed in a pre-existing 'dispersed camping' disturbed area located in the upland vegetation away from the floodplain and riparian areas. Similar to the Winter Quarters Vent pad, to serve as protection and a sediment control measure, any construction activities will be a minimum of two stream widths from the bank of the stream.

Hydrologic Sediment Control Measures R645-301-742.240, -742: (ad) The location of the swale has been added to Plate 3.2.4-6D and additional discussion has been added to the ASCA 40 description in Section 3.2 page 3-72(c). Storm water and sediment on the pad will travel east-southeast. Water and sediment reporting to the east side of pad will either be treated by a silt fence or report to the south area of the pad through the swale. Either way the runoff will be treated.

Hydrologic Impoundments R645-301-743.131, -514.320: (ad) Plates 3.2.4-6A, -6C and -6D have been modified to include an Emergency Spillway on the cuttings pond and on the sediment basin. Although they are not designed to discharge, emergency spillways were added as a precaution. Jeff Studenka was also contacted at DWQ and he indicated permitting of the cuttings pond was not necessary. Additional discussion was also added in Section 3.2, page 3-23(a) on the function of the cuttings pond.

Support Facilities and Utility Installations R645-301-521.180, -526.220: (cp) Page 3-31(b) previously indicated that the designs outlined in the Earthfax report would be followed. Additional clarification was added that the design criteria would be added to the construction criteria, including specifically compaction testing. Also, the pad facility certification by Engineering Manager - Craig Brown (page 3-21) was expanded to include the certification of the designs of the entire site (which will be submitted after completion of the site).

Maps Mine Workings R645-301-521.140: (cp) Plate 3.3.2 has been modified to better reflect the proposed mining in the Flat Canyon lease area, and since mining has not been approved the qualifier, "Any projected mining shown beyond the existing lease boundary lines is subject to future lease modifications and approvals".

PostMining Land Use R645-301-412, -413: (lr) Table 4.12-1 has the SCVF added (as it was in the previous amendment), and Page 4-78(a) has been modified to reference other sections of Section 4 of the M&RP for the various management plans and performance standards.

Backfill and Grading General R645-301-553: (cp) Section 4.1.4 was added to Section 4.1 to describe the Reclamation Plan for the Swens Canyon Ventilation Shaft (page 4-3(b)).

Topsoil and Subsoil R645-301-121.200, -242: (pb) References to disturbed acreages of 6 acres have been eliminated from the discussion to eliminate confusion. The only place it is noted is in Section 4.6 Table 4.6-4 where it distinguishes where topsoil/subsoil will be removed (so the volumes would work out). Discrepancies in the diameter of the shaft(s) is now consistent. Redistribution of the subsoil has been added to the discussion in Section 4.6 page 4-41(e).

Revegetation General Requirements R645-301-121.200: (lr) Table 4.7-11B has been modified to replace rubber rabbitbrush with Winterfat. Tables 4.7-1 through 4.7-8 have been modified to have consistent formatting.

Revegetation Timing R645-301-354: (lr) A narrative describing the timing of when the interim seed mix will be planted has been added to Section 3.2 page 3-31(d). A sentence to the timing of final seeding has been added to the same page as well. In general, the final revegetation timing is already addressed in general terms in the opening paragraph of Section 4.7. Topsoil and subsoil handling plan Section 4.6 also provides additional general timing.

Revegetation Mulching and Other Soil Stabilization R645-301-355: (lr) A sentence has been added to Section 4.7.11 addressing the possible mulch and soil stabilization methods that may be used.

Revegetation Standards for Success R645-301-356: (lr) Section 4.7.11 (page 4-50(a)) was modified to indicate a current commitment to a success standard of 2,500 woody-species per acre, with the caveat that it may be modified with consultation with USFS, DWR, DOGM, and mine personnel. This is based on the interpretation of the report that a higher percentage of grasses and forbes are more desirable for the post mining land use that the current high percentage of sage brush. Table 4.7-11B was also modified with the added qualifier, "Containerized shrubs may be used as warranted to achieve reclamation standards".

Stabilization of Surface Areas R645-301-244.100, -244.200: (pb) Section 4.6.8 has been modified to include mulching of disturbed areas after being roughened. A sentence has also been added to indicate the procedures outlined apply for areas disturbed both at the vent shaft and power line.

Chapter-1

point of tangency; thence South 38° 32' 29" West 334.32 feet to the point of a 2031.74 foot radius curve to the right; thence along the arc of said curve; (whose long chord bears South 40°17' 48" West 124.48 feet), a length of 124.50 feet to the point of tangency; thence South 42°03' 09" West 180.47 feet to the true point of beginning and containing 42.57 acres.

No surface disturbance or underground mining will be conducted on the lands controlled by the Permittee lying outside the mining permit area.

The Swens Canyon Ventilation Shaft is necessary to provide adequate ventilation within the existing lease. However, Canyon Fuel Company, LLC, has acquired the Flat Canyon Lease (UTU-77114) and the shaft will also service the ventilation needs of that area.

Canyon Fuel Company, LLC, does not own or control, indirectly or indirectly, legally or equitably any interest in the areas contiguous to the permit area other than the interests described above.

The permittee has no option, bid or other interest in any contiguous acreage other than that stated above. No application for leasing unleased Federal lands adjacent to the permit area is currently pending.

See General Chapter 1
For information previously listed in pages 1-26 through 1-29

Regulations R645-301-112 through -301-150 are updated on an annual basis for all the Canyon Fuel Company, LLC, mines. Information is located in a separate binder/file titled, "General Chapter 1"

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distance of 313.62 feet; thence S78° 31' 42" E a distance of 394.22 feet; thence S67° 59' 19" a distance of 162.86 feet; thence S67° 11' 48" E a distance of 184.95 feet; thence s66° 35' 22" E a distance of 7.51 feet; thence S68° 17' 21" E a distance of 16.44 feet; thence N14° 02' 53" E a distance of 13.25 feet; thence N 17° 36' 35" W a distance of 64.21 feet; thence n19° 35' 52" W a distance of 101.75 feet; thence N04° 54' 23" W a distance 110.10 feet; N15° 34' 28" E a distance of 118.18 feet; thence N43° 46' 10" E a distance of 1,079.17 feet; thence N51° 35' 31" E a distance of 860.51 feet; thence N21° 49' 54" W a distance of 0.62 feet; S51° 35' 33" W a distance of 860.56 feet; thence S43° 45' 55" W a distance of 1,079.56 feet; thence S15° 34' 30" W a distance of 118.17 feet; S04° 54' 20" E a distance of 110.32 feet; thence s19° 32' 19" E a distance of 102.69 feet; thence S17° 39' 42" E a distance of 63.38 feet; thence S15° 04' 51" W a distance of 12.36 feet; thence N67° 17' 42" W a distance of 205.91 feet; thence N67° 52' 22" W a distance of 49.97 feet; thence N67° 58' 39" W a distance of 114.38 feet; thence N68° 31' 43" W a distance of 394.17 feet; thence S89° 10' 54" W a distance of 313.96; thence S84° 21' 11" W a distance of 44.32 feet; thence S05° 39' 41" E a distance of 4.00 feet; which is the point of beginning and containing .3 acres, more or less.

Swens Canyon Ventilation Facility Power Line

The followings is a tract of land identified for use of an approximately 15-foot wide power line corridor located in Sections 13, 23, 24, 26, and 27, Township 13 South, Range 6 East, Salt Lake Base and Meridian, Carbon County, Utah, being further described as follows: Commencing at a point North 539 feet and East 171 feet from the SW Corner of the SE Quarter of Section 13, Township 13S, Range 6E, SL B&M;
thence South AZ194°05'06" 1353.94 feet; thence Southwest AZ246°45'44" 806.76 feet; thence Southwest AZ228°18'40" 1538.71 feet; thence South AZ203°38'57" 840.30 feet; thence South AZ194°56'30" 304.65 feet; thence South AZ200°43'30" 318.25 feet; thence South AZ204°57'15" 299.05 feet; thence South AZ217°21'11" 296.38 feet; thence Southwest AZ238°52'04" 344.64 feet; thence Southwest AZ235°18'51" 295.98 feet; thence Southwest AZ221°22'06" 165.64 feet; thence Southwest AZ224°28'34" 136.90 feet; thence Southwest AZ243°34'57" 2641.97 feet; thence Southwest AZ236°35'49" 774.17 feet; thence Southwest AZ248°37'17" 713.48 feet; thence Southwest AZ248°00'31" 628.18 feet; thence West AZ267°52'29" 678.96 feet; thence West AZ263°46'14" 882.25 feet; thence Southwest AZ249°41'06" 879.10 feet terminating at the Swens Canyon Ventilation Facility, containing approximately 4.8 acres.

~~distance of 12.36 feet; thence N67° 17' 42" W a distance of 205.91 feet; thence N67° 52' 22" W a distance of 49.97 feet; thence N67° 58' 39" W a distance of 114.38 feet; thence N68° 31' 43" W a distance of 394.17 feet; thence S89° 10' 54" W a distance of 313.96; thence S84° 21' 11" W a distance of 44.32 feet; thence S05° 39' 41" E a distance of 4.00 feet; which is the point of beginning and containing .3 acres, more or less.~~

The facilities to be constructed on the surface easements and rights-of-way are a part of the Skyline Mines and these areas of surface use are to be included in the permit area as shown on Drawing 1.6-1.

The Lawrence Reservoir (Drawing 1.6-1), proposed in 1938, was never developed. Efforts to pursue the project were discontinued and resulted in case file closure by the Utah State Engineer's Office on August 8, 1961. When Federal Coal Lease Utah 044076 was issued, the site area of the proposed Lawrence Reservoir was excluded from the leased premises. On March 27, 2001, the Lawrence Reservoir area was added to Federal Coal Lease Utah-044076 by the BLM. In a letter dated March17, 2003 and sent certified mail to Skyline Mine, the BLM approved longwall recovery of the 12 Left "A" panel that underlies a portion of the now-abandoned Lawrence Reservoir site. The BLM further determined that impacts related to subsiding this area had been adequately addressed in previous NEPA documents. The BLM approval also had 5 stipulations with which the operator will comply. Copies of the letters addressed to CFC from the BLM stating that the reservoir site is within Federal Coal Lease Utah-044076 and discussing the stipulations related to mining this portion of the lease are included as Exhibit 1.14-3.

Due to the great volume of documents involved with the ownership, right-of-entry, etc. of the Skyline properties, photocopies of the agreements have not been included in this Notice. The relevant documents are presently maintained at the offices of Canyon Fuel Company, LLC , Midvale, Utah, and at the Skyline Mine's office. Copies of the agreements can be viewed by interested persons during normal business hours.

Canyon Fuel Company, LLC holds no interest under any real estate contracts covering surface lands or other realty to be affected by mining activities at the Skyline Mines. Also, there are no purchasers of record under real estate contracts with respect to the Skyline properties.

115 Status of Unsuitability Claims [unchanged]

The Bureau of Land Management has included the proposed permit area in the Wattis Planning Unit Study to determine the results of the application of the Departmental Coal Unsuitability Criteria as mandated by the Federal Lands Review, Section 552(6) of the Surface Mining Control and Reclamation Act of 1977 (P.L. 95 87).

Canyon Fuel Company, LLC recognizes, however, that the permit area may possibly undergo further examination during some phase of the permitting process to determine if it should be designated as an area unsuitable for mining. Canyon Fuel Company, LLC believes that the environmental baseline information contained in Volume 1 clearly demonstrates that the permit area should not be so designated as an area which is unsuitable for mining.

Canyon Fuel Company, LLC does not propose to conduct or locate surface facilities within 300 feet of any occupied dwellings. The disturbed area boundary for the Swens Canyon Ventilation Shaft fluctuates between 120-150 feet from SR-264.

116 Permit Term

The following information is presented to identify permit term requirements and stipulations.

The Date of Construction commenced on June 24, 1980 upon approval of the Mining and Reclamation Plan.

Although the initial permit application covered only a five year period of mining, the information presented below estimates the anticipated mining for the life of the mining operation.

	Mine No. 1	Mine No. 2	Mine No. 3
First Coal Produced	June, 1982	Oct., 1981	1992 Est.
Termination of Mining	Dec., 2012	Dec., 2015	June 2019
Horizontal Extent of Mine Workings (Life of Mine)	3,956 acres	312.58 acres	3,810.06 acres

Vertical Extent of Mine Workings Workings (Life of Mine)	Surface to 1,500' max	Surface to 2,300' max	Surface to 1,500' max

The anticipated number of total surface land acres to be affected (life of mines) is less than the combined total of the affected acreages for each of the three mines due to the overlapping of mining operations which is inherent to this multi-seam mining operation. The total surface acreage to be disturbed by surface facilities associated with underground mining is 125.31 acres.

The following information was based on projection for the next five years (2012-2016).

	Mine No. 1	Mine No. 2	Mine No. 3
Extent of Horizontal Workings	240 acres	375 acres	1,400 acres
Extent of Vertical Workings	Surface to 1,250'	Surface to 2,250'	Surface to 2,125'

Permit Area

The construction/installation of surface facilities at the mine site, loading area, conveyor belt route, well houses, water tank pad, waste rock disposal site, and South Fork Breakout, and Winter Quarters Ventilation Facility comprise the Permit Area. The permit area acreage listed adequately accommodate areas of disturbance.

PERMIT AREAS TO BE RECLAIMED

AREA	ACREAGE
Loadout	13.86
Portal Yard	42.55
Water tanks, water lines, and Well pads (water lines not reclaimed	0.60
Conveyor Bench	14.18
Waste Rock Disposal Site and Road	32.48
South Fork Breakout	0.96
James Canyon Buried Power Line	0.30
James Canyon Buried Pipeline	1.60
James Canyon Water Wells and Road	2.95
Winter Quarters Ventilation Facility	7.93
Winter Quarters Road (not reclaimed)	4.90
North of Graben (NOG) Shaft	3.00
Swens Power line (not reclaimed)	4.80
Swens Canyon Pad	9.70
TOTAL	~~125.31~~139.81

Legal Description of Permit Area

Township 12 South, Range 6 East, SLBM

Section 26:	Portions of SW1/4SW1/4
Section 34:	Portions of NE1/4NE1/4

Township 12 South, Range 7 East, SLBM

Section 32:	Portion SE1/4SE1/4

Township 13 South, Range 6 East, SLBM

Section 1:	Portions of S1/2NW1/4, S1/2NE1/4
Section 13:	Portions of S1/2S1/2
Section 23:	Portions of E1/2E1/2, SW1/4SE1/4~~E1/2,NE1/4~~
Section 24:	Portions of N1/2~~W1/2, NE1/4~~
Section 25:	Portions of S1/2S1/2
Section 26:	Portions of NW1/4NE1/4, N1/2NW1/4, SW1/4NW1/4
Section 27:	Portions of the S1/2NE1/4, S1/2NW1/4
Section 35:	Portions of NE1/4, S1/2
Section 36:	Portions of N1/2NW1/4

Township 13 South, Range 7 East, SLBM

Section 4:	Portions of SW1/4NW1/4, NW1/4SW1/4
Section 5:	Portions of E1/2NE1/4
Section 6:	Portions of S1/2N1/2
Section 17:	Portions of S1/2S1/2
Section 18:	Portions of S1/2S1/2
Section 19:	Portions of N1/2N1/2

Township 14 South, Range 6 East, SLBM

Section 2:	Portions of W1/2NW1/4
Section 3:	Portions of SE1/4NE1/4

See Plate 1.6-3 for graphic illustration of Permit Area

Appendix 118-A

AFFIDAVIT OF PUBLICATION

STATE OF UTAH)

ss.

County of Carbon,)

I, Jenni Fasselin, on oath, say that I am the Publisher of the Sun Advocate, a twice-weekly newspaper of general circulation, published at Price, State of Utah a true copy of which is hereto attached, was published in the full issue of such newspaper for 4 (Four) consecutive issues, and on the Utah legals.com website, the first publication was on the 27th day of October, 2015, and that the last publication of such notice was in the issue of such newspaper dated the 17th day of November 2015.

Jenni Fasselin

Jenni Fasselin – Publisher

Subscribed and sworn to before me this 17th day of November, 2015.

Linda Thayn

Notary Public My commission expires January 10, 2019 Residing at Price, Utah

Publication fee, $ 436.80

LINDA THAYN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 680835
COMM. EXP. 01-10-2019

LEGAL NOTICE

Canyon Fuel Company, LLC, has filed a complete application with the Division of Oil, Gas, and Mining for a revision of the existing Mining and Reclamation Plan, C/0070005 for the Skyline Mine. Canyon Fuel Company, LLC operates the Skyline Mines with surface facilities located in Eccles Canyon which is approximately 4 miles southwest of the town of Scofield, Utah. The revision includes the addition of a power line approximately 3 miles in length providing power to a ventilation facility located in Upper Huntington Canyon.

Underground coal mining will take place in coal reserves owned or leased by Canyon Fuel Company, LLC. A legal description of the proposed areas for these new surface facilities is described as follows:

Proposed Additional Areas Authorized for Coal Mining and Reclamation Activities

Township 12 South, Range 6 East, SLBM

Section 23: Portions of E1/2E1/2, SW1/4SE1/4
Section 24: Portions of N1/2
Section 25: Portions of S1/2S1/2
Section 26: Portions of NW1/4NE1/4, N1/2NW1/4, SW1/4NW1/4
Section 27: Portions of S1/2NE1/4, S1/2NW1/4

Total acres within the affected area: 4.8 acre power line and 9.7 acre ventilation facility

The address of the applicant is: Canyon Fuel Company, LLC
225 North 5th Street, Suite 900
Grand Junction, CO 81501

After filing, copies of this permit application will be available for inspection at the following location: Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City Utah, and the Division of Oil, Gas, and Mining website under the Coal Permit files.

Written comments or requests regarding this permit renewal must be made within 30 days of the last publication of this notice, and may be addressed to the Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114-5801.
Published in the Sun Advocate October 27, November 3, 10 and 17, 2015.

AFFIDAVIT OF PUBLICATION

STATE OF UTAH)

ss.

County of Emery,)

I, Jenni Fasselin, on oath, say that I am the Publisher of the Emery County Progress, a weekly newspaper of general circulation, published at Castle Dale, State of Utah and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for 4 (Four) consecutive issues, and on the Utah legals.com webwsite; the first publication was on the 27th day of October, 2015, and that the last publication of such notice was in the issue of such newspaper dated the 17th day of November, 2015.

Jenni Fasselin

Jenni Fasselin – Publisher

Subscribed and sworn to before me this 17th day of November 2015.

Linda Thayn

Notary Public My commission expires January 10, 2019 Residing at Price, Utah

Publication fee, $ 312.00

LINDA THAYN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 680835
COMM. EXP. 01-10-2019

LEGAL NOTICE

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Underground coal mining will take place in coal reserves owned or leased by Canyon Fuel Company, LLC. A legal description of the proposed areas for these new surface facilities is described as follows:

Proposed Additional Areas Authorized for Coal Mining and Reclamation Activities

Township 12 South, Range 6 East, SLBM

Section 23: Portions of E1/2E1/2, SW1/4SE1/4
Section 24: Portions of N1/2
Section 25: Portions of S1/2S1/2
Section 26: Portions of NW1/4NE1/4, N1/2NW1/4, SW1/4NW1/4
Section 27: Portions of S1/2NE1/4, S1/2NW1/4

Total acres within the affected area: 4.8 acre power line and 9.7 acre ventilation facility

The address of the applicant is: Canyon Fuel Company, LLC
225 North 5th Street, Suite 900
Grand Junction, CO 81501

After filing, copies of this permit application will be available for inspection at the following location: Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City Utah, and the Division of Oil, Gas, and Mining website under the Coal Permit files.

Written comments or requests regarding this permit renewal must be made within 30 days of the last publication of this notice, and may be addressed to the Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114-5801.

Published in the Emery County Progress October 27, November 3, 10 and 17, 2015.

Section 2.1
Environmental Resour

North of Graben (NOG) Bleeder Shaft

Preliminary studies for permitting construction of the NOG Bleeder Shaft was conducted in 2014. The bonded permit area is approximately 3.00 acres, with approximately 1.7 acres being disturbed with construction activities. The area surveyed for cultural resource was significantly larger than the area to be disturbed. Both Class I and Class III cultural resource inventories were conducted in the area. Two(2) isolated occurrences and one (1) new cultural resources sites were identified in the vicinity of the site, but none of the sites will be impacted. In addition, the sites were documented and evaluated for eligibility for inclusion in the National Register of Historic Places, but determined not to be eligible. See CONFIDENTIAL FILE for Environmental Planning Group (EPG) report, "A Cultural Resources Inventory for the Skyline Mine Expansion and Transmission Line Construction Project, Carbon and Emery Counties, Utah."

Swens Canyon Ventilation Facility (SCVF)

In 2014 preliminary studies for permitting construction of the Swens Canyon Ventilation Facility and power line were initiated. An area of approximately 9.7 acres was proposed for addition into the permit area for the SCVF pad site. A power line corridor of approximately 15-foot by 2.6 miles, totaling 4.8 acres was proposed for addition into the permit area. A Cultural Resource survey was conducted by Environmental Planning Group, LLC (EPG) covered areas of approximately 13 acres for the pad area and a 200-foot wide corridor for the power line respectively. A Class I cultural resource file search and Class III cultural resource inventory was conducted in the area. A total of five (5) isolated occurrances and three (3) new cultural resources sites were identified, documented, and evaluated for inclusion in the National Register of Historic Places (NRHP). None of the sites were recommended for eligibility in the NRHP. Therefore, the project will have no adverse effect on those sites. See Confidential File for EPG report (A CULTURAL RESOURCES INVENTORY FOR THE SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT, CARBON AND EMERY COUNTIES, UTAH)

2.2 Geology & Geotechnical

north of Winter Quarters Canyon. The ventilation facility will include a 20-foot diameter vertical shaft, and / or a 20-foot wide slope driven at 18 degrees down, and 8-foot diameter escape shaft. The 20-foot shaft will have a 12-inch thick concrete liner, the slope will have a 8-inch thick concrete invert with the ribs and roof having a minimum 3-inch thick shotcrete liner, and the escape shaft will have a 6-inch concrete liner. When sealing at reclamation, the shaft(s) per 30 CFR Part 75.1711-1 and R645-301-551 will be completely backfilled to the surface using an engineered fill. When sealing the slope, sealing will consist of solid, substantial, incombustible material, such as concrete blocks, bricks or tile, or shall be completely filled with incombustible material for a distance of at least 25 feet into the opening. See Section 4.9 for additional details.

2.2.13 North of Graben (NOG) Bleeder Shaft

The NOG Bleeder Shaft is constructed to provide adequate ventilation for completion of the North of Graben mining district. The shaft was necessary due to encountered geologic conditions that required turning two (2) separate mining districts into one (1). The facility will include one (1) 5-foot diameter, unlined shaft. When sealing at reclamation, the shaft will be completely backfilled to the surface using an engineered fill, per 30 CFR Part 75.1711-1 and R645-301-551. Figure 4.9-C illustrates the backfilling of the shaft.

2.2.14 Swens Canyon Ventilation Facility

The Swens Canyon Ventilation Facility will be constructed to provide adequate ventilation and necessary power for mining both in existing leases and the Flat Canyon – Southwest Reserve lease. The facility includes two (2) vertical shafts of 16-foot and 8-foot diameters, respectively. Each shaft will be lined with either a concrete or steel liner which will remain in-place - below grade - at reclamation. When sealing at reclamation, the shafts will be completely backfilled to the surface using an engineered fill, per 30 CFR Part 75.1711-1 and R645-301-551. See Section 4.9 for additional details; Figure 4.9-B illustrates the backfilling of the shafts. The lithologic log for exploration hole 95-28-1, located approximately ½-mile west of the proposed site is added to Appendix A-4. Skyline intends to drill a hole on the pad location in 2016 prior to shaft construction.

2.2.15~~4~~ Subsidence Monitoring

Please refer to Section 4.17 - Subsidence Control Plan for details of the Subsidence Monitoring program and commitments to mitigate any effects due to subsidence.

Section 2.3
Groundwater Hydro

Section 2.9

completed in August 2002. Annual updates to the study have been submitted with the annual reports. This study concluded after the 2005 information was submitted based on the initial parameters of the study which indicated the study would last through one (1) year after discharge from the mine decreased to a sustained flow less than 5,000 gpm.

Samples obtained at the MC-sites were monitored for total flow, TDS, TSS, and total phosphorous. In addition a stream stability cross-section and reach survey was conducted approximately 75 yards downstream of the MC-6 monitoring location. The results of these analyses were reported with the other mine water quality monitoring reports while the study was being conducted (2002-2005).

Sites MD-1, JC-1, JC-3,and ELD-1 were also added to the monitoring site list. MD-1 is a composite sample of the all the water discharged from Skyline Mine to Eccles Creek. JC-1 and JC-3 are samples of the water discharged from the two James Canyon ground and mine dewatering wells. ELD-1 reports the total flow-only from both JC-1 and JC-3. MD-1 and ELD-1 are monitored for total flow and the results are reported to the Division on a monthly basis. Quarterly, MD-1, JC-1, and JC-3 are also monitored for TSS, TDS, and total phosphorous. Total phosphorous was taken off the analysis for MD-1 in 2016 to coincide with the UPDES permit. Since JC-3 is a PacifiCorp UPDES site, it is monitored each month for flow, TSS, TDS, oil and grease, and total iron.
Spring monitoring sites WQ1-1, WQ1-39, WQ3-6, WQ3-26, WQ3-41 WQ3-43, and WQ4-12 were added to the permit. Surface water sites CS-19, CS-20,and CS-21 were added as were wells 91-26-1 and 91-35-1. Springs S26-1 and S25-32 and Stream CS-26 were added with the North Lease Modification in 2013. All of these sites are in the North Lease area. Location of these samples sites are illustrated on Drawing 2.3.6-1.

Skyline Mine has also obtained numerous water samples from within the mine for age-dating purposes. Samples have been analyzed for both stable and unstable isotopes; the majority being analyzed for tritium and carbon 14 content. The analyses results of these samples is discussed in detail in the July 2002 Addendum to the PHC. The results of repeated tritium sampling and analysis in a few location in the mine, specifically those in the 9 and 10 Left panel areas that began in August 2001, suggest that the majority of the water is not younger than 50 years. Only a few carbon 14 samples have been obtained from these

Table 2.3.7-1
Comprehensive Water Quality Analytical Schedule
(Surface and Ground Water Stations)

Sample Site	1st Quarter: Lab Analysis*[a]	1st Quarter: Field parameters only*[1]	1st Quarter: Monthly Flow	1st Quarter: Dissolved Oxygen	1st Quarter: TDS,TSS, T-P	1st Quarter: TDS,TSS	1st Quarter: O & G	2nd[2] / 3rd[3] / 4th Quarters: Lab Analysis*[a]	Qtrly Field parameters* only[1]	Quarterly Flow	Monthly Flow	Monthly Seasonal Flow	Quarterly Water Level Only	Dissolved Oxygen	TDS,TSS, T-P	TDS,TSS	O & G	Carbon 14	Tritium	Deuterium	Oxygen 18
Streams																					
CS-3								X									X				
CS-6**	X			X			X	X						X			X				
CS-7 (F-5)									X												
CS-8									X												
CS-9								X													
CS-10									X												
CS-11								X									X				
CS-12	X							X													
CS-13	X							X													
CS-14	X							X													
CS-16																X	X				
CS-17									X												
CS-18									X												
CS-19								X													
CS-20								X									X				
CS-21								X													
CS-22										X											
CS-23										X											
CS-24								X						X			X				
CS-25								X													
CS-26								X													
CS-28																X	X				
MD-1			X	X		X					X					X					
SRD-1			X								X										
F-10									X												
UP&L-10								X													
VC-6	X			X			X	X						X			X				
VC-9	X			X			X	X						X			X				
VC-10		X							X												
VC-11										X											
VC-12										X											
NL-1 through NL-42 (See Section 2.4.4)												X									

Table 2.3.7-3
MONITORING STATION IDENTIFICATION

ECCLES CANYON/MUD/FISH CREEK DRAINAGES

STREAM STATIONS - 14 Stations

CS-3	CS-6	CS-9	CS-11	CS-19	CS-20	CS-24
CS-21	VC-6	VC-9	VC-10	VC-11	VC-12	CS-25
CS-26	NL sites (varies)					

MINE DISCHARGE STATIONS - 4 Stations
CS-12 (Mine #3) CS-14 (Mine #1) MD-1 (Composite CS-12 & CS-14)
SRD-1 (Total Mine Site Discharge to Eccles Creek/Scofield Reservoir)*

FRENCH DRAIN STATIONS - 1 Station
CS-13

HUNTINGTON CANYON

STREAM STATIONS - ~~12~~ 13 Stations

CS-7 (F-5)	CS-8	CS-10	CS-16	CS-17	CS-18
CS-22	CS-23	UPL-10	F-10	EL-1	EL-2
CS-28					

WASTE ROCK DISPOSAL SITE

STREAM STATIONS - 4 Stations
WRDS #1 WRDS #2 WRDS #3 WRDS #4

GROUNDWATER STATIONS

SPRINGS - 27 Stations

S10-1	S12-1	S13-2	S13-7	S14-4	S15-3	S17-2
S22-5	S22-11	S23-4	S24-1 Sulfur	S24-12	S26-13	S34-12
S35-8	S36-12	2-413	3-290	WQ1-39	WQ3-6	WQ3-26
WQ3-41	WQ3-43	WQ4-12	8-253	WQ1-1	WQ36-1	S25-32
S26-1						

WELLS (MONITORING) - 1 Well Stations

W79-10-1B	W79-14-2A	W79-26-1	W79-35-1A	W79-35-1B
92-91-03	W2-1(98-2-1)	W20-4-1	W20-4-2	W99-4-1
W99-21-1	W20- 28-1	JC-1	JC-3	91-26-1
91-35-1	ELD-1 (Total of JC-1 and JC-3)*	W08-1-5	WC-1 thru WC-9	

WELLS, CULINARY -Referenced but not monitored
W13-1 W13-2 W17-1 W17-3 W24-1

NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES)
001 Portal Area 002 Loadout Area 003 Waste Rock Area 004 Winter Quarters JC-3 James Canyon

* Sites are monitored for total flow only and the results are reported to the Division on a monthly basis.

Section 2.4
Surface Water
Hydrology

Section 2.7

Surface water stations in Eccles Canyon were sampled more frequently than those on Huntington Creek during the initial phases of mining.

Eccles Canyon stream stations are shown on Table 2.3.7-3 and are analyzed for those constituents identified in Tables 2.3.7-2 with an annual monitoring as per Table 2.3.7-1.

Stream monitoring station CS-24 was added in Winter Quarters Canyon, with the addition of sediment pond discharge point UPDES-004 from the Winter Quarters Ventilation Facility. Stream site CS-24 is located downstream of the ventilation facility pad, and UPDES-004 represents the discharge from the pad site. Sampling frequency and analysis are located in Tables 2.3.7-1 and 2.3.7-2, respectively.

Stream monitoring station CS-28 was added in Swens Canyon upstream of the Swens Canyon Ventilation Facility. Site CS-16, located at the mouth of Swens Canyon, which previously had been reduced to field parameters-only analysis will return to 2nd-4th quarter lab analysis monitoring with CS-28. Refer to Tables 2.3.7-1 and 2.3.7-2 for monitoring details.

Stream monitoring station CS-25 was added in Woods Canyon as mining progressed east in Section 36, T12S, R6E. CS-25 is located downstream of any mining activity. In addition, nine (9) piezometers (WC-1 through WC-9N) were added in the canyon to monitor the near surface groundwater associated with Woods Canyon Creek.

Sampling will continue at all surface water stations throughout the post-mining period and until the reclamation effort is determined successful by the regulatory authority. Samples will also continue to be analyzed for the parameters outlined in Tables 2.3.7-1, 2.3.7-2, and 2.3.7-3 throughout the post-mining period, unless deletions in the list of parameters is determined to be appropriate.

Several monitoring stations were added to the monitoring schedule with the incorporation of the North Lease Tract. CS-19 and CS-21 have been added to monitor the quantity and quality of the water in Woods Canyon Creek and CS-20 has been added to monitor the quantity and quality of the water in Winter Quarters Creek - monitoring both mining upstream and water quality upstream of the Winter Quarters Ventilation Facility (WQVF). CS-24 was added in Winter Quarters Creek below the (WQVF) to monitor any affects associated with the pad.

As part of the Skyline Mine subsidence monitoring plan, a total of 42 new water monitoring sites have been identified in the North Lease area (Plate 2.3.6-2 Table 2.3.7-2A). Sites NL-1 through NL-42 have been selected to monitor flows on the perennial reaches of both Winter Quarters and Woods Canyon drainages one year prior to , during,
and one year following longwall undermining of the perennial section of stream. The sites will be monitored monthly in June through October. If

Section 2.5
Hydrologic Impacts
of Mining Activities.

Section 2.10

nearest irrigation rights are centered around the two areas of Scofield and in Flat Canyon, southwest of the permit area. Irrigated lands consist primarily of pasture. The pastures identified in Flat Canyon are located primarily west of proposed mining, and due to the glacio-lacustrine sediments deposited there, affects to the water rights are not anticipated. Only stockwatering rights are present in the Skyline permit area. A limited number of wells are located in the general area, none of which are located directly on the property or within the permit area. Recent large mine inflows to Mine #2 has resulted in concern voiced by local government and private interests that water entering the mine is coming from nearby Electric Lake. However, data collected and analyzed by Skyline Mine for the purpose of determining the source of the inflows strongly indicates there is no significant connection between the surface waters and the mine waters. As discussed in the July 2002 Addendum to the PHC (modified in October 2002, April 2003, and June 2004), the Star Point does not transmit water easily. Fractures within the Star Point in the mine area has allowed the sandstone to begin dewatering by discharging to the mine. The Star Point does not appear to have a significant discharge point located immediately down gradient of the mine. Indeed, the age of the water in the sandstone suggests it takes several thousand years to move through the aquifer in spite of the high transmissivity of the fractures within the sandstone. Therefore, it is unlikely any surface or ground water rights are being adversely affected. Because it is not certain that the ground water discharges into the Huntington Creek drainage, there is no evidence that water is being removed from that drainage to Eccles Creek, part of the Price River drainage. Tritium analysis of the water in the 10 Left area of Mine #2 and water from the James Canyon well JC-1 indicates a minor amount of modern water is being pumped from the well and the mine. However, this water is not necessarily originating from Electric Lake. Therefore, there does not appear to be a significant volume of surface water being transferred between drainage basins.

2.5.2 Mining Impact on Water Quantity

Due to the high shale content of the Blackhawk Formation, recharge to the deep ground water system through the Blackhawk Formation is slow. Fractures in the formation seal readily due to swelling of the bentonitic shale when wet. As a result, the impact of mining (including subsidence) on the quantity of water in the permit area will be minimal. This has been verified through the results of the subsidence study in Burnout Canyon. (A discussion of the mining impacts on the aquatic resources may be found in Section 2.8.) The Burnout Canyon study resulted in the determination that no significant impacts had occurred to the stream drainage as a result of mining induced subsidence. While the gradient of the stream was flattened in a few locations and slightly increased in others, the overall change in the stream morphology was not significantly different than changes that occur in channelized sandstone was encountered during mining of the southwestern permit area which produced approximately 1,400 gpm. This was repeated at several locations in areas of Mine #2 until the mine was discharging approximately 8,500 to 9,500 gpm in August 2002 and 9,000 to 10,500 gpm in October 2002. Even though the large inflows have significantly subsided since October 2002, the near future mining activities have been directed toward the North Lease area.

The PHC for the Skyline Mine was updated by an Addendum to the PHC dated July 2002 and further updated in October 2002, April 2003, and June 2004. The addendum contains significant information regarding the large inflows to the mine. To better understand the hydrologic system and the water within the Star Point Sandstone, Skyline Mine contracted with Hydrologic Consultants, Inc. of Lakewood, Colorado produce a ground water model of the Star Point Sandstone. This model endeavored to delineate the possible areal extent of the aquifer, the volume of water contained in the aquifer, and the potential sources and discharge locations of the aquifer. The model has been used to help determine what, if any, impacts are occurring to the waters available in the mine area, including State appropriated water rights. The model was completed and improved in June 2004 and a copy of the report describing the results of the modeling effort has been added to the PHC.

As described in the July 2002 Addendum to the PHC, draining of the ground water contained within the Star Point Sandstone does not appear to have a significant impact on discharges of ground water in the mine or adjacent area nor does it appear that the water entering the mine is causing a loss of surface water in the Huntington or Price River drainages. The majority of the flows into the mine enter through faults and fractures that trend generally north-south to northeast-southwest. The flows move up through the floor of the mine in almost all cases. The water is apparently stored in the Star Point Sandstone under significant potentiometric head. Ages of the water indicate that water moves very slowly through the Star Point system in spite of the fractures and faults that appear to be open enough to allow water to flow freely into the mine in isolated locations. This suggests that the aquifer does not have a discharge point that releases large volumes of water nor is the aquifer replenished at a high rate of inflow. While the
Star Point is exposed in out crop north, south, and east of the mine, significant volumes of water would need to be entering the system at an elevation great enough to create the potentiometric head encountered in the Star Point beneath the Mine #2 workings. Plate 2.3.4-2 illustrates changes to the potentiometric surface of the regional aquifer as result of extracting water from the mine from 2001 through 2013. During that period, the potentiometric surface has changed very little. The plate, inconjunction with studies by Petersen Hydrologic, Inc. (PHC Appendix M) suggest Skyline continues to monitor stream flows in Winter Quarters, Woods, Huntingtion, Eccles, and Mud Creeks to identify any impacts if they occur in these drainages related to the mine inflows.

No springs or water production wells in the mine permit or adjacent areas have reportedly been negatively impacted by the large mine inflows. There has been some concern voiced by local government and private interests that water entering the mine is coming from nearby Electric Lake. However, data collected and analyzed by Skyline Mine for the purpose of determining the source of the inflows strongly indicates there is no significant connection between the surface waters and the mine waters. As stated previously, this is discussed at length within the July 2002 Addendum to the PHC.

Water encountered in the mine is either utilized underground as processed water or is pumped from the mine. Procedures for handling of mine water are discussed in detail in Section 3.2. Indigenous water associated with the coal will be removed from the area. This, however, will represent only a small fraction compared to the water flowing from the Wasatch Plateau. The water pumped from the mine is added to the flow of Eccles Creek and into Electric Lake and has a positive effect on the aquatic flow systems.

The construction of surface facilities utilized in conjunction with the Skyline Mines (yard areas, roads, conveyor lines, etc.) resulted in temporary increases in the suspended sediment concentration of the adjacent stream. However, because of the regulatory requirement that sediment control measures be provided for all areas of surface disturbance, concentrations of suspended material were significantly reduced. Minimization efforts, however, met with varying degrees of success.

Sediment control structures such as sediment ponds, Alternate Sediment Control Areas (ASCAs), and Special Exemption Areas (SEAs) are discussed in detail in Section 3.2 - Components of Operations, subsections 3.2.1 and 3.2.12, respectively. Following construction, areas such as extensive outslopes of roads and ponds, sediment control will be managed by temporary devices such as silt fences, straw bales, wattles, or vegetative matting until vegetation is established.

Implementing the sediment control structures listed above, minimal to no adverse effects to the hydrologic balance are anticipated with the construction of the Swens Canyon Ventilation facility.

Over long periods of time, groundwater in the Wasatch Plateau can be expected to flow towards the lowlands if not removed, passing through saline shales and emerging to augment streamflow with a dissolved solids content that significantly exceeds the concentrations found in the headwaters area. Because the Skyline Mines will act as interceptor drains, the groundwater that is brought to the surface from the mines has a much lower dissolved solids content than would have existed if the water was to continue its downward movement through shaley layers. Thus, the mines will have some beneficial impact on the chemical quality of water in the region.

The increased stream flow resulting from mine discharges, particularly during the summer low flow period, appears to benefit the Eccles Creek fishery by creating flow and temperature stabilization. The increased flows to Scofield Reservoir most likely benefitted the fish population in the lake by maintaining a sufficient level of dissolved oxygen to avoid a general fish kill that frequently occurs in the lake during periods of drought periods, such as has been occurring in the mine area since 2000. The mine has also been discharging large volumes of water since August 2002 with TDS concentrations only slightly higher than background levels. This good quality water flows to and is

The water consumed in operating underground equipment, dust suppression, and evaporation is obtained from ground water sources within the mine. These underground water sources are not connected to the surface waters in the area. Extensive research has been performed by the mine to verify that water currently entering the mine is not coming from the surface or depleting surface waters. The recent July 2002 Addendum to the PHC presents data supporting this statement. The data suggests the water intercepted underground is at least 4,000 to 25,000 years old and, based on the results of tritium analyses from most of the mine waters, does not typically contain water that has been exposed to the atmosphere in the past 50 years. Additionally, the steady rate of decline in ground water levels in monitoring wells within the permit area and the results of age-dating the ground water inflows to the mine indicating the water is not getting appreciably younger, suggests that the aquifer is not receiving significant recharge of "young" surface waters.. Continued monitoring by the mine of the surface waters and seeps and springs flows in the permit and adjacent areas have shown no discernable impacts due to the increased mine inflows that were encountered in March 1999 and have continued through November 2002. It is the operator's position that the water consumed in operating Skyline Mine is not depleting surface water sources. In fact, there is an overall net gain to local river systems discharging to the Colorado River as a result of Skyline Mine discharge.

In anticipation of the Winter Quarters Ventilation Facility being constructed, a discharge point (004) was added to accommodate both storm water and mine discharge into Winter Quarters Creek in 2009. A numeric model study conducted by Earthfax Engineering (Appendix A-1, Volume 2) indicates Winter Quarters Creek can receive a maximum discharge of 6,200 gpm while not being erosive to the creek. In the event discharge from Outfall 004 routinely exceeds 6,200 gpm additional armoring to the outfall location and investigation of the impacts to Winter Quarters creek will be initiated.

A pond was added at the Swens Canyon Ventilation Facility, but not as a sediment control structure for the pad. The sole intent of the pond is to collect the drill cuttings from the shaft. Once construction of the shaft is complete, the pond will only collect water from immediately above the pond.

As mining progressed north of Winter Quarters Canyon, the longwall panel orientation was rotated 90 degrees to maximize the coal recovery. This rotation increased mining in an easterly direction into an area of thinner overburden. The study conducted by Apagito Associates indicates longwall mining can be conducted in areas with overburden dow to 475 feet. In Panel 11 Left Woods Canyon creek overlies the center of the panel with overburden ranging from approximately 1000 feet to 500 feet. Water monitoring of the creek, shallow groundwater in the creek bottom, macroinvertebrate, fish and vegetation monitoring of the stream corridor will all be studied to monitor any impacts to the creek. The combination of geology, cover, the panel located in the center of the creek, and the minimal aquatic habitat available in Woods Canyon Creek all support that there will be minimal probable hydrologic consequences to mining further east in Woods Canyon. Detailed discussions of water monitoring are discussed in Sections 2.3 and 2.4, the aquatic wildlife resources are discussed in Section 2.8, and the subsidence control plan discussed in Section 4.17 of this M&RP.

The following information is supplied as required by the Windy Gap process as it applies to existing coal mines in the Upper Colorado River basin:

Mine Consumption: (culinary well - Water Right 91-5010) =41.69 ac-ft (2004 consumption)

Ventilation Consumption / Evaporation:
(assumes 70 deg. F, 60 total days annually, 20% humidity air intake, 95% humidity air out-take; air density difference of 0.001 lbs/ft)

(353,312 cu-ft/min) (.001)(0.1198) = 42 gal/min.
= 11.21 ac-ft annually

Coal Producing Consumption / Coal Moisture Loss:
- 6.1% Inherent moisture
- 8.54 % run-of-mine moisture
- 2.44% moisture added to coal by cutting (8.54-6.1)

Projected 2005 Tonnage 237, 500 tons
Projected 5 yr Average 1,898,672 tons

Tons water/year = (1,898,672)(0.0244)= 46,328 tons water/year
Lbs water/year = 92,656,000
Gallons/year = 92,565,000 (0.1198)=11,100,189 gallons/year
=34.06 ac-ft annually

Sediment Pond Evaporation:
Evaporation estimate calculation uses evaporation data from Pacificorp evaporation pan located at Electric Lake spillway. Data was from 1998 through 2003.

Pond 001 (Mine Site) - 0.39 acre (surface area)
- 0.15 ac-ft/month (ET)
- 228,096 (gallons/year)
- 0.70 ac-ft/yr

Pond 002 (Rail Loadout) - 0.44 acre (surface area)
- 0.15 ac-ft/month (ET)
- 257,422 gallons/year
- 0.79 ac-ft/yr

Pond 003 (Refuse Pile) - 0.27 acre (surface area)
- 0.15 ac-ft/month (ET)
- 159,667 gallons/year
- 0.49 ac-ft/yr

Pond 004 (Winter Quarters) – 0.036 acre (surface area)
- 0.15 ac-ft/month (ET)
- 19,551 gallons/year
- 0.06 ac-ft/yr

Swens Canyon (drill cuttings pond) – 1.08 ac (surface area)
-0.15 ac-ft/month (ET)
- 633,744 gallons/year
- 1.94 ac-ft/yr

Total Annual Pond Evaporation = 3.98~~2.04~~ac-ft

Springs and Seeps Effects From Subsidence - Not Applicable to this calculation
Alluvial Aquifer Abstractions into Mine - Not Applicable
Deep Aquifer Pumpage - Not Applicable
Postmining Inflow - (0)
Direct Diversions - Not Applicable
Dust Suppression - 5,000 gallons/truck load. Data based on 2003 use; last fully active year.
= 3.7 ac-ft/yr
Mine Discharge - last 6 month average = 3,757 gpm
= 6,059 ac-ft/yr

Using the Windy Gap Process at the Mine site, water depletions include Mine Consumption, Ventilation Consumption, Coal Producing Consumption, Sediment Pond Evaporation, and Dust Suppression totaling approximately 94 acre-feet per year. The only addition to the system, as defined by the Windy Gap process is the mine discharge which is currently averaging approximately 6,060 acre-feet per year, indicating the Skyline Mine has a net gain of approximately 5,966 acre-feet year to the Colorado River drainage system.

2.5.3 Alternative Water Supply

OSM Regulation 30 CFR 783.17 requires that alternative sources of water supply be identified if mining impacts will result in the contamination, diminution, or interruption of existing sources.
Because no significant adverse hydrologic impacts are expected as a result of mining in the Skyline permit area, no individual or collective source of alternative water supply has been identified.

Section 2.7
Vegetation

2.7.9 North of Graben (NOG) Bleeder Shaft

The NOG Bleeder Shaft is constructed to provide adequate ventilation for completion of the North of Graben mining district. The shaft was necessary due to encountered geologic conditions that required turning two (2) separate mining districts into one (1). The facility will include one (1) 5-foot diameter, unlined shaft. The area permitted for the bleeder shaft is approximately 3.0 acres, with a disturbed area of approximately 1.7 acres. Both soils and vegetation information specific to the site were collected in 2014 prior to construction. In general the NOG Bleeder Shaft site encompasses a mix of musk thistle, cheatgrass, bluebunch wheatgrass, and aspen on south-facing hillside located approximately 200 feet downhill from the existing Granger Ridge USFS road. A portion of the new access road will be constructed is located in an aspen area that had been disturbed previously by other activities, and appears to have been later re-seeded. Attempts were made to minimize the size of the pad utilizing the existing flat areas adjacent to the USFS road, but geologic conditions prohibited placing the shaft on the road. No threatened or endangered species were identified. The vegetation report is located in Appendix A-2, Volume 2 (Vegetation of the NOG Ventilation Site 2014, Mt Nebo Scientific).

2.7.9 Swens Canyon Ventilation Facility

The Swens Canyon Ventilation Facility (SCVF) was necessary to provide both ventilation and power for underground mining in the Flat Canyon Lease – Southwest Reserves portion of the mine. Both soils and vegetation information specific to the SCVF site were collected in 2014 prior to construction. In general, the SCVF pad site encompasses a sagebrush and mountain brush south-facing hillside. The existing access road up Swens Canyon was modified slightly, moving it closer to the creek to better utilize a generally flat portion of the valley upland area to minimize the disturbance of constructing the SCVF access road. No riparian vegetation was disturbed. No threatened or endangered species were identified. The vegetation report is located in Appendix A-2, Volume 2 (Vegetation of the Powerline Corridor & Swens Canyon Pad 2014, Mt. Nebo Scientific).

Section 2.8
Aquatic Wildlife
Resources

No perennial streams are being undermined. Wife Canyon has various springs that day-light in or near the stream channel, that run on the surface a short distance prior to disappearing into the alluvium. Both the East and West Forks of Andrew Dairy Canyon shows the same characteristics in short reaches. Approximately 900-1300 feet of overburden exist in the area being undermined, further minimizing any impacts. Andrew Dairy Spring, which exists immediately outside the area to be mined is being monitored as Spring S25-32. Water Right 91-3917 is a Spring located above the area to be mined and will be monitored S26-1. No monitoring of aquatic resources is necessary in these drainages.

UP Canyon - Scofield Waste Rock site

The Scofield Waste Rock site is located in UP Canyon at the confluence of two ephemeral unnamed drainages. No aquatic wildlife habitat has been noted in either drainage.

Project Impacts on Fisheries Resources

The surface facility disturbances in the portal area encroached on sections of all three upper Eccles Creek forks. In order to reduce sedimentation of these stream segments and the main stream, the tributaries and a section of Eccles Creek proper immediately below the tributary confluences were diverted into closed culverts. This modified approximately 4,200 feet of total stream habitat but did not reduce available fish habitat since fish were not found above the U.S. Forest boundary, prior to the diversion. Downstream drift of macroinvertebrates from the upper reaches of these forks still occurs as before.

At the coal loadout facilities near the mouth of the canyon (Station ECO5), approximately 600 feet of stream was moved to the north into a new channel. The new channel is 100 feet shorter but has nearly the same gradient (3 feet additional vertical drop/1,000 feet horizontal channel).

Degradation of Eccles Creek between the National Forest boundary and the coal loadout facilities should continue to be minimal since road and conveyor plans were developed and are being implemented to minimize effects on the stream.

Water being discharged from the mine is augmenting the Eccles Creek stream flow. This increased stream flow is especially beneficial during summer months when normal stream flows are low. Water temperatures are also moderated by this increased flow.

There should be little impact on Huntington Creek above Electric Lake. Impacts to date have been associated only with the construction of a new UDOT highway. Sediment control measures minimized the impact during the construction activity.

Prior to construction of the Winter Quarters Ventilation Facility (WQVF) silt fencing or similar best management practice will be installed along the entire length of the construction zone to minimize sediment and debris from entering the creek. Once construction is complete and other sediment controls are installed, these situation structures will be removed. During the life of the WQVF pad, long term sediment control will be implemented thorough a sediment pond (UPDES discharge point 004).

At this point in time there are believed to be no other potential impacts on either Winter Quarters or Woods Canyon Creeks.

Prior to construction of the Swens Canyon Ventilation Facility (SCVF) silt fencing or similar best management practice will be installed along the section of road to be modified adjacent to minimized sediment and debris from entering Swens Canyon Creek. Once construction is complete, these sediment structures will be removed. The SCVF is a minimum of 350 feet north of the creek with a minimal potential of impacting the creek. An associated power line bringing power to the SCVF from the mine site runs overland a majority of the distance. Following recommendations from Manti-LaSal US Forest Service personnel, the power line will be buried from the SCVF under Huntington Creek to the east side of the Huntington Creek basin. It is anticipated this will be achieved using horizontal drilling

Section 2.9
Terrestrial Wildlife

The area is considered critical summer habitat for deer and elk. During development of the facility, daily activity will include vehicle traffic and construction activities. After construction, the use of the area will return to historic uses, with only an exhaust fan operation remaining. Construction of the pad will occur in Fall of 2015, so the critical summer fawning/walving period will not be impacted. Construction of the fan facility will occur in spring/summer of 2016, since the ventilation facility is needed by Fall of 2016. If construction begins after June 1st, when the peak fawning/calving period begins, the area will be surveyed to detect the presence of any potentially fawning/calving individuals. This will consist of walking the area 1000 feet below the construction area. If any individuals are encountered, they will be monitored, and construction will not begin until the individual is no longer in the area (See Alpine memo dated July 2015). After construction, the impacts will be minimal since the fan system that is being installed will be equipped with an Exhaust Silencer with an overall pressure level of 76dBA at 36" from the fan. Access will be limited by a locked gate.
No sage grouse habitat exists in the area. Figure 2.9-8 has been added which shows Utah DWR's Sage Grouse Management Area threat analysis, including habitat areas. Skyline Mine lease area is shown relative to the Sage Grouse Management Areas. A wildlife survey report conducted in 2014 which addressed goshawk, raptors, American three-toed woodpecker, and Threatened and Endangered species determined no species of concern would be impacted by the construction of the shaft (See Appendix A-2, Volume 2 for Alpine Ecological report and Alpine memo dated July 2015).

2.9.8 Swens Canyon Ventilation Facility (SCVF)

The SCVF is permitted to encompasse approximately 9.7 acres. The project also includes an approximately 2.62 mile power line, with a permitted 15-foot wide corridor which totals approximately 4.8 acres. Minimal disturbance is anticipated with the power line as the 3-phase, 12.5 kV, single pole power line, with compact construction has been adapted for raptors and no road building will be involved with the installation. Access to the power corridor will be limited to minimal cross-country travel with either a rubber-tired or tracked vehicle.

General wildlife and raptor surveys conducted in both 2013 and 2014 were consistent with previous studies with no threatened or endangered species being observed in either the power line corridor or the SCVF site. A specific Western Boreal Toad survey was also conducted in 2014 indicating the absence of the species. (See Apppendix A-3, Volume 2 for studies conducted by Alpine Ecological). Noise will not be an issue after construction as no fan is planned for the facility. The power line is buried through Upper Huntington to minimize visual impacts. Habitat loss through the power line corridor will be minimal as vegetation should be re-established in the following growing season. Habitat disturbed by the SCVF will be re-vegetated at reclamation at a lower woody-species density with an increased forb and grasses density to provide a better post mining habitat. Areas used for wildlife, logging, and grazing will be returned to their historic uses.

Sec. 2.10 Raptors

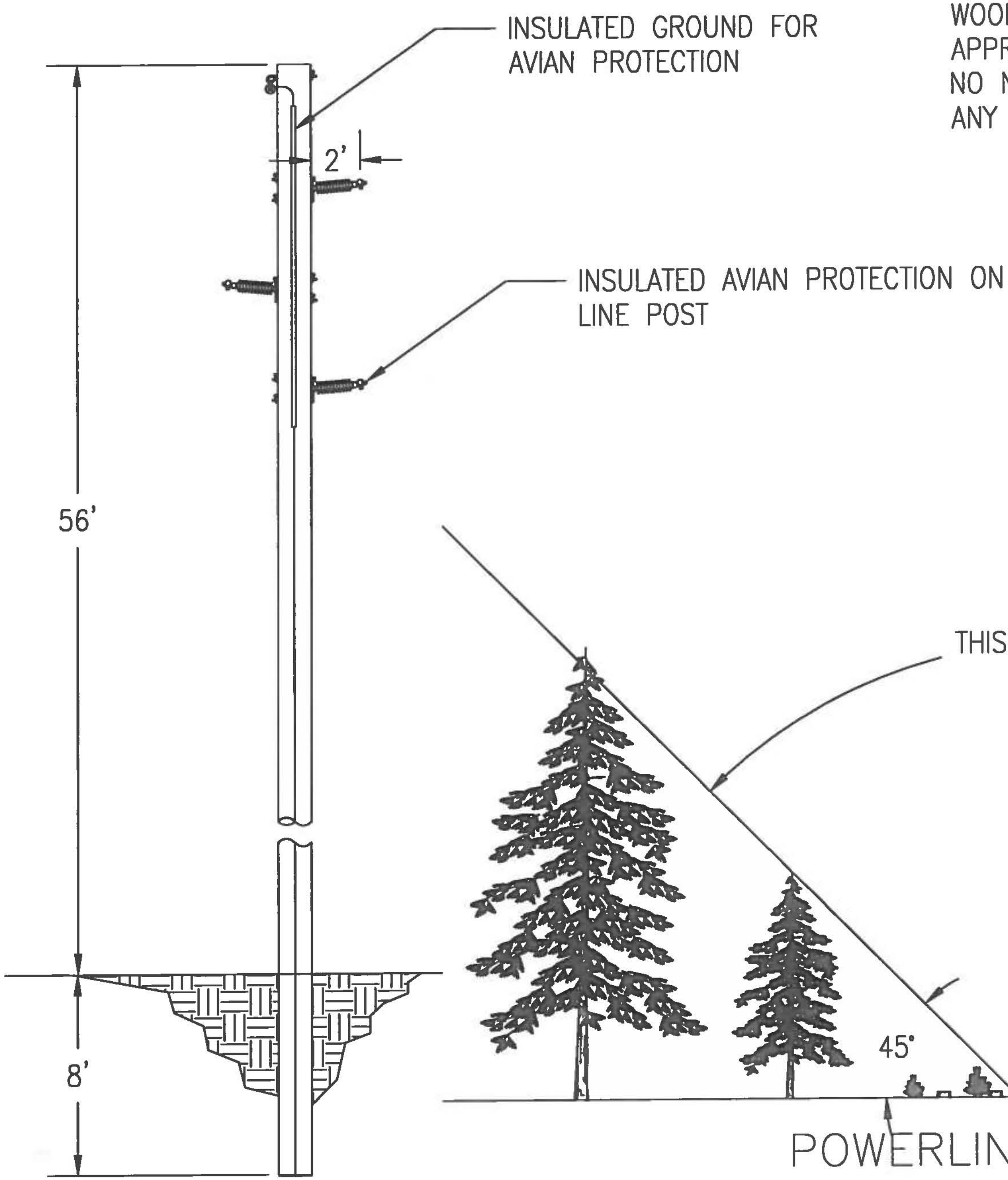
Prior to the construction of the Swens Canyon Vent Facility (SCVC) raptor and wildlife surveys were conducted in both 2013, 2014, and 2015 (see Appendix A-2, Volume 2 for reports). A juvenile goshawk nest was found on the edge of the power line corridor and will be monitored in 2016. Because of the location, wildlife biologist Mace Crane anticipates the nest will not be occupied in the future. Assuming it is occupied during construction, appropriate mitigation measures will be implemented per US Forest Service personnel instructions. See Figure 2.10-1 for avian protection on the line posts and power line clearing area. No long-term impacts due to increased vehicle and human activity are anticipated at the vent facility after construction because the site is adjacent SR-264 with moderate daily traffic and a popular campsite is located adjacent to the road and Swens Canyon Creek.

Raptor surveys indicate that there may be raptors nesting in the vicinity of the Scofield Waste Rock Disposal site. A raptor survey was conducted in 1995 by Skyline Mines to determine if there were any active nests within a 1/2 mile radius of the disposal site. No nests were found by environmental personnel from Skyline Mine. Another raptor survey was conducted in 2007 for the waste rock expansion site and one raptor nest was identified within 3 mile. According to the analysis, the nest has been in place for some time and the raptors have habituated to the activities of the waste rock site. This nest will be monitored in spring 2008 for its status. Results of the status will be reported in the Annual report.

2.10.1 Conclusion

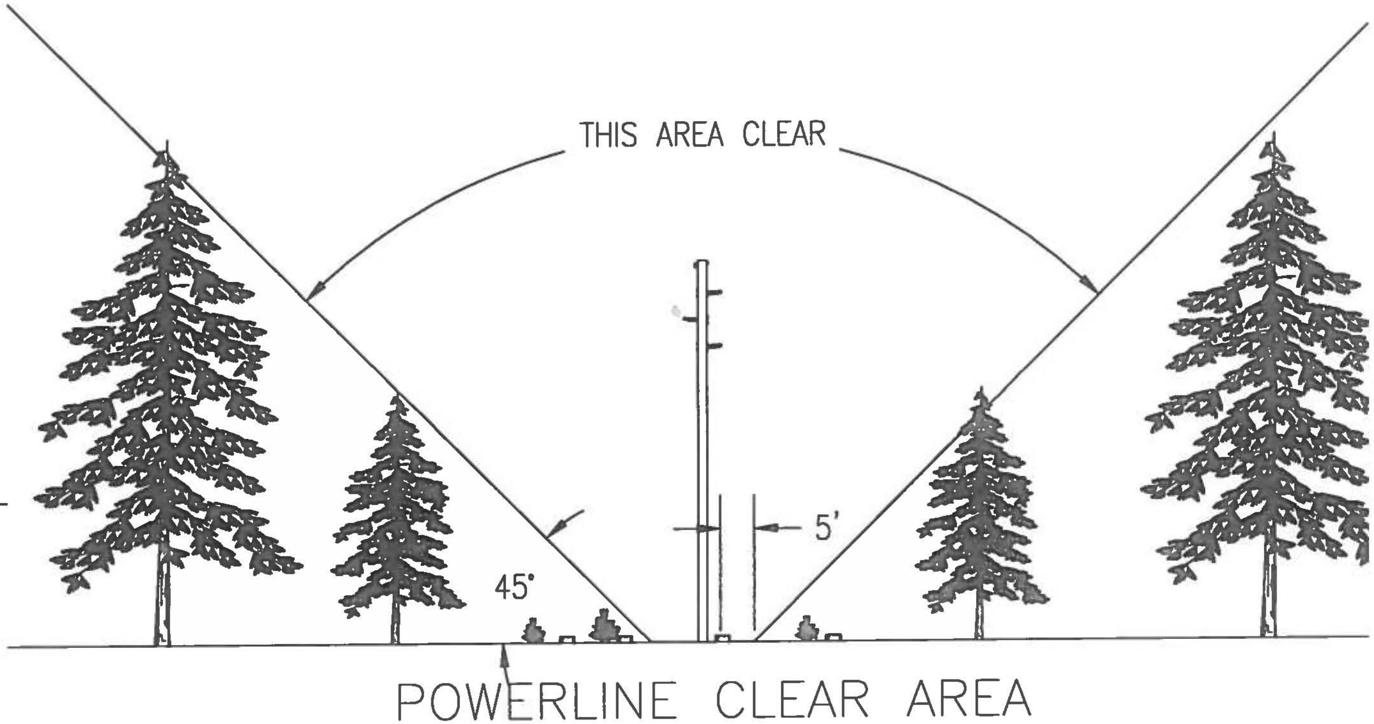
Raptor species, normally found in conifer forests, occur in small numbers on the Skyline Mine area. Nesting habitat for tree nesting species provides the only readily available habitat there. Bald eagles pass through the area and stop over in adjacent regions during that migration. They, however, move on as winter sets in. Peregrine falcons may also pass over the area in migration, but any number that would do so is certainly small. No nesting sites of either species are known nor suspected in the Skyline area. The nearest known sites are in excess of 20 miles from the Skyline area. The overall elevation of the mining region is high enough and the habitat such as to restrict the density and diversity of raptors. It is concluded that development of the skyline Mine area will not have and adverse effect on critical raptor species, and any species that may be affected are common enough that the impact will be minimal on the populations.

WOOD POLES
APPROXIMATELY 200 STRUCTURES
NO NEW ROADS FOR CONSTRUCTION PLANNED
ANY ROADS BUILT FOR CONSTRUCTION WILL BE RECLAII



POLE DETAIL

SCALE: NONE



POWERLINE CLEAR AREA

SCALE: NONE

Sec. 2.11 Soils

North of Graben (NOG)Bleeder Shaft

A detailed description of the soils associated with the NOG Bleeder Shaft is available in Appendix A-2, Volume 2, titled, "Order 2 Soil Survey of the North of Graben (NOG) Bleeder Shaft Area" (January 16, 2015). The survey conducted by Long Resources Consultants, Inc. provides a comprehensive assessment of the various soils within the area. The permit area encompasses approximately 3.0 acres. The soil type is represented by the McCadden Family, with shallow soil depths overlying shallow sandstone bedrock. It is considered to have good-to-fair available water capacity, and fair-to-good reclamation material with pH values ranging 6.2 - 7.0 and a saturation range of 44.1 - 72 percent. The soil pit (14SKY07) sampled at the site location identified a rich A-horizon of approximately 4-inches. The entire A-horizon will be salvaged. Where there is less than six-inches in the A horizon, up to 4-inches of the subsoil (Bw1 horizon) will be collected and stockpiled for reclamation. Quality control for the salvage of the topsoil will be primarily by color conducted under the guidance of trained personnel. To confirm the nutrient status of the topsoil, an analysis of the available nitrogen, phosphorus, and potassium will be conducted once the material is placed in the topsoil pile. At post-construction of the site, an as-built survey of the site will be conducted to confirm the amount of topsoil salvaged.

Swens Canyon Ventilation Facility (SCVF)

A detailed description of the soils associated with the Swens Canyon Ventilation Facility (SCVF) and associated power line is available in Appendix A-2, Volume 2, titled, "Order 2 Soil Survey of the Powerline Corridor Swens Pad Ventilation and Escape Shafts Coal Pile Expansion at the Skyline Mine" (December 2014). The survey conducted by Long

Resources Consultants, Inc. provides a comprehensive assessment of the various soils that are within the power line corridor and the pad site. No soils are anticipated to be disturbed along the power line with the exception of soils moved for the placement of the single, wooden poles, and the area where the buried section of cable daylights, which are both exempt due to the limited disturbance. The buried section of power line will be bored from the Swens pad using a directional drilling method. Where the buried cable connects to the above-ground section, any potentially disturbed topsoil will be salvaged and a sample collected to test N,P,K analyzing for future treatment when reclaiming. The power line corridor is approximately 2.6 miles in length and will be approximately 15-feet wide with no disturbance of the topsoil anticipated. Installation will be conducted using rubber-tired vehicles or tracked vehicles keeping the number of access trips necessary for construction to a minimum.

The SCVF pad site encompasses approximately 9.7 acres with two (2) soil types present. Approximately ½ the site is represented by the Hailman soil family, with a sandy loam on 5-15% slopes. The estimated topsoil savage depth is approximately 16-inches, with and estimated subsoil depth of approximately 27-inches. The remainder of the site is represented by the Kamack soil family with a sandy loam on 10-35% slopes. The estimated topsoil salvage depth is approximately 10-1nches, with an estimated subsoil depth of approximately 31-inches. Plate 3.2.4-4F illustrates the removal areas, potential depths, and the topsoil stockpile location.

Section 2.12 Topsoi

North of Graben (NOG)Bleeder Shaft

A detailed description of the soils associated with the NOG Bleeder Shaft is available in Appendix A-2, Volume 2, titled, "Order 2 Soil Survey of the North of Graben (NOG) Bleeder Shaft Area" (January 16, 2015). The survey conducted by Long Resources Consultants, Inc. provides a comprehensive assessment of the various soils within the area. The permit area encompasses approximately 3.0 acres. The soil type is represented by the McCadden Family, with shallow soil depths overlying shallow sandstone bedrock. It is considered to have good-to-fair available water capacity, and fair-to-good reclamation material with pH values ranging 6.2 - 7.0 and a saturation range of 44.1 - 72 percent. The soil pit (14SKY07) sampled at the site location identified a rich A-horizon of approximately 4-inches. The entire A-horizon will be salvaged. Where there is less than six-inches in the A horizon, up to 4-inches of the subsoil (Bw1 horizon) will be collected and stockpiled for reclamation. Quality control for the salvage of the topsoil will be primarily by color conducted under the guidance of trained personnel. To confirm the nutrient status of the topsoil, an analysis of the available nitrogen, phosphorus, and potassium will be conducted once the material is placed in the topsoil pile. At post-construction of the site, an as-built survey of the site will be conducted to confirm the amount of topsoil salvaged.

Swens Canyon Ventilation Facility (SCVF)

A detailed description of the soils associated with the Swens Canyon Ventilation Facility (SCVF) and associated power line is available in Appendix A-2, Volume 2, titled, "Order 2 Soil Survey of the Powerline Corridor Swens Pad Ventilation and Escape Shafts Coal Pile Expansion at the Skyline Mine" (December 2014). The survey conducted by Long

Resources Consultants, Inc. provides a comprehensive assessment of the various soils that are within the power line corridor and the pad site. No soils are anticipated to be disturbed along the power line with the exception of soils moved for the placement of the single, wooden poles, and the area where the buried section of cable daylights, which are both exempt due to the limited disturbance. The buried section of power line will be bored from the Swens pad using a directional drilling method. Where the buried cable connects to the above-ground section, any potentially disturbed topsoil will be salvaged and a sample collected to test nitrogen, phosphorus, and potassium analyzing for future treatment when reclaiming. The power line corridor is approximately 2.6 miles in length and will be approximately 15-feet wide with no disturbance of the topsoil anticipated. Installation will be conducted using rubber-tired vehicles or tracked vehicles keeping the number of access trips necessary for construction to a minimum.

The SCVF pad site encompasses approximately 9.7 acres with two (2) soil types present. The majority of the site is represented by the Hailman soil family, with a sandy loam on 5-15% slopes. The soil pit identified an estimated topsoil depth is approximately 16-inches (S1 from Figure 2 of soil survey). The remainder of the site consisting of the access road is represented by the Kamack soil family with a sandy loam on 10-35% slopes (S2), with an estimated topsoil depth of approximately 10-1nches. Approximately 1-foot of topsoil will be salvaged and stored. Plate 3.2.4-4F illustrates the removal areas, and estimated depths of combined topsoil and subsoil to be stockpiled totaling approximately 15,100 cu-yds. Topsoil (~8750 cu-yd) and subsoil (~6350 cu-yd) will be segregated on the pile using orange fencing/construction fabric. Once stored, the topsoil will be analyzed for available nitrogen, phosphorus, and potassium for future soil treatment. Efforts will be made to minimize the steepness of the slopes of the topsoil by configuring the pile with the steeper slopes being subsoil. A berm and silt trap will be used to retain the material until vegetation is established. The surface of the pile will also be deep-gouged, seeded, and top-dressed with mulch or straw. The seed mix is the same used for the North of Graben Bleeder shaft (Section 4.7, Table 4.7-10A)

Section 2.14
Prime Farmland

2.14 PRIME FARMLAND INVESTIGATION

A pre-application investigation was conducted by the Permittee to determine if any prime farmland would be impacted within the area of the proposed surface facilities in Eccles Canyon, and within Woods and Winter Quarters Canyons of the North Lease Tract. Based on the criteria in 30 CFR 783.27 paragraph (b), items 1 and 5, the Eccles Canyon area cannot be classified as prime farmland. This opinion is substantiated by Dr. Therom B. Hutchings, State Soil Scientist for the Soil Conservation Service (See Exhibit A).

A similar finding was made by the Natural Resources Conservation Service for the North Lease Tract (See Appendix Volume A-2). As shown in the Exhibit, Ano prime farmland or farmland of statewide importance occurs on the recently acquired North Lease@. Therefore, a negative determination for prime farmland classification of the Skyline project area is requested.

Leland Sassor of the Natural Resource Conservation Service (NRCS) was contacted in December 2008 concerning a Prime Farmland Determination in the location of the proposed Winter Quarters Ventilation Facility. Provided the information, he researched the area and confirmed (verbally) later that no Prime Farmland is identified in the area of the pad location. This is consistent with earlier determinations.
Joe Dyer of the NRCS was contacted in 2012 concerning a Prime Farmland Determination in the North Lease Modification expansion area. He determined no Prime Farmland exists in the lease expansion area (See Appendix Volume A-2 for his correspondence).

Joe Dyer was contacted again in 2014 for a Prime Farmland Determination for the Swens Canyon Ventilation Facility. A 'No Prime or unique farm lands' determination is included in Appendix Volume A-2, Volume 2 in the form of an email correspondence.

Sec. 3.2
Components of Operatio

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Revised: 12-30-15

Skyline Mine
Swens Canyon Ventilation Facility

I certify that the roads, cuttings pond, sediment basin, and pad at the Skyline Mine – Swens Canyon Ventilation Facility were constructed under the supervision of a registered, professional engineer. It was constructed in a prudent manner and field-fit to meet design specifications. Designs as outlined in the Skyline Mine – Swens Canyon Ventilation Shaft Pad Design Report (Appendix Volume A-5, Section 24) were followed.

The final construction of the shaft-cuttings pond adequately accommodates the designed volume of cuttings from the drilling of the two (2) shafts on site, and the storm run-off from the disturbance associated with the pond. The pond has been designed to contain stormwater runoff from the 100-year, 24-hour storm event, one year of accumulated sediment, and the cuttings from the creation of the shafts. It is not designed as a sediment control structure for the Ventilation Facility. The pond is significantly oversized and is designed not to discharge.

Craig W. Brown Date

The emergency spillway will not normally discharge during the design runoff events. However, assuming the primary spillway was not functioning and the pond was assumed full to the emergency spillway crest (8075.55 ft) prior to the occurrence of a 25-year, 6-hour storm event, the emergency spillway is calculated to discharge 2.06 cfs with a velocity of 4.69 fps at the crest. This velocity is considered non-erosive.

The required volume for annual sediment storage has been estimated at 1,108 cubic feet. The 60 percent sediment volume is at an elevation of 8071.7 feet. The 100 percent sediment 'clean-out' marker is at an elevation of 8072.1 feet which corresponds to the elevation of the 6-inch diameter decant pipe.

Swens Canyon Ventilation Facility Cuttings Pond

The function of the Swens Canyon Ventilation Facility cuttings pond is to collect the cuttings from the construction of the shaft. The pond is not designed as a sediment control structure for the site. After the deposition of shaft cuttings, the only runoff reporting to the pond will be the area immediately upstream of the pond and the pond itself - watersheds DW-2 and UW-2; see Plate 3.2.4-4D for details. The total maximum volume of cuttings contributing to the pond will be approximately 13,000 CY. The total runoff area contributing to the pond, including the pond itself, is 2.0 acres. The pond will contain the runoff from a 100-year, 24-hour storm event in addition to sediment yielded from its catchment area. The pond has been designed to contain the storm water runoff from the required 10-year, 24-hour storm event (430 CY), one year of accumulated sediment (320 CY), and cuttings from the creation of the shafts. As the water from the cuttings evaporates or infiltrates, the volume will likely decrease to approximately 6,500 CY. With the 6,500 CY of available sediment storage after cuttings have dried, the 60% sediment cleanout elevation will be 8,698.2 asl (4,100 CY). In addition, the pond has been designed to safely convey the peak flow from a 25-year, 6-hour storm event immediately following a 10-year, 24-hour storm event via the design emergency spillway and a prudent engineering feature (See Plate 3.2.4-4C for design details). The pond is not intended to discharge, and Division of Water Quality personnel was contacted and indicated a discharge permit was not necessary as the cuttings pond was exempt under the '2005 Energy Act'. Although not a sedimentation pond, the cuttings pond will be inspected quarterly and PE-certified as the sedimentation ponds.

3.2.2 Overburden and Topsoil Handling

A comprehensive discussion pertaining to this operational component of the mine plan is presented in Section 4.6 - TOPSOIL AND SUBSOIL HANDLING PLAN.

3.2.3 Coal Processing

Maps 3.2.3-1 and 3.2.3-1A are flow diagrams of the entire coal handling system. Designated capacities represent

Run of Mine (R.O.M.) coal is brought out of the mines by conveyor belts and it is temporarily stored in an 8,000 ton capacity concrete silo or the open coal storage area. As the coal is needed, it is transported by conveyor belts to a crushing system and then to the overland conveyor that transports it to the railroad loadout facility. Coal transported to the railroad loadout facility may go directly into the storage silos or may be placed in the RLO open coal storage area. Some coal is still shipped by truck direct from the truck loadout area. In the event of an emergency situation coal can be transported from the truck loadout area to the railroad loadout facility.

Stoker Coal

A stoker coal circuit is located on the coal storage silos at the train loadout area. A stoker loadout storage tank is located on

Swens Canyon Ventilation Facility

The Swens Canyon Ventilation Facility (SCVF) and Power Line project are needed for the future of the Skyline Mine for multiple reasons. The 3-phase, 12.5 kV, single pole power line, with compact construction is necessary to supply the power needs as mining moves southwest. Attempts to supply the power through the mine is not practical due to the voltage-drop associated with running an insulated cable for a significant distance. Running the power overland eliminates the voltage-drop problem. Similarly, the ventilation shaft in Swens Canyon is necessary to exhaust the air from the mine closer to actual workings. No fan is planned for the ventilation shaft. In addition to the 16-foot ventilation shaft, a 8-foot escape shaft may be installed at the facility as an additional safety measure to enable the evacuation of the mine in an emergency situation (See Plate 3.2.4-4G for details). The approximately 9.7 acre disturbed area also includes space for a transformer, a topsoil pile protecting the topsoil for reclamation, and a drill-cuttings pond designed solely to collect and store the cuttings from drilling of the shafts. The pond is not designed as a sediment control device for the site, and is designed to contain runoff from a 100-year, 24-hour storm event of the surface area represented by the pond itself. Storm water from the pad is controlled as an Alternate sediment control area (ASCA), see Section 3.2.12 for details.

The SCVF includes the construction of a 1,200-foot auxiliary access road to the site, beginning with approximately 500-feet of existing USFS road 0228 adjacent to Swens Canyon creek. Approximately 240-feet road 0228 will be re-aligned approximately 60-feet south of its current location to accommodate the auxiliary road to the pad. The re-alignment is through a pre-existing 'dispersed campground' that has already disturbed the upland vegetation in the area. Specific care has been taken to insure the floodplain and riparian vegetation will not be disturbed. The remainder of the access road is 17-feet wide, supported by roadbase and gravel, sloping at 2 percent into a 1.5H:1V ditch, with a minimum turning radius of 90-feet . Road drainage reports to ditches DD-1 through DD-3 as shown on Plate 3.2.4-4D, with flow from DD-1 reporting to culvert C-1 and comingling with flow from DD-2 at a tie-in pad and discharging to Swens Creek through C-2. Ditch DD-3 reports to Swens Creek through C-3. The disturbed area ditches are temporary and designed to convey runoff from a 10-year 24-hour storm event. The existing road grade begins at 2.3 percent to 3.3 percent, increases to 7.25 percent and tops out at the site at 1.99 percent. Plate 3.2.4-4A and -4B outline details of the road. The pad and associated cut are designed as an Alternate Sediment Control Area (ASCA) where storm water will report to the south end of the pad and settled out against the highwall/berm. Water from the east side of the pad will flow south then west through a swale to the settling area. Runoff from the settling area will not drain into either shaft as there is a minimum of 1.5-feet freeboard from the maximum height of the settling basin to the collar of the shafts as the collar of the shafts extend approximately 2-feet above the

pad elevation (Plate 2.3.4-4G). Plates 3.2.4-4A through -4G illustrate both the overall and detailed designs
of the site. A detailed report outlining the designs of the pad, the hydrologic and geotechnical analysis, and other design specifics are provided in a separate report located in Appendix Volume 5, Section 24 (Skyline Mine Swens Canyon Ventilation Shaft Pad Design Report – Earthfax, December 2014). The construction specifications outlined in the Earthfax report were included in the construction bid package to be followed, which includes compaction tests. See page 3-21 for the Professional Engineer certification that the site was constructed as designed.

Sediment control structures used during construction such as silt fencing and straw bales will remain in place for one year after construction and will be removed anytime thereafter. Erosion control blankets, wattles, or straw bales will be used to control erosion during interim vegetation establishment. The interim seed mix (Table 4.7.11A) will be applied following construction and associated surface-preparation, and prior to the first snowfall. Additional details of the topsoil/subsoil handling plan are located in Section 4.6. The timing of final revegetation will follow a similar timing and sequence.

dam was completed, a principal emergency spillway was constructed. The pond is shown in plan view and in cross section on (Map 3.2.1-4). The pond requires only limited maintenance, i.e., sediment removal to an approved disposal site when 60% of the design sediment storage volume is exceeded. The pond was enlarged in 1993 to facilitate a small (.04 acres) area being added to the drainage area. Not in hard copy nor incorporated.

Swens Canyon Ventilation Facility Pond

The pond at the Swens Canyon Ventilation Facility is not a traditional sedimentation pond used for sediment control of the site. The sole intention of the pond is to store the cuttings from the drilling of the shafts. Upon completion of the shafts, the only storm water to report to the pond will be from the disturbed area of the pond itself. The pond is designed to contain the runoff from a 100-year, 24-hour storm event and not anticipated to discharge.

3.2.7 Signs and Markers

The Permittee has posted all signs and markers required by State of Utah and Federal requirements. Signs are constructed of durable material and are uniformly designed for high visibility and readability. All signs and markers will be maintained during operations to which they pertain and will conform to local ordinances and codes.

Mine and Permit Identification Signs

The Permittee has posted identification signs at the points of access to the permit area from public roads and highways. The signs state the name, business address and telephone number of the Permittee, the identification numbers of current mining and reclamation permits and other authorizations to operate in a color that will provide significant contrast to the color of the sign board and can easily be seen and read. The identification signs will be maintained in place until after release of all bonds.

Perimeter Markers

The perimeter of the areas affected by surface operations or mining facilities has been posted with easily identifiable markers with blue steel fence posts.

Utah Power and Light Company policy dictated that the separation of responsibility would be at the connection to the electrical sub-station which means that the power line corridor was established by Utah Power and Light and the line construction and maintenance remains their responsibility. Consequently, the Permittee was not in position to require a particular power line construction technique. The Permittee did, however, relay the Division request to provide raptor protection to Utah Power and Light. (See Division correspondence dated June 19, 1981, James W. Smith Jr. to Vernal J. Mortensen; Re: Guidelines on Perimeter Markers and Raptor Protection on Power Lines - Exhibit 1.) Utah Power and Light responded that it is their standard procedure to adhere to raptor protection practices. A copy of the Utah Power and Light correspondence is attached. (See Exhibit 2.)

To meet the increased power demands of mining in the Southwest Reserves district, a combination overhead-buried power line was extended from Eccles Canyon to Swens Canyon. The 3-phase, 12.5 kV, single pole power line, with compact construction is necessary to supply the power needs as mining moves southwest. Attempts to supply the power through the mine is not practical due to the voltage-drop associated with running an insulated cable for a significant distance. Running the power overland eliminates the voltage-drop problem. The powerline is overhead, with the exception of a section running from the pad, under Huntington Creek, to the base of the valley bottom.

3.2.11 South Fork Breakout Area

The Upper O'Connor seam required a breakout to improve ventilation. The breakout is on a south facing slope in a side canyon of the South Fork of Eccles Creek (see map 3.2.11-1).

Access to the breakout area is via an existing road up the South Fork of Eccles Creek to the Manti-LaSal National Forest boundary. From the Forest boundary on, the road had been water barred and was reopened. Where the road leaves the main South Fork tributary, it crosses two side drainages. Temporary 18" culverts were installed in these drainages during the construction period. The Forest Service road then continues up the side drainage. Approximately 600 feet up the side drainage a new ancillary life of project road was constructed for a distance of 75' across the drainage to the breakout area (see map 3.2.11-1). During installation of the culverts silt fence and/or straw bales, dikes were placed downstream to control sediment in the stream.

Area 39. This 1.01 acre area addresses both the undisturbed area between the upper undisturbed ditch (UDW-4 from Earth Fax report) and the primary portion of the WQVF access road (DW-5 from Earth Fax report). Sediment from the area is controlled by a catch basin that incorporates a wattle to trap sediment prior entering a culvert taking water under the road (Plate 3.2.4-3A). The ditch has been widened in the vicinity of catch basin to accommodate the installation of the wattles. The outfall of the culvert, although not having a erosive velocity, is armored with riprap to further reduce any sediment loading.

Area 40: The NOG Bleeder Shaft pad is an area that addresses runoff from both small undisturbed area UW1, and disturbed areas DW3, DW5, and DW6 that include the cutbank/highwall, road, and pad. The area contributing runoff to the pad is approximately 0.8 acres. The pad is designed to slope back (or north) into the northwest section of the pad. Water will be able to collect and drop out sediment prior to being discharge off the site via a culvert. Sediment can reach a height of 0.40 feet prior to needing cleaning which will accommodate approximately 160 cu-ft of sediment storage. See Appendix A-5, Section 25 for the Earthfax Hydrology Design report.

Area 40: The Swens Canyon Ventilation Facility pad is an area that addresses both a small undisturbed area (UW3) and the pad (DW3) totaling 1.5 acres (Plate 3.2.4-4D). Storm water runoff and sediment from the area flows to the east-southeast area of the pad. Water and sediment reaching the east side of the pad will either be treated by a silt fence or directed to the south portion of the pad using a berm. Water and sediment reaching the south end of the pad is controlled by a swale and small catch basin located at the southern portion of the pad. At that location, the small amount of water will collect to a maximum depth of 1.28-inches and eventually evaporate. The maximum design velocity is 1.02 ft/sec which is not considered erosive. See Attachement A of Earthfax Swens Canyon Design Report in Appendix Volume 5, Engineering Calculations, Section 24 for details.

Area 41: The Swens Canyon Ventilation Facility Topsoil Pile is designed to safely retain runoff from a 100-year, 24-hour storm event (176 cu-yds.) and one year of predicted sediment yield (195 cu-yds.) Topsoil will be collected/contained in the sediment basin and will either be retained in-place or re-deposited on the pile. Once vegetation is established on the Topsoil Pile, the sediment yield will be significantly reduced. Plate 3.2.4-4D illustrates the area.

On all areas not reporting to a sediment pond, and classified as Alternate Sediment Control Areas, the alternate sediment control measure such as straw bales, silt fences, catch basins, excelsior mats, etc. will be maintained until there is adequate vegetative cover to properly filter any surface runoff (see Sec. 20, Vol. 5 for design). When this can be demonstrated, the alternate control measures will be removed and the area reclassified as an "Exempt area". (See Sec. 21, Vol. 5 for Demonstrations) On all areas classified as Exempt Areas, if they should become redisturbed they will be reclassified as ASCA areas and will have the runoff treated with a designed treatment.

Sec. 3.3
Timing of Opera

3.3 TIMING OF OPERATION

The construction phase of the Skyline Mines project commenced in the summer of 1980. The construction phase included the dirtwork and installation of surface facilities and premining activities such as portal conveyor slope drivage. The construction phase continued during 1982 with the installation of surface facilities and portals. Construction is expected to continue throughout the life of the mines to support and maintain the operation.

No. 3 mine commenced coal production in October 1981. The total period of coal production is expected to be 38 years: life of Mine No.1, 30 years; life of Mine No.2, 27 years; and life of Mine No. 3, 38 years. Plate 3.3-1 shows Mine No. 1 (Upper O'connor Seam), Plate 3.3-2 shows Mine No. 3 (Lower O'Connor "A" and Flat Canyon Seams), and Plate 3.3-3 shows Mine No, 2 (Lower O'Connor B Seam. The timing and sequence of mining of any or all seams is dependent upon mining conditions. North Lease modifications are located on Plate 3.3-2.

Mine No. 4 was initiated in early 2015 with rehabbing portions of the West Mains and driving a slope down to the Lower O'connor A/Flat Canyon Seam. Plate 3-3-4 illustrates the timing, sequence of mining, and the mining of the various seams in Mine No. 4. The timing and sequence of mining of any or all seams is dependent on mining conditions that are subject to change

Cessation of Operation

Prior to any temporary cessation of the Skyline mining operations for a period of 30 days or more, or as soon as it is determined that a temporary cessation will extend beyond 30 days, the Permittee will submit to the appropriate regulatory authority a notice of its intent to cease or abandon operations.

The Permittee's notice will state the exact number of surface acres and extent of subsurface strata which had been affected by underground or surface developments in the permit area prior to cessation or abandonment of mining. The cessation notice will also state the extent and kind of surface reclamation completed to date and the backfilling, regrading, revegetation, environmental monitoring, underground opening closures completed. It will also state water treatment activities the Permittee plans to continue during the temporary cessation period. During periods of temporary cessation, the Permittee will effectively support and maintain all surface access openings to underground operations, and secure surface facilities in areas

Section 4.1
Reclamation Plan

4.1.4 Reclamation Plan – Swens Canyon Ventilation Shaft

Reclamation activities will include removing any structures, such as electrical facilities, any mobile field offices, emergency hoist structures, etc. Compliant to both State Regulations R645-301-551 and MSHA 30 CFR 1711, the shaft(s) will be completely backfilled with an engineered fill. Assuming the shaft(s) were originally drilled using the blind-bore method, the cuttings stored in the cuttings pond area will be used to backfill the shaft(s). If the raised-bore method was used, the fill will need to be shipped to the site. The shaft will be backfilled above the pad surface with excess fill, allowed to settle for approximately one (1) year prior to removing the pad (See Section 4.9 and Figure 4.9-B for details). Once all structures are removed and the shaft sealed, the slopes will be reclaimed to the approximately original contour (AOC) using extreme roughening as the primary form of sediment control. The small section of the USFS road that was rerouted for the access to the pond will be re-established in its former location. Plates 4.4.2-4A and 4.4.2-4B illustrate the proposed final reclamation designs. The site will be reseeded as outlined in Section 4.7 of the M&RP. In the event of revegetation not achieving reclamation standards, additional work will be conducted to insure sediment control on the site.

Section 4.2

Reclamation
Timetable

TABLE 4.2-1 **RECLAMATION TIMETABLE**

	Task	Phase I	Phase II	Phase III	Phase IV
	Recovery of Underground Equipment				
	Seal Mine Portals				
	Remove Winter Quarters Fan and housing				
	Remove NOG Shaft fan and housing				
	Remove Swens Canyon Shaft and housing				
Demolition					
	Mine Site - Lower Bench				
	Winter Quarters Ventilation Facility				
	Mine Site - Middle Bench				
	Mine Site - Upper Bench				
	Overland Conveyor				
	Rail Loadout Facilities				
	Remaining Facilities (pump houses, wells, water tanks)				
Earth Work					
	Seal and Backfill Winter Quarters Mine Openings				
	Install Interim Sediment Control				
	Backfill and Compact				
	Remove Sedimentation Ponds				
	Topsoil Replacement				
	Back fill and compact NOG Shaft				
	Back fill and compact Swens Canyon Shaft				
	Revegetation				

Section 4.3
Reclamation Bond
Calculations

Bonding Calculations

Direct Costs

Subtotal Demolition and Removal	$2,189,956
Subtotal Backfilling and Grading	$1,770,652
Subtotal Revegetation	$421,756
Direct Costs Subtotal	$4,382,364

Indirect Costs

Mob/Demob	$416,259	10.0%
Contingency	$208,130	5.0%
Engineering Redesign	$104,065	2.5%
Main Office Expense	$283,056	6.8%
Project Management Fee	$104,065	2.5%
Subtotal Indirect Costs	$1,115,575	26.8%
Total Cost 2014	**$5,497,939**	

Escalation factor		5
Number of years		0.019
Escalation	$542,532	
Reclamation Cost Escalated	$6,040,471	

Reclamation Bond Amount (rounded to nearest $1,000) 2019 Dollars	**$6,040,000**

Posted Bond March 18, 2015	$5,799,000
Difference Between Cost Estimate and Bond	$301,061
Percent Difference	5%

Ref	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Shop Warehouse 01																			394012
	Administration Bld 02																			27154
	Mine No 1 Transfer Tower 03																			44110
	BC 2 Drive House 04																			9422
	BC 3 Drive House 05																			40300
	Crusher Raw Coal 06																			29295
	Truck Loadout 07																			7090
	Railcar Loadout 08																			23377
	Conveyors 8 total 09																			99678
	Water Tanks Two 10																			6318
	Pump House 11																			1126
	Well House Three 12																			4756
	Water Treatment Bld 13																			17830
	Misc Storage Bld 14																			9435
	Overland Conveyor 15																			95092
	Guard Rail 16																			18195
	Rock Dust Bld 17																			5743
	Overland Dust Collector 18																			1296
	Substation 19																			1797
	Power Line 20																			528
	Cap Magazine 21																			34
	Fuel Storage 22																			2634
	Propane Tanks 23																			470
	Stacking Tube 24																			4900
	Reclaim Tunnel 25																			40535
	Slope Proctection Apron 26																			15574
	Concrete Lined Ditch 27																			1175
	Raw Coal Silo 28																			14063
	Parking Area Middle 29																			2178
	Truck Loadout Foundation 30																			206
	Road Pad Lower 31																			3372
	Silo Rail Loadout 32																			124659
	Loadout Foundation RR 33																			5124
	Pavement Rail Loadout 34																			82539
	Steel 35																			11075
	James Canyon 36																			126205
	Culvert Backfilling 37																			9041
	Channel Construction 38																			520548
	Equipment 39																			265747
	Portal Face Door 40																			6297
	Concrete Building 41																			1750
	Winter's Quarters Ventilation 42																			72809
	North of Graben (NOG) Bleeder Shaft 43																			19894
	Swens Canyon Vent Shaft 44																			22573
	Total																			2189956

Ref.	Description Swens Canyon Ventilation Facility 44	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Steel																			
	Substation/Transformers 42																			
	Structure's Demolition Cost	Steel Bld Large	02 41 16 13 0020	0.27	CF													1000	CF	270
	Escape Shaft																			
	Structure's Demolition Cost	Steel Bld large	02 41 16 13 0020	0.27	CF													88	CF	24
	Fencing																			
	Topsoil Pile	Fencing barbed wire 3 strand	02 41 13 60 1600	2.1	LF													1050	LF	2205
	Ventilation Pad	chain link remove 8'-10'	02 41 13 60 1700	4.22	LF													1000	LF	4220
	Cuttings Pond	Fencing barbed wire 3 strand	02 41 13 60 1600	2.1	LF													1100	LF	2310
	Subtotal																			9029
	Concrete																			
	Substation																			
	Escape Shaft Pad	Concrete demo		15.5	CY													45	CY	698
	Shaft Collar and Pad, temp	Concrete demo		15.5	CY													100	CY	1550
	Misc	Concrete demo		15.5	CY													30	CY	465
	Concrete's Vol. Demolished	Concrete demo		15.5	CY													25	CY	388
	Loading Cost																1.3	260	CY	
	Disposal Costs	Front end loader track 3 CY		2.05	CY													260	CY	533
	Loading Cost	Disposal on site		9.8	CY													260	CY	2548
	Subtotal																			6181
		Transmission Line Removal																		
	Concrete Demolition																			
	Demolition Cost	D6R Series II (9-54) (1st14)		61.36	hr									120						7363
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			7363.2
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			0
	Total																			22573

* shows 50% reduction in volume for steel sheds - no interior walls
- Concrete unit cost for <15-inches per Nielson Construction 2014
NO FAN Demolition - the fan will be disassembled and used at a future location
Chain link gates will be opened manually

	Equipmer Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Portal 01															71677
Water Tank 02															12626
Lower Terrace 03															199039
Middle Bench 04															263112
Upper Bench West Fork 05															139434
Southwest Fork 06															99702
Loadout Faclities 07															191024
South Fork Portal Area 08															74000
Waste Rock Disposal 09															413660
Pond Enlargement Interim 10															1899
Pond Diversion DU2 Interim 11															460
Interim Sediment Control 12															5335
Overland Conveyor 13															1875
James Canyon 14															0
Winter Quarters 15															123885
North of Graben Bleeder Shaft 16															69140
Swens Canyon Vent Shaft 17															103784
Total															1770652

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Swens Canyon Ventilation Facility 17															
Sealing Shaft - 16 ft O.D.															
(+) 6 inch rock	20.38				20.38	1	20.38	CY	226				226	CY	4606
2 inch - 4inch Rock	29.29				29.29	1	29.29	CY	76				76	CY	2226
Gravel	29.29				29.29	1	29.29	CY	491				491	CY	14381
Sand	23.08				23.08	1	23.08	CY	38				38	CY	877
Bentonite	35.35				35.35	1	35.35	CY	102				102	CY	3606
Concrete	120				120	1	120	CY	91				91	CY	10920
Fill Material - already on site					0	1	0	CY						CY	0
General fill by dozer, no compaction			31 23 23.17 0020			1	1.87	CY	7074	CY			6739	CY	13228
Subtotal															**49844.38**
Sealing Escape Shaft - 8ft O.D.															
(+) 6 inch rock	20.38				20.38	1	20.38	CY	32				32	CY	652
2 inch - 4inch Rock	29.2				29.2	1	29.2	CY	10.5				10.5	CY	307
Gravel	29.29				29.29	1	29.29	CY	213				213	CY	6239
Sand	23.08				23.08	1	23.08	CY	5				5	CY	115
Bentonite	35.35				35.35	1	35.35	CY	22				22	CY	778
Concrete	120				120	1	120	CY	30				30	CY	3600
Fill Material					0	1	0	CY					0	CY	0
General fill by dozer, no compaction			31 23 23.17 0020			1	1.87	CY	995				995	CY	1860.65
Subtotal															**13552**
Backfilling and grading															
CAT 345BL II	13000	73.86	0.1	63.03	225.53	1	225.53	HR					24	HR	5413
D10R semi EROPS	0	0	0	0	0	1	0	HR					32	HR	0
Pickup Crew 4x4 ton	3620	27.05	0.1	61.72	114.1	1	114.1	HR					40	HR	4564
CLAB				168.4	168.4	1.5	252.6	HR					40	HR	10104
Foreman average outside				169.03	169.03	1	169.03	HR					40	HR	6761
Subtotal															**26842**
Topsoil															
D10R semi EROPS	0	0	0	0	0	1	0	HR					30	HR	0
Pickup Crew 4x4 ton	3620	27.05	0.1	61.72	114.1	1	114.1	HR					30	HR	3423
CLAB				168.4	168.4	1	168.4	HR					30	HR	5052
Foreman average outside				169.03	169.03	1	169.03	HR					30	HR	5071
Subtotal															13546
TOTAL															103784

Ref.	Description	Materials	Means Referen Number	Unit Cost	Unit	Length	Widt	Height	Diame	Area	Volum	Weigh	Densit	Time	Numb	Unit	Quant Factor	Unit	Cost
	Vegetation Costs																		
	Skyline Mine																		
	South Facing Slopes 1H:3H or Greater																		
	Seeding	South Facing Slope Seed 1H : 3H or gentler	Skyline	208	/AC					39.81						AC	39.81	AC	8280
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					39.81						AC	39.81	AC	1585
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.346	/MSF					39.81						AC	1734	MSF	17940
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.016	/MSF					39.81						AC	1734	MSF	39910
	Subtotal																		67715
	North Facing Slopes																		
	Seeding	North Facing Slopes Seed	Skyline	208	/AC					20.33						AC	20.33	AC	4229
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					20.33						AC	20.33	AC	413
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.35	/MSF					20.33						AC	886	MSF	9170
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.014	/MSF					20.33						AC	886	MSF	20390
	Subtotal																		34202
	Riparian Habitat																		
	Seeding	Riparian Habitat Seed	Skyline	50	/AC					0.04						AC	0.04	AC	2
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					0.04						AC	0.04	AC	0
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	0	/MSF					0.04						AC	2	MSF	0
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	21.41	/MSF					0.04						AC	2	MSF	50
	Subtotal																		52
	Soth to West Facing Slopes																		
	Seeding	Riparian Habitat Seed	Skyline	49	/AC					39.81						AC	39.81	AC	1960
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					39.81						AC	39.81	AC	1585
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.346	/MSF					39.81						AC	1734	MSF	17940
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.016	/MSF					39.81						AC	1734	MSF	39910
	Subtotal																		61395
	North to East Facing Slopes																		
	Seeding	Riparian Habitat Seed	Skyline	49	/AC					20.33						AC	20.33	AC	996.17
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					20.33						AC	20.33	AC	12198
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.35	/MSF					20.33						AC	886	MSF	9170
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.014	/MSF					20.33						AC	886	MSF	20390
	Subtotal																		42754
	Waste Rock																		
	Seeding	Waste Rock Slopes Seed	Skyline	71.82	/AC					12.81						AC	12.81	AC	920
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					12.81						AC	13	AC	164
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.341	/MSF					12.81						AC	558	MSF	5770
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.011	/MSF					12.81						AC	558	MSF	12840
	Subtotal																		19694
	James Canyon																		
	Seeding	Waste Rock Slopes Seed	Skyline	72.16	/AC					4.85						AC	4.85	AC	350
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					4.85						AC	4.85	AC	24
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.332	/MSF					4.85						AC	211	MSF	2180
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.033	/MSF					4.85						AC	211	MSF	4860
	Subtotal																		7414
	Riparian Stem Supplement																		
	Stems	Bare root seedlings, 11" to 16" med. soil	02915 4	1.42	Ea										9800	Ea	13916	EA	19550
	Subtotal																		19550
	Silt Fence Interim Vegetation																		
	Stems	Bare root seedlings, 11" to 16" med. soil	02915 4	1.42	Ea	20000										LF	20000	EA	30460
	Subtotal																		30460
	Reveg Loadout Sediment Pond																		
	Seeding	Riparian Habitat Seed	Skyline	67	/AC					0.3						AC	0.3	AC	20
	Mulch	Hay 1" material only 029105000250	Reveg0	600	/AC					0.3						AC	0.3	AC	180
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10	/MSF					0.3						AC	13	MSF	130
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.077	/MSF					0.3						AC	13	MSF	300
	Subtotal																		1500
	Winter Quarters Ventilation Facility Bond																		
	REVEGETATION																		
	Winter Quarters Ventilation Facility																		
	South facing slopes																		
	Seeding	south facing slope seed mix		208	/AC					2.36						AC	2.36	/AC	490
	Mulch	Hay 1" material only 029105000250		600	/AC					2.36						AC	2.36	/AC	1416
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only		2.4272	/MSF					2.36						AC	103	/MSF	250
	Equipment	Hydro Spreader (equip. & labor) B-81		26.893	/MSF					2.36						AC	103	/MSF	2770
	Tublings																		
	Quaking Aspen	Bare root seedlings, 11" to 16" med. soil		1.79	ea					2.36						AC	400	AC	1960
	Blue Elderberry	Bare root seedlings, 11" to 16" med. soil		1.79	ea					2.36						AC	400	AC	1960
	Subtotal																		14170
	North of Graben Bleeder Shaft Bond																		
	REVEGETATION																		
	North of Graben Bleeder Shaft																		
	South facing slopes																		
	Seeding	North of Graben Bleeder Shaft seed mix		200	/AC					1.7						AC	1.7	/AC	340
	Mulch	Hay 1" material only 029105000250		600	/AC					1.7						AC	1.7	/AC	1020
	Fertilizer	Fertilizer Hyrdo Spread Mat. Only		0.5803	/MSF					1.7						AC	74.1	/MSF	43
	Equipment	Hydro Spreader (equip. & labor) B-81		6.7476	/MSF					1.7						AC	74.1	/MSF	500
	Tublings																		
	Quaking Aspen	Bare root seedlings, 11" to 16" med. soil		1.79	ea					1.7						AC	200	AC	360
	Red Elderberry	Bare root seedlings, 11" to 16" med. soil		1.79	ea					1.7						AC	20	AC	36
	Mountain Snowberry	Bare root seedlings, 11" to 16" med. soil		1.79	ea					1.7						AC	100	AC	180
	Subtotal																		2369

* Hay material only: assume 2 tons/ac (1 to 2 tons recommended in The Practical Guide to Reclamation in Utah pp.112-113)
*2014 R.S. Means and 2014 Nevada SRCE use $0.15/lb ($300/ton)

Ref.	Description	Materials	Means Referen Number	Unit Cost	Unit	Length	Widt	Height	Diame	Area	Volum	Weigh	Densit	Time	Numb	Unit	Quant Factor	Unit	Cost
	Swens Canyon Ventilation Facility																		
	South Facing slopes																		
	Seeding	south-facing slope seed mix		207.63	/AC					9.7						AC	9.7	AC	2014
	Mulch	Hay 1" material only*		14.46	/MSF					9.7						AC	423	MSF	6117
	Fertilizer	Fertilizer Hyrdor Spread Mat. Only	Reveg0	10.341	/MSF					9.7						AC	423	MSF	4374
	Equipment	Hydro Spreader (equip. & labor) B-81	Reveg0	23.014	/MSF					9.7						AC	423	MSF	9735
	Tublings																		
	Sagebrush	Bare root seedlings, 11" to 16" med. soil		1.79	ea					9.7			400			AC	400	AC	6945
	Rabbitbrush	Bare root seedlings, 11" to 16" med. soil		1.79	ea					9.7			400			AC	400	AC	6945
	Subtotal																		36130
	Description Areas Subtotal																		337405
	Revegetation																		
	25% of Initial Seeding																		
	Subtotal																		84351
	Total																		421756

Section 4.4
Backfill, Soil Stabilizat[illegible]
compaction, contour
Grading

4.4.2 Grading and Final Contour

All highwalls and cutslopes will be reclaimed using geotechnically stable fill slopes with surfaces that have been sufficiently roughened with deep gouging. The operational bench slopes will be graded back to the approximate original contour at a two horizontal to one vertical slope (2h:1v) or shallower upon abandonment, utilizing a bulldozer working along the slopes. A geotechnical analysis will be made of this slope at the time of reclamation and design adjustment made as necessary to insure slope stability. The sediment pond at the portal area will be removed during the initial reclamation phase.

The reclamation plan is shown on in maps 4.4.2-1A, 4.4.2-1AA. 4.4.2-1B. 4.4.2-1BA, 4.4.2-1B1 and 4.4.2-1AC. Costs and mass balance data associated with reclamation may be found in the Engineering Calculations, Volume 5.

Grading operations will be possible at the railroad load-out site which will be returned to the approximate original contour and shown on Maps 4.4.2-1C and 4.4.2-1D. Water Tank final reclamation contours are shown on Maps 4.4.2-1E and 4.4.2-1F. The waste rock disposal site final reclamation contours are shown on Map 4.16.1-1B.

The Winter Quarters Ventilation Facility grading and final contour plan will be similar to the sites listed above. Once excess material has been used in sealing the slope and shaft as outlined in Sections 4.1.2 and 4.9, any retaining walls, highwalls or cutslopes will be reclaimed using geotechnically stable fill slopes with the final surface being roughened with deep gouging. The pad will be graded back to the approximate original contour, unless the post-mining land use changes. The sedimentation pond will be removed once sufficient re-contouring of the pad has taken place. See Plates 4.4.2-3A and 4.4.2-3B for the reclaimed site configuration.

The North of Graben (NOG) Bleeder Shaft is similar to all previously listed sites. Once the shaft has been filled as outlined in 4.1.2 and 4.9, any cut-slopes will be reclaimed with the final surface being roughened with deep gouging. The pad will be graded back to the original contour. Plates 4.4.2-5A and -5B illustrate the reclaimed surface.

The Swens Canyon Ventilation Facility will continue with the grading and contour plans listed above, using geotechnically stable fill slopes. Material generated during construction of the shafts and stored in the cuttings pond area, will be used as backfill for the shafts following the backfill designs located in Section 4.9 and Figure 4.9-B. The pad will be graded back to the approximate original contour. The small section of the USFS road that was rerouted for access to the pad will be re-established in its former location. Plates 4.4.2-4A and 4.4.2-4B illustrate the proposed final reclamation designs.

Sec 4.6

Topsoil/Subsoil
Handling Plan

Sec. 4-3

Topsoil to be removed from the North of Graben (NOG) Bleeder Shaft area will be collected from the disturbed area as construction advances. Based on the Order 2 Soil survey (See Appendix A-2, Long Resources Consultants, Inc.) the depth of suitable topsoil will be approximately 4-inches from the A-horizon and up to 4-inches of the B-horizon if necessary. Construction will take place predominantly on the south-facing slope (Soil Profile 14SKY07) dominated by quaking aspen, mountain big sagebrush and grasses. Brush and topsoil will be salvaged simultaneously and stored in the designated topsoil storage area. Larger trees will be placed in a brush pile within the disturbed area to be redistributed at reclamation. A small portion of the existing US Forest service road will be re-routed to utilize flat, previously disturbed areas adjacent to the road. The northslope is dominated by Englemann spruce, and other conifers.

The soils identified in the survey are classified as loam and sandy-loam. The slope is 41 percent. The taxonomic classification is McCadden family, lithic Haplocryolls loamy-skeletal, mixed superactive. At site 14SKY07, which is most representative of the site, the EC values range from 0.23-.037dS/m, Sodium Absorption Ration (SAR) 0.14-0.21, and an estimated Available Water Capacity range of 0.76-1.35 in/ft. - all acceptable ranges to use the available material. The topsoil stockpile is designed to store approximately 1,129 cu-yds of material, and an as-built survey of the pile and site will be conducted at post-construction to confirm the amount of material salvaged. The topsoil stockpile will be located at the west end of the disturbed area where the pad access road leaves the USFS road (See Plates 3.2.4-5A through -5C). Prior to re-distribution, a sampling of the nutrient content (N:P:K)will be conducted to deteirimine the need for fertilizer application when compared to the baseline information. See Section 4.6.3 for Topsoil Protection measures.

The topsoil and subsoil from the Swens Canyon Ventilation Facility (SCVF) area will be collected from the disturbed area as construction advances. The associated soil survey (see Appendix A-2, Volume 2) the depth of topsoil ranges from approximately 0.83 to 1.3 feet. It is estimated approximately 8,750 cu-yds of topsoil and 6,350 cu-yds of subsoil will be collected and stored. The total topsoil, subsoil removal will store approximately 15,100 cu-yd of material. Efforts will be made to segregate the topsoil and topsoil.

The soil units are mapped as the Hailman family and Kamack family which are both considered a sandy loam found on slopes of 5-15% and 10-35%, respectively. The Available Water Capacity (AWC) suitability for the topsoil component of these units is considered Good to Fair while the AWC suitability for the subsoil in these units is considered Fair to Poor.

Of the two (2) soil samples collected in the area of the pad, the EC, Sodium Absorption Rate (SAR), and TOC were all in acceptable ranges to use the available material (see Appendix D of Long Resources Order 2 Soil Survey, Appendix A-2 Volume 2 for details). The Topsoil storage area is designed with a capacity of 16,400 cu-yds, located immediately south of the SCVF pad (see Plate 3.2.4-4F).

TABLE 4.6-4 (Continued)

TOPSOIL REDISTRIBUTION

	Acreage	Planned Depth Inches	Cubic Yds
Overland Conveyor Route	.39	12	629 (Private)
NOG Bleeder Shaft	1.7*	19	4,388 (USFS)

*1.7 acres is only the disturbed area. The permit area encompasses approximately 3.0 acres.

	Acreage	Planned Depth Inches	Cubic Yds
Swens Canyon Ventilation Facility North Slope	5.4****	12	8755 (USFS)
			48,056 (Private)
			~~81,852~~90,607 (USFS)
GRAND TOTAL	~~60.30~~65.70		~~129,908~~138,663**

*Both of these areas are located on National Forest lands and 78,593 cubic yards of National Forest topsoil was removed and stored from these area. The topsoil over and above that planned for redistribution that came from National Forest lands will be redistributed on National Forest lands, as directed by the Manti-LaSal National.

**81,852cubic yards are need for revegetation on National Forest lands and 43,966 cubic yards are needed for revegetation on private lands. As indicated in Section 2.11, there is 79,281 cubic yards of topsoil available for revegetation on National Forest Lands and 44,526 cubic yards of topsoil available for revegetation on private lands.

***2,198 cubic yards are available at the Scofield site. The remainder of the topsoil will come from the portal yard stockpile or other outside source.

****5.4 acres does not include the acreage of the topsoil pile and areas not disturbed in the permit area. Plate 3.2.4-4F illustrates topsoil (~8,755 cu-yds.)and subsoil removal area. Only topsoil is included in the table although approximately 6,345 cu-yds of subsoil will be stored in the pile as well.

4.6.6 Winter Quarters Ventilation Facility Topsoil Redistribution

Topsoil redistribution will commence once removal of all facilities and modification of the pad site to achieve the approximate original contours (AOC) is completed. Distribution of the topsoil will take place immediately prior to re-vegetation activities to minimize erosion. Topsoil will be placed with a bulldozer or comparable machinery to approximate grade. Following topsoil placement to approximate grade, a trackhoe or comparable machinery will deep-gouge or roughen the surface prior to commencement of re-vegetation activities.

4.6.7 NOG Bleeder Shaft Topsoil Redistribution

The topsoil redistribution will start one-year after the shaft has been backfilled to allow for settling, any facilities have been removed, and the earthwork has regarded the road and pad to the approximate original contours (AOC). Re-vegetation activities will immediately follow the distribution of topsoil to minimize erosion. Topsoil will be placed with a bulldozer or comparable machinery to approximate grade, followed by deep-gouging of the surface. Mulch, matting or other best technology currently available (BTCA) will be used as a top-dressing once seed has been distributed.

4.6.7 Swens Canyon Ventilation Facility Topsoil and subsoil Redistribution

As with previous sites, both subsoil and topsoil redistribution will commence once the shafts have been adequately backfilled, and the area of the pad site has been roughly re-graded, subsoil will be re-distributed to achieve approximate original contours (AOC). Topsoil will then be placed with a bulldozer or comparable machinery to achieve approximate grade. Once topsoil is placed, a trackhoe or comparable machinery will deep-gouge or roughen the surface prior to commencement of re-vegetation activities. Following seed distribution, and any remedial soil treatments, topsoil and seed will be retained using a hydro-mulch, certified weed-free straw, erosion control blankets, a combination or other best technology currently available at the time. These procedures apply to both areas associated with the vent facility and any disturbance associated with the power line installation.

Section 4.7
Revegetation Plan

fiber matting will be used since all slopes are expected to be either flat or less than 1.5h:1v. Revegetation success will be evaluated. All ditches and retaining walls will be maintained until the vegetation success standards of R614-301-356 are met. No reclamation is planned for the access roadway at the request of the property owner's representative.

The livestock permittee through the owner has requested that the sedimentation pond not be reclaimed. If, over a period of time, it shows that the pond holds natural runoff water and will be beneficial for livestock and wildlife use, it will not be removed. However, for planning and bonding purposes the sedimentation pond is to be removed and reclaimed (Map 4.16.1C). In the event the pond is not removed, Map 4.16.1B illustrates the reclamation work.

4.7.8 South Fork Breakout

After the area has had the soils redistributed, as outlined in Section 4.6.5, the site will be revegetated. The aspen site will use the seed mixture shown on Table 4.7-4 while the spruce-fir site will use the mixture shown on Table 4.7-5. Following the distribution of topsoil, the area will be evenly covered with certified weed-free straw mulch. The soil with the straw cover will then be deep gouged. The straw will be incorporated in the soil during the deep gouging activities. The appropriate seed mix will then be hand-broadcast and/or through the use of an appropriate hand-held mechanical device at the prescribed rate of application.

Fertilizer rates and applications are discussed in the soil preparation and fertilizer plan (Section 4.5).

Information submitted in 2012 demonstrated the South Fork of Eccles Creek Breakout area qualified for Phase II bond release (See Vegetation Sampling for Phase II Bond Release in South Fork Canyon, 2011, Mt. Nebo Scientific, Inc. - Appendix A-2 Volume 2). To insure Phase III bond release, Skyline conducted husbandry practices and planted additional woody species as a rate of 1,800 to 2,000 plants per acre in 2012. Table 4.7-8~~D~~ outlines a list of recommended woody species (tublings) based on Dr. Patrick Collins review of the site. The additional woody species were necessary because they were not planted originally due to an oversight.

James Canyon Area

Refer to Section 2.7 for a discussion of the revegetation success standards for the James Canyon Project area. Refers to Sections 2-11 and 4-20 for additional information pertaining to the project.

4.7.9 Winter Quarters Ventilation Facility (WQVF)

Refer to both Section 2.7 and the Mt. Nebo Vegetation report located in Appendix A-2, Volume 2 for a discussion of the vegetation for the WQVF. The interim and final revegetation seed mixes for the WQVF area are listed in Tables 4.7-8A through 4.7-8C. Reclamation success standards are based on the reference area(s) identified in the Mt. Nebo report. Noxious plants invading the WQVF permit area will be controlled by hand-grubbing, and/or approved herbicides. Surveillance will be monitored annually during the liability period.

4.7.10 NOG Bleeder Shaft

Refer to both Section 2.7 and the Mt. Nebo Vegetation report located in Appendix A-2 Volume 2 for a discussion of the vegetation of the NOG Bleeder Shaft site. Portions of the area were previously disturbed and re-vegetated, while other portions are undisturbed. Both the interim and final re-vegetation seed mixes are listed in Tables 4.7.-10A and -10B, with the areas seeded being top-dressed mulch, straw, or matting when the seed is distributed. Reclamation success standards are based on the reference areas identified in the Mt. Nebo report. Noxious weeds will be controlled during the liability period. Sediment control structures used during construction such as silt fencing and straw bales will remain in place for one year after construction and will be removed anytime thereafter. Erosion control blankets, wattles, or straw bales will be used to control erosion during interim vegetation establishment.

4.7.11 Swens Canyon Ventilation Facility (SCVF)

Refer to both Section 2.7 and the Mt. Nebo Vegetation report located in Appendix A-2, Volume 2 for a discussion of the vegetation for the SCVF. The interim and final revegetation seed mixes for the SCVF area are listed in Tables 4.7-11A, and 4.7-11B, respectively. Following topsoil and subsoil handling outlined in Section 4.6, seed distribution, and any remedial soil treatments, seed will be retained using a hydro-mulch, certified weed-free straw, erosion control blankets, a combination or other best technology currently available at the time. Reclamation standards are based on a combination of the reference area identified in the Mt. Nebo report, and the recommendations within the report. The area has been mapped as crucial summer range for deer and elk by the Utah Division of Wildlife Resources (DWR). Consequently, a pre-set woody species value of 2,500 plants per acre is currently proposed for a revegetation success standard at the proposed disturbed Sagebrush/Grass area. However, that may be re-evaluated at bond release if an increased percentage of forbs and grasses is determined more desirable for the post-mining land uses. A modification in the woody-species will be based on consultation with USFS, DWR, DOGM, and mine personnel. Noxious plants invading the SCVF permit area will be controlled by hand-grubbing, and/or approved herbicides. Surveillance will be monitored annually during the liability period.

Table 4.7-1

SEED MIXTURE
South-facing slopes of 1h:3v or lower and flat areas

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Bromus marginatus (Mountain brome)	2.00
Elymus spicatus (Bluebunch wheatgrass)	2.00
Elymus glaucus (Blue Wildrye)	2.00
Poa pratensis (Kentucky Bluegrass)	0.50
Forbs	
Lathyrus lanszwertii (Thickleaf peavine)	4.00
Geranium viscosissimum (Sticky geranium)	1.00
Lupinus alpestris (Mountain lupine)	2.00
Shrubs and trees (handset at 1 m intervals)[c]	
Populus tremuloides (Quaking Aspen)	
Symphoricarpos utahensis (Mountain snowberry)	
Artemesia tridentata (Big Sagebrush)	
Total	**13.50**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

[c] Containerized shrubs may be used

Table 4.7-2

SEED MIXTURE
North-Facing Slopes

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Bromus marginatus (Mountain brome)	2.00
Poa pratensis (Kentucky Bluegrass)	0.50
Forbs	
Arnica cordifolia (Heart-leaf arnica)	0.50
Osmorhiza berteroi (Sweetroot, spreading)	0.50
Geranium viscosissimum (Sticky geranium)	1.00
Lupinus alpestris (Mountain lupine)	2.00
Lathyrus lanszwertii (Thickleaf sweetpea)	4.00
Shrubs and trees (handset at 1 - 2.5 m intervals)[c]	
Symphoricarpos utahensis (Mountain snowberry)	
Engelmann spruce (Engelmann spruce)	
Abies lasiocarpa (Subalpine fir)	
Total	**10.50**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

[c] Containerized shrubs may be used

Table 4.7-3

SEED MIXTURE
Riparian Habitat Seed Mixture

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Elymus trachycaulus (Slender wheatgrass) (on terrace areas)	3.00
Bromus marginatus (Mountain brome) (on terrace areas)	3.00
Deschampsia cespitosa (Tufted hairgrass) (along bank areas)	2.00
Poa pratensis (Kentucky Bluegrass) (along terrace areas and bank margins)	2.00
Shrubs and trees (handset at 1/2 - 1 m intervals)[c]	
Salix lutea (Yellow willow)	
-rooted cuttings 1/2 m interval (on banks and rip-rap areas)	
Picea pungens (Blue Spruce)	
- 1 m intervals (tublings) (on terrace areas)	
Rosa woodsii (Woods rose)	
- 1/2 m intervals (tublings) (on bank areas)	
Rubus idaeus (American red raspberry)	
- 1/2 m intervals (tublings) (on rip-rap areas)	
Total	**10.00**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist
[b] Rates based on broadcast seeding methods
[c] Containerized shrubs may be used

Table 4.7-4

SEED MIXTURE
South to West Facing Slopes

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Elymus lanceolatus (Streambank wheatgrass)	4.0
Elytrigia dasystachya (Thickspike wheatgrass)	4.0
Bromus marginatus (Mountain brome)	5.0
Phleum pratensis (Timothy)	0.5
Poa pratensis (Kentucky Bluegrass)	0.1
Forbs	
Achilliea millifolium (Yarrow)	0.1
Artemisia ludoviciana ('Summit' louisiana sagewort)	0.1
Linumm lewisii (Lewis flax)	1.0
Melilotus officinalis (Yellow sweetclover)	2.0
Penstemon strictus ('Bandera' rocky mountain penstemon)	0.5
Shrubs and trees	
Amelanchier alnifolia (Sacatoon serviceberry)	1.0
Artemisia tridentata vaseyana (Mountain big sagebrush)	0.2
Rhus trilobata (Squawbush)	3.0
Rosa woodsii (Woods rose)	1.0
Symphoricarpos utahensis (Mountain snowberry)	2.0
Total	**24.50**

Transplants [c]	#/acre
Chrysothamnus nauseosus albicaulis (Whitestem rubber rabbitbrush)	250.0
Populus tremuloides (Quaking Aspen)	400.0
Sambucus cerulea (Blue elderberry)	400.0

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

[c] Containerized shrubs may be used

Table 4.7-5

SEED MIXTURE
North to East-facing slopes

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Elymus lanceolatus (Streambank wheatgrass)	3.0
Bromus marginatus (Mountain brome)	6.0
Festuca ovina (Hard sheep fescue)	1.0
Poa pratensis (Kentucky Bluegrass)	0.2
Forbs	
Achilliea millifolium (Yarrow)	0.1
Aster chilensis (Pacific aster)	0.1
Lupinus sericeus (Silky lupine)	2.0
Melilotus officinalis (Yellow sweetclover)	1.5
Osmorhiza occidentalis (Sweet anise)	2.0
Penstemon strictus ('Bandera' rocky mountain penstemon)	0.5
Shrubs and trees [c]	
Sambucus racemosa (Red elderberry)	1.0
Symphoricarpos utahensis (Mountain snowberry)	2.0
Total	**19.40**

Transplants [c]	#/acre
Abies concolor (White fir)	200.0
Picea englemanii (Engelmann spruce)	400.0
Potentilla fruiticosa (Woody cinquefoil)	100.0
Rubus idaeus (American raspberry)	100.0

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range
[b] Rates based on broadcast seeding methods
[c] Containerized shrubs may be used

Table 4.7-6

SEED MIXTURE
Shrub Supplement for Riparian Zone
to be used in addition to the South and North Slope mixtures

Species [a) c)]	#/acre
Cornus stolonifera (Red-osier dogwood)	200.0
Mahonia repens (Creeping Oregon grape)	400.0
Salix spp. (Wllow cuttings)	2000.0

[a)] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[c)] Containerized shrubs may be used

Table 4.7-6A

SEED MIXTURE
Waste Rock Disposal Area

Species [a]	Rate [b] (Lbs PLS/Ac)
Grasses	
Pascopyrum smithii (Western wheatgrass)	4.0
Elytrigia dasystachya (Thickspike wheatgrass)	4.0
Bromus marginatus (Mountain brome)	6.0
Poa pratensis (Kentucky Bluegrass)	0.1
Forbs	
Artemisia ludoviciana ('Summit' louisiana sagewort)	0.1
Linumm lewisii (Lewis flax)	1.5
Melilotus officinalis (Yellow sweetclover)	1.5
Penstemon strictus ('Bandera' rocky mountain penstemon)	0.5
Astragalus cicer (Cicer milkvetch)	0.5
Total	**18.20**
Transplants [c]	#/acre
Chrysothamnus nauseosus albicaulis	
(Whitestem rubber rabbitbrush)	200.0
Artemisia tridentata vaseyana (Mountain big sagebrush)	1000.0
Rosa woodsii (Woods rose)	500.0

[a] Depending on commercial availability, species can be substituted by a qualified botanist or
[b] Rates based on broadcast seeding methods
[c] Containerized shrubs may be used

Table 4.7-8

Suggestions for Containerized Plants for Revegetation in South Fork Canyon at the Skyline Mine in Carbon County, Utah

Scientific Name	Common Name
Abies lasiocarpa	Subalpine Fir
Chrysothamnus viscidiflorus	Low Rabbitbrush
Chrysothamnus nauseosus	Rubber Rabbitbrush
Lonicera involucrata	Black Twinberry
Picea engelmannii	Engelmann spruce
Populus tremuloides	Aspen
Ribes aureum	Golden Currant
Ribes viscosissimum	Sticky Currant
Ribes cereum	Wax Currant
Sambucus racemosa	Red Elderberry
Symphoricarpos oreophilus	Mountain Snowberry

**Species used wil be dependent on commercial availability. Substitutions possible if reviewed beforehand if reviewed by a qualified botanist or range specialist.*

Table 4.7-9A

Interim Revegetation Seed Mixture for the Winter Quarters Ventilation Facility		
Species [a]	Rate [b] (Lbs PLS/Ac)	Seeds/ft^2
Elymus lanceolatus (Thickspike wheatgrass)	4.00	14.14
Elymus smithii (Western wheatgrass)	5.00	14.46
Elymus trachycaulus (Slender wheatgrass)	4.00	14.69
Hedysarum boreale (Utah sweetvetch)	10.00	7.71
Poa pratensis (Sandberg bluegrass)	0.30	14.99
Total	**23.3**	**66.0**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

Table 4.7-9B

Final Revegetation Seed Mixture for the Riparian Community at the Winter Quarters Ventilation Facility

Species [a]	Rate [b] (Lbs PLS/Ac)	Seeds/ft^2
Forbs		
Aquilegia caerulea (Rocky Mountain columbine)	1.0	8.45
Geranium viscosissimum (Sticky geranium)	7.0	8.36
Grasses		
Agrostis stolonifera (Creeping bentgrass)	0.05	7.35
Carex microptera (Smallwing sedge)	0.40	7.78
Carex nebraskensis (Nebraska sedge)	0.50	6.13
Elymus trachycaulus (Slender wheatgrass)	2.00	7.35
Juncus articus (Mountain rush)	0.03	7.51
Poa pratensis (Kentucky bluegrass)	0.10	5.00
Total	**11.08**	**57.93**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

Table 4.7-10A

Interim Revegetation seed Mixture for the North of Graben Bleeder Shaft

Species [a]	**Rate** [b] **(# PLS/Ac)**	**Seeds/ft^2**
Forbs		
Achillea millefolium (Common yarrow)	0.6	51
Rudbeckia occidentalis (Western coneflower)	1	51
Grasses		
Bromus carinatus (Mountian brome)	8	15
Elymus trachycaulus (Slender wheatgrass)	8	25
Poa secunda (Sandberg bluegrass)	3	46
Total	**20.60**	**188.00**

a) Depending on commercial availability, species can be substituted by a qualified botanist

b) Rates based on broadcast seeding methods

Table 4.7-10B

Final Revegetation seed Mixture for the North of Graben Bleeder Shaft

Species [a]	Rate [b] (#/ac or Lbs PLS/Ac)	Seeds/ft²
Shrubs and Trees [c]	**(#/ac)**	
Populus tremuloides (Quaking Aspen)	200	n/a
Sambucus racemosa (Red Elderberry)	20	n/a
Symphoricarpos oreophilus (Mountain snowberry)	100	n/a
Forbs	**(Lbs PLS/ac)**	
Achillea millefolium (Common yarrow)	0.6	46
Rudbeckia occidentalis (Western coneflower)	1	51
Heliomeris miltiflora (Showy goldeneye)		
Grasses	**(Lbs PLS/ac)**	
Bromus carinatus (Mountian brome)	8	51
Elymus trachycaulus (Slender wheatgrass)	8	15
Elymus spicatus (Bluebunch wheatgrass)	6	26
Poa secunda (Sandberg bluegrass)	3	25
Total	26.6	214

a) Depending on commercial availability, species can be substituted by a

b) Rates based on broadcast seeding methods

c) Containerized Planting as appropriate

Table 4.7-11A

Interim Revegetation Seed Mixture for the Sagebrush/Grass Community at the Swens Canyon Ventilation Facility

Species [a]	Rate [b]	Seeds/ft^2
Forbs		
Achillea millefolium (Yarrow)	0.06	4
Penstemon spp (Penstemon spp)	3.00	10
Grasses		
Bromus marginatus (Mountain brome)	6.00	22
Elymus spicatus (Bluebunch wheatgrass)	3.00	10
Elymus trachycaulus (Slender wheatgrass)	3.00	10
Poa Secund (Sandberg bluegrass)	0.50	11
Total	**15.56**	**67.00**

[a] Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

[b] Rates based on broadcast seeding methods

[c] Containerized shrubs may be used

Table 4.7-11B

Final Revegetation Seed Mixture for the Sagebrush/Grass Community at the Swens Canyon Ventilation Facility

Species [a)]	Rate [b)] (Lbs PLS/Ac)	Seeds/ft^2
Shrubs [c)]		
Artemesia tridentata vaseyana (Mountain big sagebrush)	0.50	10
Krascheninnikovia lanata (Winterfat)	0.10	4
Mahonia repens (Creeping Oregon grape)	0.25	2
Forbs		
Achillea millefolium (Yarrow)	0.06	4
Penstemon spp (Penstemon spp)	3.00	10
Eriogonum ovalifolium (Cushion buckwheat)	2.00	8
Potentilla glandulosa (Sticky cinquefoil)	0.20	20
Erigeron spp (Daisy spp)	0.40	16
Grasses		
Bromus marginatus (Mountain brome)	6.00	22
Elymus spicatus (Bluebunch wheatgrass)	3.00	10
Elymus trachycaulus (Slender wheatgrass)	3.00	10
Poa Secund (Sandberg bluegrass)	0.50	11
Total	**19.01**	**127.00**

a) Depending on commercial availability, species can be substituted by a qualified botanist or range specialist

b) Rates based on broadcast seeding methods

c) Containerized shrubs may be used as warranted to achieve reclamation standards

Section 4.9
Opening & Sealing Pla

Shafts

Skyline Mine does not have any shafts initiated permitting the Winter Quarters Ventilation Shaft (WQVF) in 2010. Should any be designed in the future, Rreclamation will be in compliance with State regulation R645-301-551 and consistent with MSHA, CFR 75.1771. Shafts or other opening to the surface from an underground mine will be capped, sealed and backfilled, or otherwise properly managed, as required by the Division. Permanent closure measures will be designed to prevent access to mine workings by people, livestock, fish and wildlife, and to keep acid or other toxic drainage form entering groundwater or surface waters.

Figure 4.9-B illustrates how the WQVF shafts will be reclaimed through backfilling. The bottom 50-feet of the shaft will be filled with non-combustible material as follows: starting at the bottom with large, course 6+ inch rock for approximately 20 feet (including mine area); followed by successively by smaller rock; culminating with a 5-foot bentonite layer, 5-foot concrete layer, and an additional 5-foot bentonite layer. The remainder of the shaft will be filled to the surface with pit run or other reject fill. The bottom 50 feet of the shaft has been designed to both minimize accumulation of gas and filling of the shaft with water - should either condition occur. The shaft(s) reclamation design addresses both mass stability and movement in multiple ways: grading of the fill from coarse to fine minimized movement while allowing pore space for possible saturation; the bentonite-concrete layers (~15 total feet) are utilized as both a cap and seal, providing a barrier for both saturation and mass movement; and finally, once the shaft is full to the surface, a 20-foot mound is placed over the former opening to accommodate additional compaction. The mound provides approximately an additional 5 percent of material for compaction. It is proposed the shaft be filled and allowed to settle for approximately one (1)year prior to completely reclaiming the WQVF pad to approximate original contours (AOC).

A shaft in the North of Graben area (NOG Bleeder Shaft) will be abandoned in the same fashion. Figure 4.9-D illustrates the abandonment. Notable differences include the diameter of the shaft (5-feet) and the depth (~1,400-feet). The shaft will not be lined and since the shaft was drilled using the raise-bore method, all the backfill material will need to be imported to the site.

Shafts in the Swens Canyon Ventilation Facility (SCVF) area will be abandoned in the same fashion. Figure 4.9-D illustrates the abandonment. The notable differences are the depth(s) and diameter of the shaft(s). Cuttings from the drilling of the shaft(s) will be used in the backfill at reclamation (Blind-bore). If the raised-bore method is used, all the material will need to be imported to the site.

Mine Entries

In compliance with 30 CFR 75.1711-2, seals will be installed in all entries as soon as mining is completed and the mine is to be abandoned. (See Figure 4.9-A for typical portal seal.) The seals will be located at least 25 feet inside the portal entry. The opening will be sealed with solid, substantial, incombustible material, such as concrete blocks, bricks or tile, or shall be completely filled with incombustible material. Figure 4.9-C illustrates a cross section of the WQVF seal. The WQVF seal has incorporated a water-tight seal in the event water is encountered at reclamation.

Section 4.11
Protection of
Hydrologic Balan

discharged from this location when discharge parameters are met. A Utah Pollution Discharge Elimination System (UPDES) water discharge point was added to the Skyline Mine water discharge permit in December 2009 to accommodate discharging water to Winter Quarters Creek both from the sedimentation pond and potentially future mine water discharge.

The Winter Quarters decline slope portal is at an elevation of 8120 feet which is down dip and at a lower elevation than portions of the Mine workings. To safeguard against a gravity discharge at reclamation, should the mine flood to the portal level, both the shafts and slope have been sealed and backfilled to prevent any discharge at reclamation (See Section 4.9).

4.11.10 North of Graben (NOG) Bleeder Shaft

The NOG Bleeder shaft includes a 3.0 acre bonded permit area, with approximately 1.7 acres of disturbance with a 50-ft by 80-ft pad, 784-ft road, topsoil pile, diesel storage tanks, generator, and a 5-ft diameter shaft. The site is adjacent to an existing USFS road located at the top of Granger Ridge. No pond is necessary for sediment control due to minimal disturbance. The shaft opening is located approximately 1,400 feet above the mine workings eliminating concern of any gravity discharge during the operation of the shaft.

4.11.11 Swens Canyon Ventilation Facility (SCVF)

The Swens Canyon Ventilation Facility included the designs of an exhaust shaft and an emergency escapeway shaft, and a drainage plan for both the disturbed and undisturbed drainage. The majority of undisturbed drainage has been diverted around the site, while the disturbed area drainage has been minimized with a number of Alternate Sediment Control Areas (ASCAs) that eliminate the need for a sedimentation pond. The shafts are located significantly higher than the flow in Swens Canyon eliminating any chance of water from the creek entering the shaft. Similarly, the shaft is approximately 900 feet above and up dip of the majority mine workings, eliminating concern of gravity discharge during the operation of the mine. See Section 4.9 for the detailed reclamation of the shafts.

Section 4.12
Post Mining Land Us

TABLE 4.12-1

PROPOSED POSTMINING LANDUSE

Area	Present Ownership	Premining Landuse	Proposed Postmining Use	Alternative Use	Capacity To Support Proposed Use	Relationship To Existing Landuse Policies
Mine Site and Exploratory Excavations	USFS	Wildlife/ Grazing Habitat	Wildlife/ Grazing Habitat	Picnic Area	Adequate	Compatible
Conveyor and Pipeline	Private	Grazing/ Wildlife Habitat	Grazing/ Wildlife Habitat	Wildlife Habitat	Adequate	Compatible
Main Access Road	State	Forest Access and Service Road	State Road	None	Adequate	Compatible
Loadout	Private	Grazing, Picnic and Stock Pens*	Grazing/ Wildlife	Wildlife Habitat	Adequate	Compatible
Waste Rock Disposal	Private	Grazing/ Wildlife Habitat	Grazing/ Wildlife Habitat	Wildlife Habitat	Adequate	Compatible
South Fork Breakout	USFS	Wildlife/ Grazing Habitat	Wildlife/ Grazing Habitat	Wildlife Habitat	Adequate	Compatible
James Canyon	USFS/Private	Wildlife/ Grazing Habitat	Wildlife/ Grazing Habitat	Wildlife Habitat	Adequate	Compatible
Winter Quarters Ventilation Facility	Private	Grazing Mining Wildlife	Grazing Wildlife	Adequate	Adequate	Compatible
NOG Bleeder Shaft	USFS	Wildlife	Wildlife	Adequate	Adequate	Compatible
Swens Canyon Ventilation Facility	USFS	Wildlife/ Grazing	Wildlife/ Grazing	Adequate	Adequate	Compatible

The mine support roads will be reclaimed in the permit area. Culverts and blacktop surfacing material will be removed. Reclamation would then include recontouring, ripping, adding cross drains, water bars, topsoil and seed.

Removal of Scofield Waste Disposal Site Sedimentation Pond

The livestock permittee through the owner has requested that the sedimentation pond not be reclaimed. If, over a period of time, it shows that these ponds hold natural runoff water and will be beneficial for livestock and wildlife use, they will not be removed. However, for planning and bonding purposes the sedimentation pond is to be removed and reclaimed (Map 4.16.1C). In the event the pond is not removed, Map 4.16.1B illustrates the reclamation work.

Removal of Winter Quarters Ventilation Facility (WQFV) Sedimentation Pond

The WQVF area sedimentation pond will be removed during early Phase II reclamation. Alternate sediment control measures such as silt fences, straw bales and check dams will be used until the area is vegetated and runoff meets applicable standards.

Removal of the Swens Canyon Ventilation Facility (SCVF) Cuttings Pond

The SCVF area sedimentation pond is solely used for cuttings from construction of the shafts. It is not intended as a sediment control structure for the site. Once the shafts are constructed, the ponds will only collect water from the immediate vicinity of the pond. Material from the pond will be used in the backfilling of the shafts at reclamation. As shown in Table 4.12-1, both pre- and post-mining uses are the same; Wildlife/grazing habitat. For details on the management plans and performance standards see pertinent Chapter 4 section of this M&RP such as Sections 4.4 (Backfilling), 4.6 (Topsoil handling), 4.7 (Revegetation),and 4.9 (Openings Sealing.

Section 4.13
Ponds, Embank

The portal area sedimentation pond is recessed and, therefore, has no embankments requiring geotechnical investigations. The engineering evaluation for the load-out area sedimentation pond is discussed in Section 3.2.1 and in Volume 5.

The loadout area sedimentation pond was designed and built with a combined slope of 4:1. Engineering justification for departure from the recommended 5:1 combined slope is included in the Engineering Calculations, Section 1 of Volume 5. During sediment clean out of the loadout sedimentation pond, the pond shall be drained of all the water that will meet permit requirements. Water not meeting discharge requirements may be used to water roads for dust suppression, water vegetation within the area reporting back to the sediment pond or may be hauled to the portal area sedimentation pond.

The rock disposal area sedimentation pond is recessed and, therefore, has no embankments requiring geotechnical investigation. During sediment clean out of the rock disposal sedimentation pond, the pond shall be drained of all the water that will meet permit requirements. Water not meeting discharge requirements may be used to water roads for dust suppression, water vegetation within the area reporting back to the sediment pond or may be hauled to the portal area sedimentation pond.

The Winter Quarters Ventilation Facility pond has an embankment that will be built according to designed specifications. Engineering Calculations are located in Volume 5, Section 24, and illustrated on Map 3.2.4-3D.

The four sediment ponds will be inspected, at a minimum, once each calendar quarter for structural weakness, erosion, and other hazardous conditions. Any deficiencies found will be reported to DOGM. Reports are kept at the mine office and are available upon request.

The Swens Canyon pond is technically not a sediment pond for storm water sediment control at the site, but a drill-cuttings pond from the drilling of the shafts. The pond is designed to contain the storm water runoff from a 100-year, 24-hour storm event and is not designed to discharge. Engineering Calculations are located in Appendix Volume 5, Section 24 of the M,&RP (Swens Canyon Ventilation Shaft Pad, EarthFax, 2014), and illustrated on Plate 3.2.4-4C.. It will be inspected for structural integrity on a frequency similar to the other sedimentation ponds.

Section 4.17
Subsidence Control PG

area of the forest and will likely never be harvested (Carter Reed, Manti-La Sal National Forest, Oral Communication 10-2002).

Included in the Subsidence Probability Survey for Woods Canyon, Skyline contracted Agapito Associates, Inc. (AAI) to evaluate the subsidence impacts of conducting full-extraction mining in areas with as little as 400 feet of overburden (Appendix A-1, Vol.2). The AAI analysis utilizes a numerical model – Surface Deformation Prediction System (SDPS) (Agiotuantis and Karmis 2002) that incorporates, information from the Burnout Canyon area study, local geology, mining and subsidence data. The study predicted less than five(5) feet of subsidence would occur in the Woods Canyon area and mining could safely be conducted in areas with 475 feet of overburden. Other items identified in the AAI study inculde: 1) the average gradient in Woods Canyon (5.71%)is greater than in Burnout Canyon (4.12%) which suggests the hoizontal strain will be spread along a longer stream path and dampen direct impacts of tensile strain; and 2) the US Bureau of Mines (USBM) criteria for subsidence classifies Woods Canyon as having class III (shaley and silty sandstone) overburden, and the appropriate overburden thickness multiplier would be 461 feet. Incidentally, the same USBM report (1979) originated the 60 times the bodies of water of 'catastrophic' potential size such as large rivers and lakes. The 60 time the extraction thickness is a conservative generalization that somewhat mis-characterizes the USBM study recommendations.

Prior to acquiring the Flat Canyon Lease, additional mining was conducted in the Upper Huntington drainage in existing leases. The Swens Canyon Ventilation shaft was constructed to facilitate this mining. A pre-subsidence survey was conducted over the area to insure no adverse effects from subsidence would impact road SR-264, the proposed ventilation shaft or the power line. No buildings exist in the area. Plate 4.17-3-1A illustrates the anticipated areas of subsidence.

4.17.2 Mining Methods

The mining methods to be used by the Permittee include longwall mining, room and pillar mining with pillar removal, and room and pillar mining with pillars left in place. Certain room and pillar mining systems are designed to provide full support and will prevent subsidence. Subsection 3.1.5 contains descriptions of the mining methods to be implemented.

Full extraction areas include room and pillar panels with pillar removal and longwall panels. Subsidence prediction work has shown the expected maximum planned and controlled subsidence will vary from 0 to 24 feet, assuming that the total cumulative extraction from the three mineable seams will not exceed 30 feet.

4.17.3 Subsidence Effect Prevention Measures

It is anticipated that the planned subsidence will result in a generally uniform lowering of the surface lands in broad areas, thereby limiting the extent of material effect to those lands and causing no appreciable change to present land uses and renewable resources. The Permittee established a subsidence monitoring program in the early stage of mining for use in reviewing the surface effect of mining and as an aid in future mine planning.

In areas where mining related subsidence would damage resources, room and pillar mining methods will be used. Wherever the pipeline and creek buffer zones coincide, creek buffer zone requirements take precedence. Where the yield pillar/barrier system is used, the

Section 4-18
Fish and Wildlife Pla

Waste Rock Site

Fish and Wildlife Enhancement Measures:
$ Species to be planted and the rates per acre will follow the specifications in Table 4.7-6A.
$ Seeds and seedlings planted during reclamation will include diverse palatable species.
$ See Section 2.9 for additional discussion of Wildlife at the Waste Rock site.

Winter Quarters Ventilation Facility (WQVF)
Fish and Wildlife Enhancement Measures:
$Species to be planted and seeded and rates per acre are outlined in Mt Nebo Report (Appendix A-2, Volume 2).
will be used in reclamation as outlined by Dr. Shiozawa (Appendix A-3, Volume 2)
• Photo documentation of the pre-disturbed stream wcollected for re-construction of the stream bank morphology
• The WQVF was specifically designed to be constructed a minimum of two (2) stream widths from the stream channel, thus providing a buffer zone of riparian and other upland vegetation to minimize impacts and maintain appropriate habitat.

• During construction, operation, and reclamation of the WQVF site, noxious plants invading the permit area will be controlled by hand-grubbing, and/or approved herbicides. Surveillance will be monitored annually during the liability period.

NOG Bleeder Shaft
Fish and Wildlife Enhancement Measures:
- Species will be planted and seeded as outlined in Section 4.7
- During construction, operation, and reclamation of the site, noxious plants invading the site will be controlled by approved herbicides. Monitoring and treatment will continue annually during the liability period.

Swens Canyon Ventilation Facility (SCVF)
Fish and Wildlife Enhancement Measures:
Species to be planted and seeded at the prescribed rates per acre are outlined in Section 4.7, Tables 4.7-11A and -11B. This will provide better wildlife habitat in the future. Any areas disturbed along the pipe line corridor needing repair after the first growing season after construction will be reclaimed in a similar manner.
No enhancement measures are necessary along Swens Canyon Creek.
During construction, operation, and reclamation of the SCVF site, noxious plants invading the permit area will be controlled by hand-grubbing, and/or approved herbicides. The areas will be monitored annually throughout the liability period

Section 4.20
Transportation
Facilities

4.20.5 Winter Quarters Ventilation Facility Road

The pre-existing road in Winter Quarters Canyon is classified as an ancillary road based on the following criteria: it is not used to transport coal or spoil; it is not used for access or other purposes for a period in excess of six months; and it will not be retained for a specifically approved postmining land use. The access is primarily across private land. Although improvements to the road were made by the Mine, the improvements were included in the easement of the lease and will not be altered during reclamation.

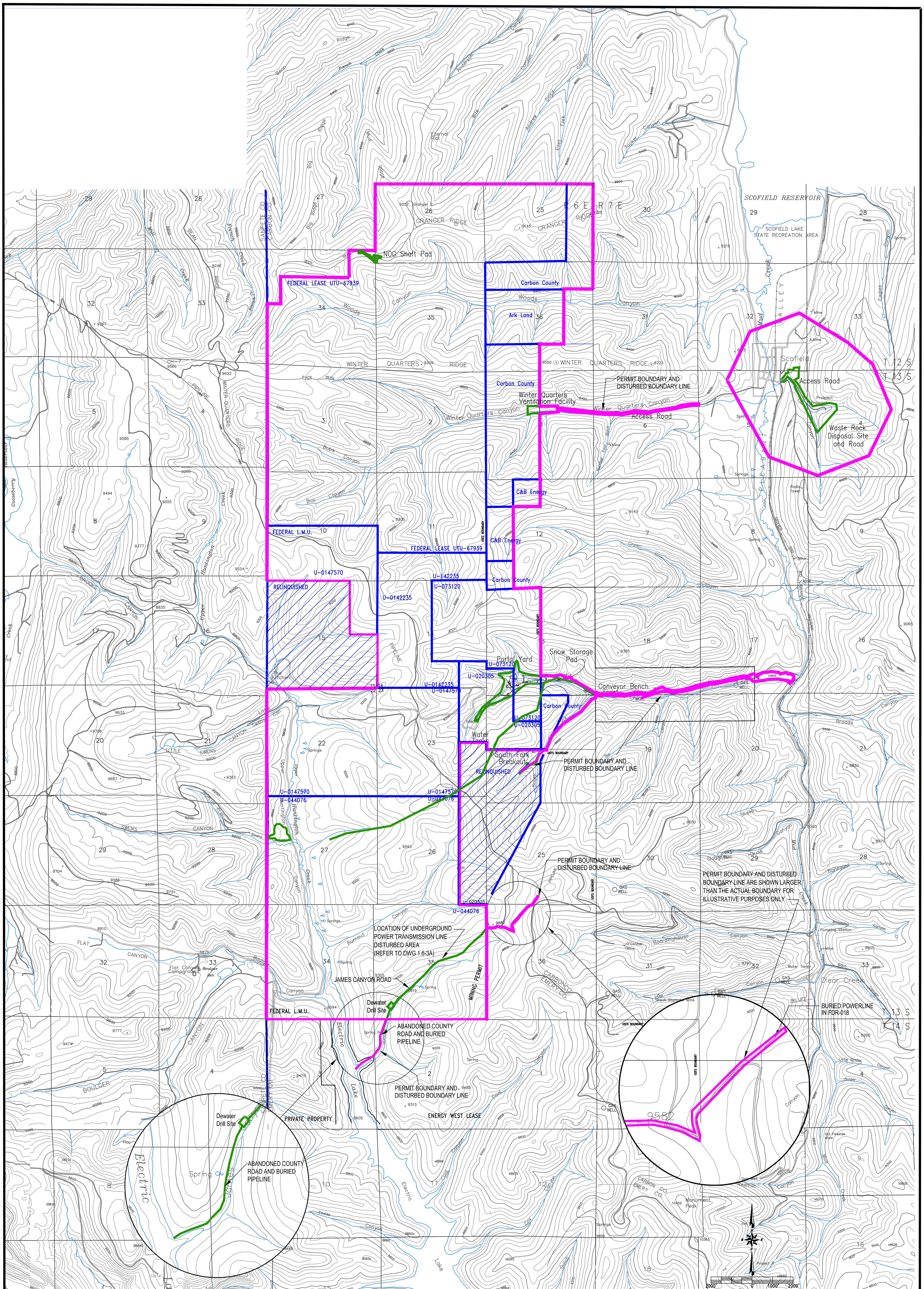
The approximately 450 foot access road built for the Winter Quarters Ventilation Facility pad will be removed during reclamation. See Plates 3.2.4-3b and -3e for detailed road illustrations and Plates 4.4.2-3A and 4.4.2-3B for reclamation details.

4.20.6 North of Graben (NOG) Bleeder Shaft Road.

The NOG Bleeder Shaft access road is classified as an ancillary road since 1) it is not used to transport coal or spoil: 2) it is not used for access or other purposes for a period in excess of six (6) months; and 3) it will not be retained for a specifically approved post-mining land use. The access is located on land exclusively managed by the US Forest Service. The approximately 780-foot road built for the NOG Bleeder Shaft will be removed during reclamation. See Plates 3.2.4-5A through -5D for detailed road illustrations and Plates 4.4.2-5A and -5B for reclamation details.

4.20.7 Swens Canyon Ventilation Facility (SCVF) Road

Both the pre-existing and new access road in the SCVF area are classified as ancillary roads. The pre-existing road will be slightly rerouted while the SCVF is functional, but will be re-established in its original location at reclamation. The approximately 900 foot access road built for the SCVF pad will be removed during reclamation. See Plates 3.2.4-4A, and -4B for detailed road illustrations, and Plates 4.4.2-4A and -4B for reclamation details.



ADJACENT AREA SITE DESCRIPTION:
Active Lease Areas, Permit Boundary, and
1/2 Mile beyond Waste Rock Disposal Site

13,525 ACRES SITE PERMIT BOUNDARY

PERMIT AREA	SITE DESCRIPTION
13.86	RAIL LOADOUT
42.55	PORTAL YARD
0.60	WATER TANKS, TRANSMISSION LINES (not reclaimed) & WELL PADS
0.96	SOUTH FORK PORTALS
14.18	CONVEYOR BENCH
32.48	WASTE ROCK DISPOSAL SITE
7.93	WINTER QUARTERS VENTILATION FACILITY
4.90	WINTER QUARTERS ROAD (not reclaimed)
1.60	JAMES CANYON BURIED PIPELINE
0.30	JAMES CANYON BURIED POWER LINE
2.95	JAMES CANYON WATER WELLS AND ROAD
3.00	NOG Bleeder Shaft
14.50	Swens Shaft and Power line (powe line not reclaimed)
139.81	

LEASE ACREAGE WITHIN ADJACENT AREA

FEDERAL COAL	ACREAGE
U-0147570	1532.70
U-0142235	520.0
U-073120	557.22
U-044076	2489.32
U-020305	279.40
UTU-67939	4061.52
TOTAL	9,440.16

NON-FEDERAL COAL	ACREAGE
C&B COAL	120.00
CARBON COUNTY	811.25
ARK LAND COMPANY	240.00
TOTAL	1,171.25

NOT ALL ACREAGE FOR EACH LEASE IS WITHIN THE PERMIT BOUNDARY, REFER TO PART 1, TABLE 1.114.

LEGEND

ADJACENT AREA: Areas Authorized for Coal Mining and Reclamation Activities (SEE CHIA FOR HYDROLOGIC ADJACENT AREA)
PERMIT BOUNDARY
LEASE BOUNDARY

NOTES:
1. COORDINATE BASE ON MINE GRID DATA.
2. MAP DIGITIZED FROM 1:24000 USGS QUADRANGLE MAPS, SCOFIELD, UTAH AND FAIRVIEW LAKES, UTAH.
3. MINE FACILITY, CONVEYOR, AND NEW ECCLES CANYON ROAD LOCATIONS FROM EXISTING RECORD DATA AND INCORPORATED TO MAP IN BEST FIT LOCATIONS.
4. UTM GRID TICK VALUES SHOWN ARE IN METERS.

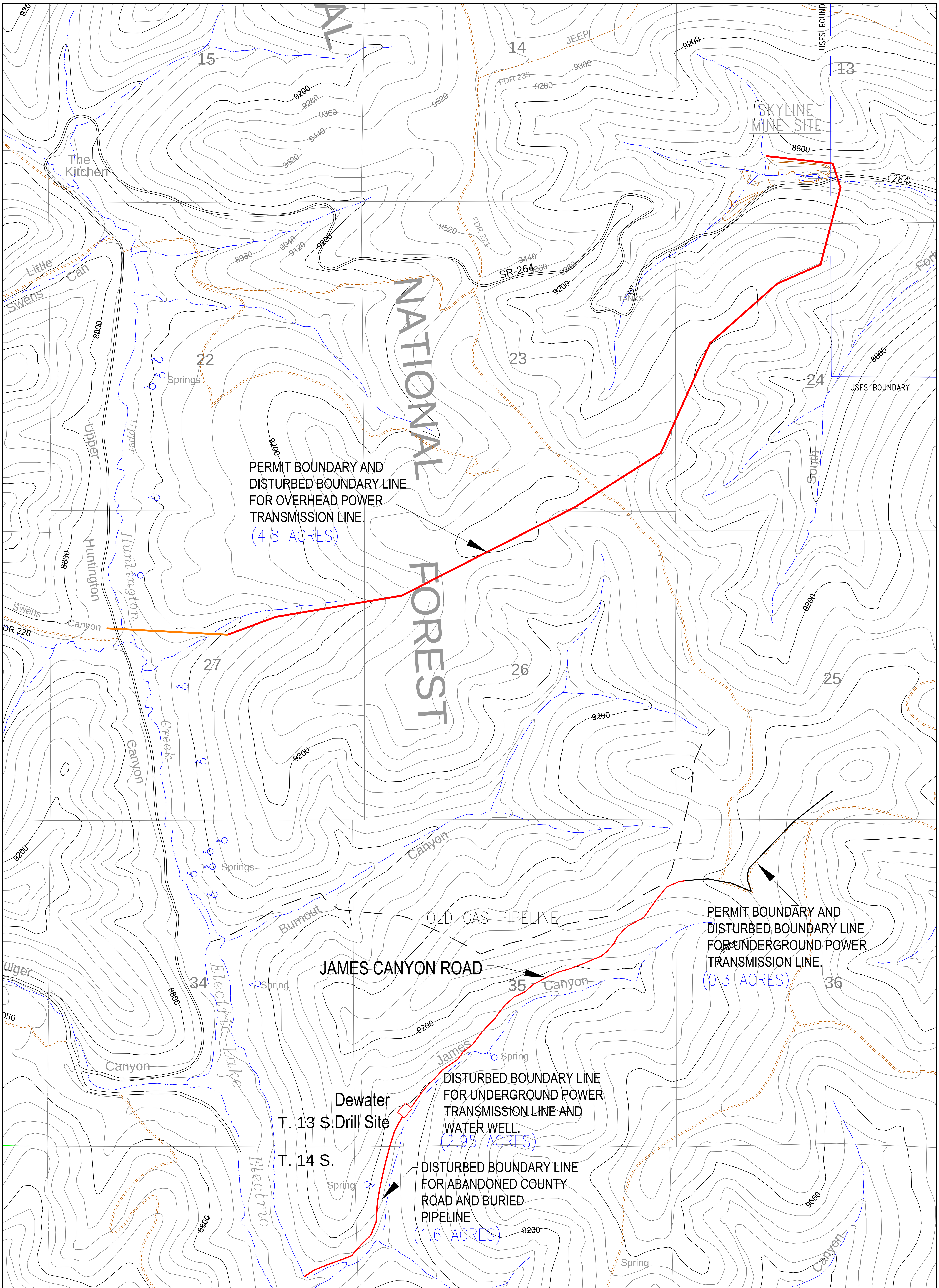
BASE PREPARED BY INTERMOUNTAIN AERIAL SURVEYS, SALT LAKE CITY, UTAH – M96147

DATE	No.	REVISIONS	DR./CHKD.
AUG 02	1		/VSM
NOV 02	2		/VSM
JUNE 07	3	MODIFIED PERMIT BOUNDARY (IBC & WASTE ROCK) SKYLINE MINES PERMIT AREA, LEASE AREAS.	BR/GG
MAR 2010	4	ADDED ADJACENT AREA, MODIFIED PERMIT AND LEASE BOUNDARIES	AB/GG
JUL 2010	5	ADDED WINTER QUARTERS ACCESS ROAD	AB/GG
AUG 2010	6	MODIFIED ADJACENT AREA	AB/GG
OCT 2012	7	Modified Adjacent Area with Lease Mod. and Relinquishments	GG/GG
July 2014	8	Corrected permit boundary to include water line from Tanks	GG/GG
April 2015	9	Added the NOG shaft pad	TE/GG
DEC 2015	10	Added Swens shaft pad and power line	/

SKYLINE MINE PERMIT AREA

Canyon Fuel Company, LLC
Skyline Mines
HC35 BOX 380, HELPER, UTAH 84526
435-448-6463

SCALE: 1" = 2000' | DATE: 9/24/01 | CK.BY: G. Galecki
DWG. NO.: 1.6-3 | DR.BY: JLP/CDH
CAD FILE: 1.6-3REV9_4-6-15
REVISION: 10
12/30/15



LEGEND

- DISTURBED AREA BOUNDARY LINE
- PERMIT AREA BOUNDARY LINE
- UNDERGROUND POWER LINE

I CERTIFY THAT THE INFORMATION CONTAINED HEREON IS CORRECT TO THE BEST OF MY KNOWLEDGE.

2000' 0' 1000' 2000'

CONTOUR INTERVAL: 80 Feet

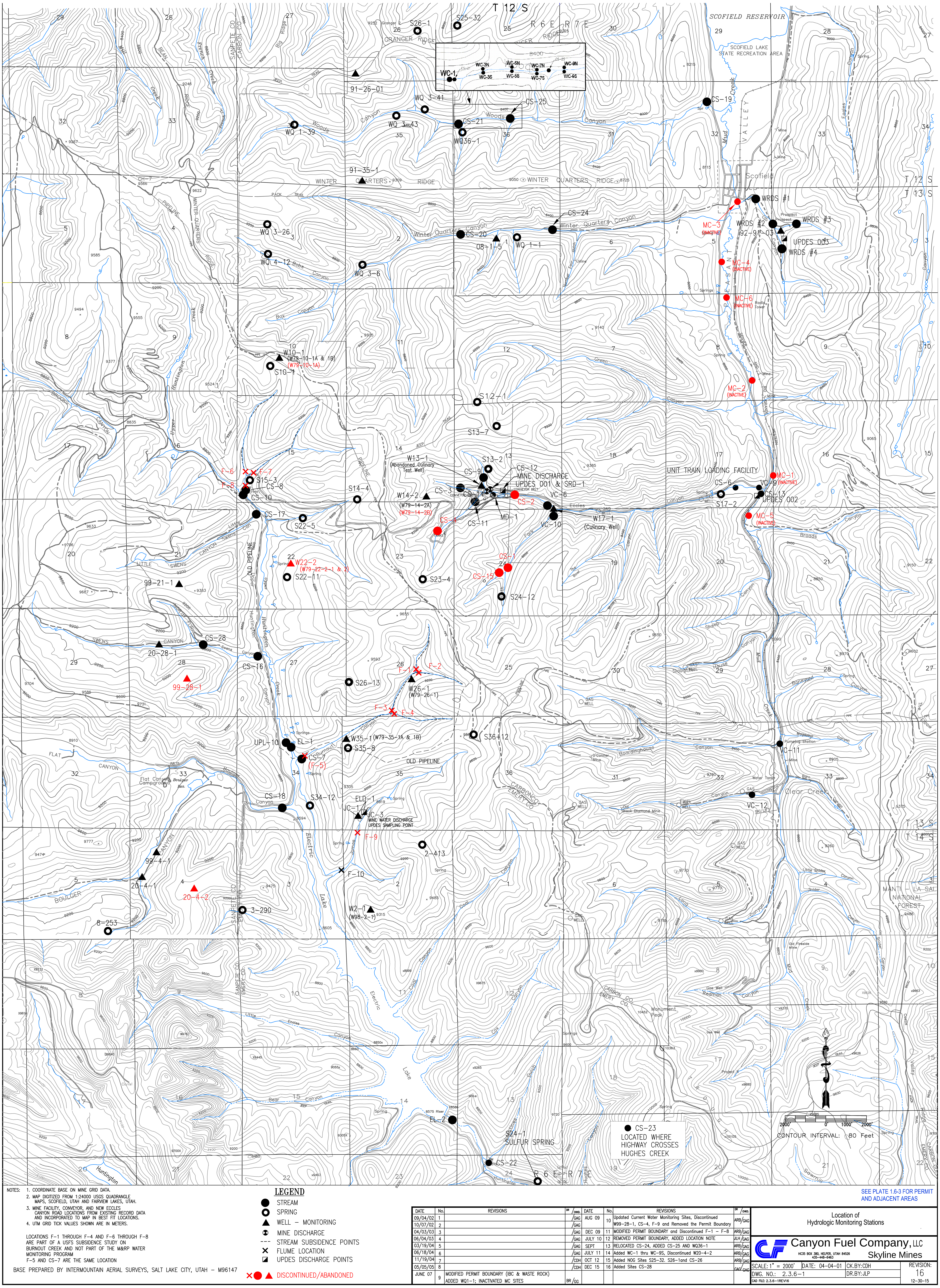
DATE	#	REVISIONS	DR. / CHKD.
12/30/2015	1	ADD POWER LINE CORRIDOR FOR SWEN CYN PAD	TE / GG

SKYLINE BURIED PIPE AND POWER LINES

Canyon Fuel Company, LLC
Skyline Mines

HCR 35 BOX380, HELPER, UT. 84526 435-448-2632

CAD FILE: 1.6-3(A)	DATE: 10/17/2001	CK.BY: G. Galecki	REVISION: 1
	SCALE: FULL	DR.BY: J. Armstrong	
DWG. NO.: 1.6-3(A)			12/30/2015



SEE PLATE 1.6-3 FOR PERMIT AND ADJACENT AREAS

NOTES:
1. COORDINATE BASE ON MINE GRID DATA.
2. MAP DIGITIZED FROM 1:24000 USGS QUADRANGLE MAPS, SCOFIELD, UTAH AND FAIRVIEW LAKES, UTAH.
3. MINE FACILITY, CONVEYOR, AND NEW ECCLES CANYON ROAD LOCATIONS FROM EXISTING RECORD DATA AND INCORPORATED TO MAP IN BEST FIT LOCATIONS.
4. UTM GRID TICK VALUES SHOWN ARE IN METERS.

LOCATIONS F-1 THROUGH F-4 AND F-6 THROUGH F-8 ARE PART OF A USFS SUBSIDENCE STUDY ON BURNOUT CREEK AND NOT PART OF THE M&RP WATER MONITORING PROGRAM
F-5 AND CS-7 ARE THE SAME LOCATION

BASE PREPARED BY INTERMOUNTAIN AERIAL SURVEYS, SALT LAKE CITY, UTAH - M96147

LEGEND

- STREAM
- SPRING
- WELL - MONITORING
- MINE DISCHARGE
- STREAM SUBSIDENCE POINTS
- FLUME LOCATION
- UPDES DISCHARGE POINTS
- DISCONTINUED/ABANDONED

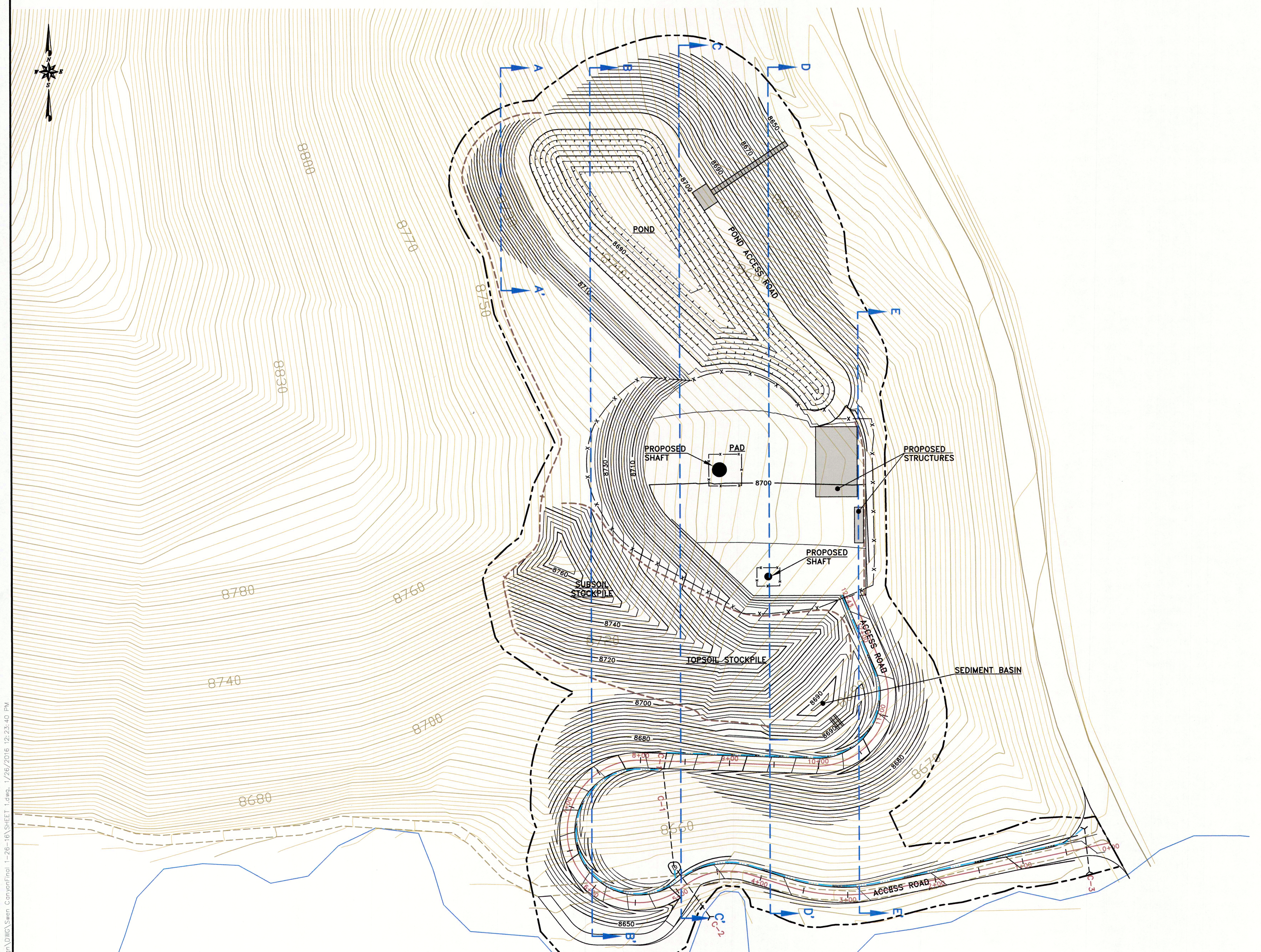
DATE	No.	REVISIONS	DR/CHKD.	DATE	No.	REVISIONS	DR/CHKD.
09/04/02	1		/GAG	AUG 09	10	Updated Current Water Monitoring Sites, Discontinued W99-28-1, CS-4, F-9 and Removed the Permit Boundary	ARB/GAG
10/07/02	2		/GAG				
04/03/03	3		/GAG	DEC 09	11	MODIFIED PERMIT BOUNDARY and Discontinued F-1 - F-8	ARB/GAG
06/04/03	4		/GAG	JULY 10	12	REMOVED PERMIT BOUNDARY, ADDED LOCATION NOTE	JLH/GAG
03/19/04	5		/GAG	SEPT	13	RELOCATED CS-24, ADDED CS-25 AND WQ36-1	ARB/GAG
06/18/04	6		/GAG	JULY 11	14	Added WC-1 thru WC-9S, Discontinued W20-4-2	ARB/GAG
11/19/04	7		/CDH	OCT 12	15	Added NOG Sites S25-32. S26-1and CS-26	ARB/GAG
05/05/05	8		/CDH	DEC 15	16	Added Sites CS-28	GAG/GAG
JUNE 07	9	MODIFIED PERMIT BOUNDARY (IBC & WASTE ROCK) ADDED WQ1-1; INACTIVATED MC SITES	BR/GG				

Location of
Hydrologic Monitoring Stations

Canyon Fuel Company, LLC
HC35 BOX 380, HELPER, UTAH 84526
435-448-6463
Skyline Mines

SCALE: 1" = 2000'	DATE: 04-04-01	CK.BY:CDH	REVISION: 16
DWG. NO.: 2.3.6-1		DR.BY:JLP	
CAD FILE: 2.3.6-1REV16			12-30-15

SWENS CANYON SHAFT
PAD LAYOUT



INDEX OF DRAWINGS

TITLE	SHEET NO.
COVER SHEET AND FINAL OPERATIONAL PLAN	SHEET 1
OPERATIONAL CROSS-SECTIONS AND ROAD PROFILE	SHEET 2
POND AND SEDIMENT BASIN DRAINAGE PLAN	SHEET 3
WATERSHED AND DRAINAGE DETAILS	SHEET 4
DRAINAGE DETAILS	SHEET 5
TOPSOIL REMOVAL PLAN	SHEET 6
RECLAMATION PLAN	SHEET 7
RECLAMATION CROSS-SECTIONS	SHEET 8

LEGEND

- 8140 — EXISTING GROUND MAJOR CONTOUR (10 FOOT)
- EXISTING GROUND MINOR CONTOUR (2 FOOT)
- 8140 — OPERATIONAL GROUND MAJOR CONTOUR (10 FOOT)
- OPERATIONAL GROUND MINOR CONTOUR (2 FOOT)
- OPERATIONAL GROUND DEPRESSION CONTOUR
- EXISTING ROAD
- EXISTING PAVED ROAD
- PROPOSED ROAD
- DISTURBED AREA BOUNDARY
- PROPOSED BERM OR SILT FENCE
- PROPOSED DITCH
- PROPOSED FENCE
- A A' OPERATIONAL CROSS SECTION LOCATION (SEE SHEET 2, FOR CROSS-SECTIONS)

OPERATIONAL (CUBIC YARDS)

SOIL	CIVIL3D CUT	CIVIL3D FILL	TOPSOIL REMOVED
POND	18,900	30,400	5,900
PAD	27,800	100	5,700
ACCESS ROAD	5,000	1,600	3,500
TOTAL	51,700	32,100	15,100

DISTURBED AREA = 9.7 ACRES

EXCESS CUT MAY BE PLACED ALONG FACE OF POND EMBANKMENT OR HAULED OFFSITE.

CUT AREAS ALONG THE ACCESS ROAD, PAD, AND ABOVE THE POND ARE DESIGNED AT 1.5:1 (HORIZONTAL:VERTICAL). WHERE BEDROCK IS ENCOUNTERED THE SLOPE MAYBE AS STEEP AS 0.5:1, AS APPROVED BY ENGINEER.

THE D.A.B ALLOWS FOR VARIATIONS IN CUT SLOPE AND EXPANSION OF THE POND EMBANKMENT FILL.

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A. JIMENEZ
1/26/2016
STATE OF UTAH

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

0 60' 120'
CONTOUR INTERVAL = 2'

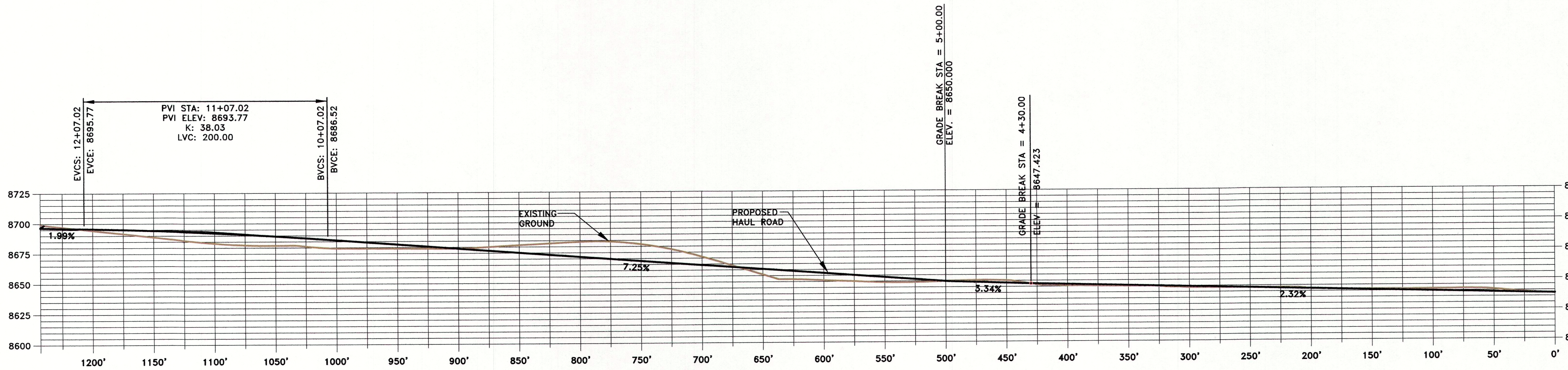
SEAL:

DATE	No.	REVISIONS

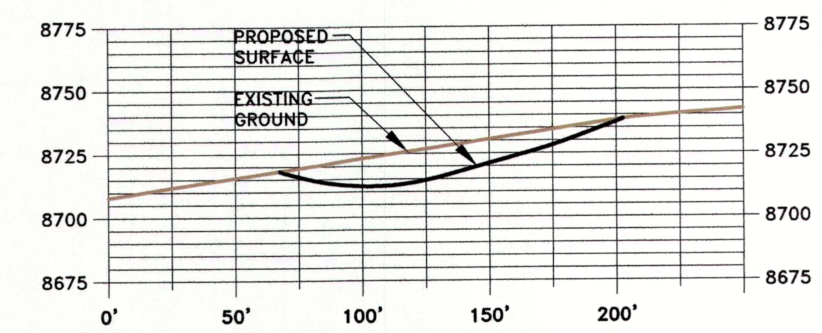
SWENS CANYON
SHAFT
PAD LAYOUT

Canyon Fuel Company, LLC
Skyline Mines

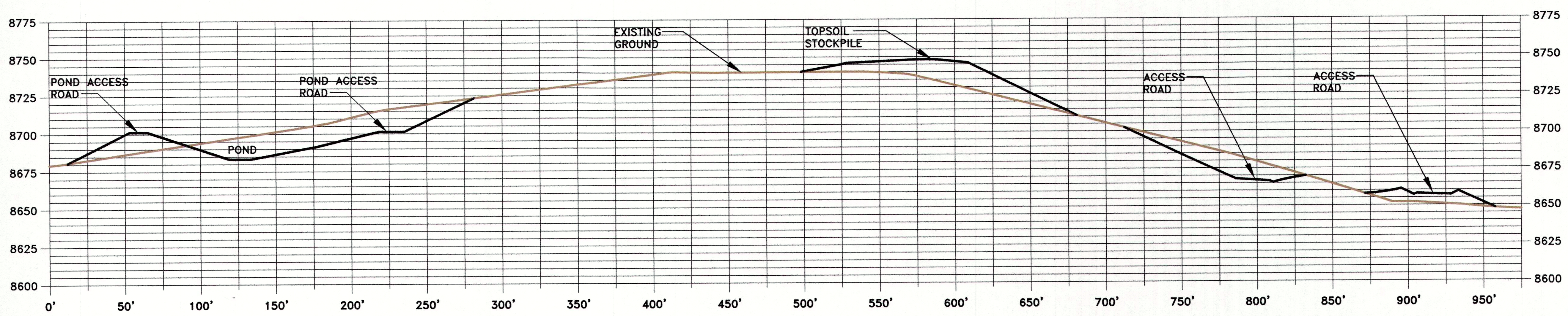
P.O. BOX 719 HELPER, UTAH 84526 801-637-7925	DATE: JAN, 2016	CK.BY:TAJ	REVISION: 1
CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: 1" = 60'	DR.BY: SWF	
DWG. NO.: 3.2.4-4A		SHEET 1	



HAUL ROAD PROFILE
SCALE:1"=60'
HORZ. AND VERT.



SECTION A-A'
SCALE:1"=60'
HORZ. AND VERT.



SECTION B-B'
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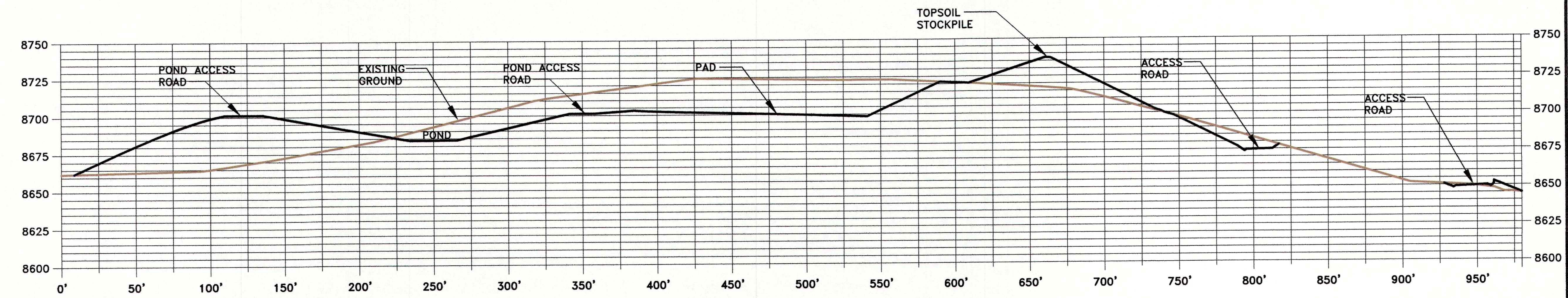

SECTION C-C'
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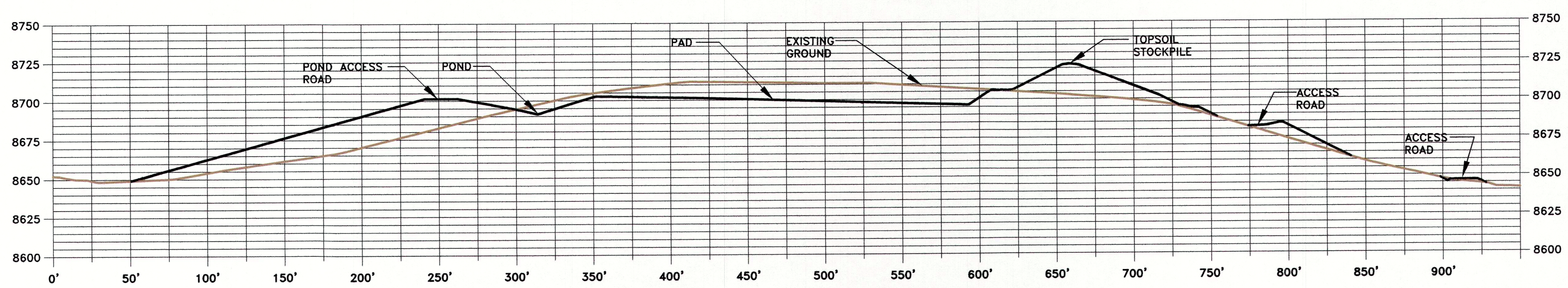
HORZ. AND VERT.



SECTION D-D'
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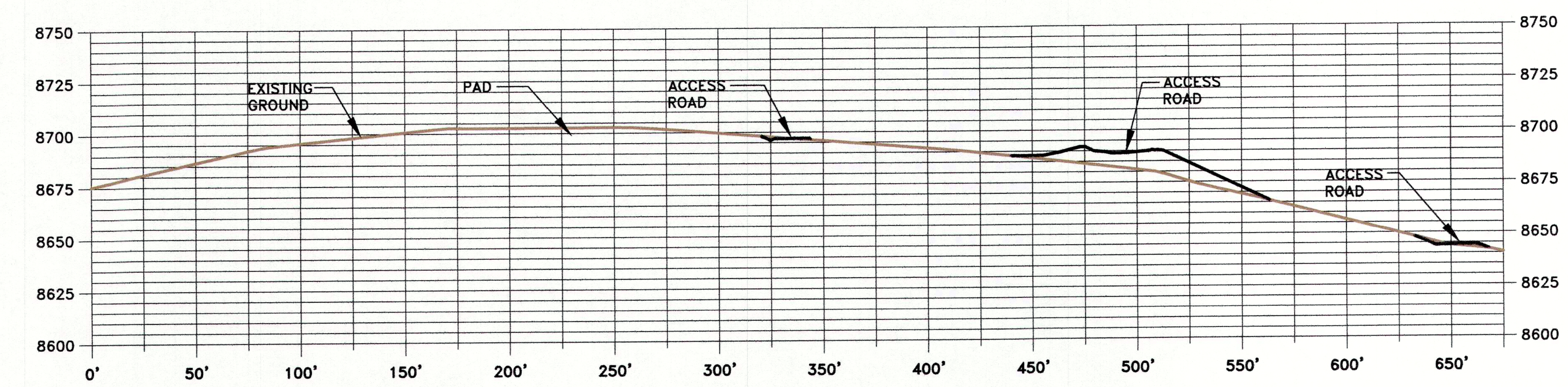
HORZ. AND VERT.



SECTION E-E'
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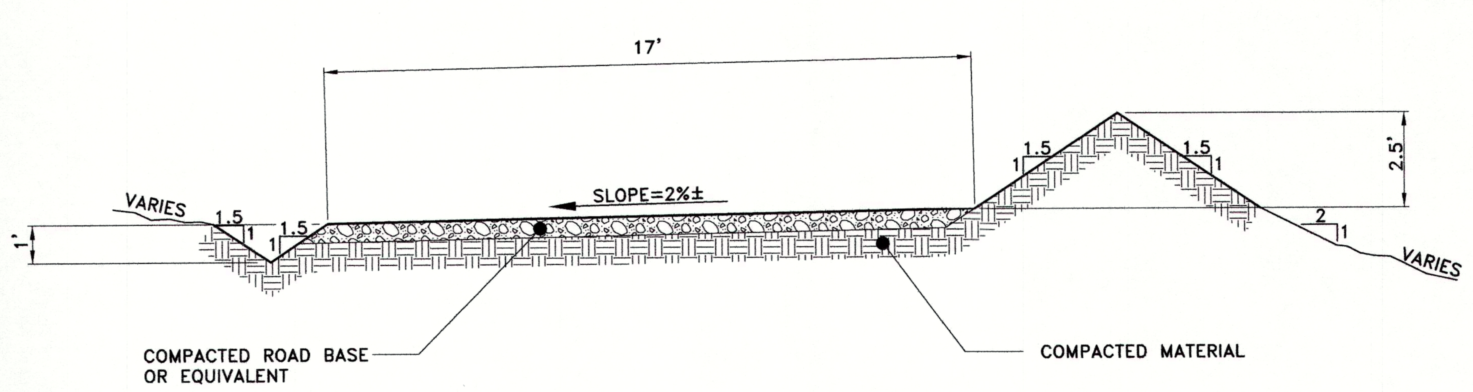
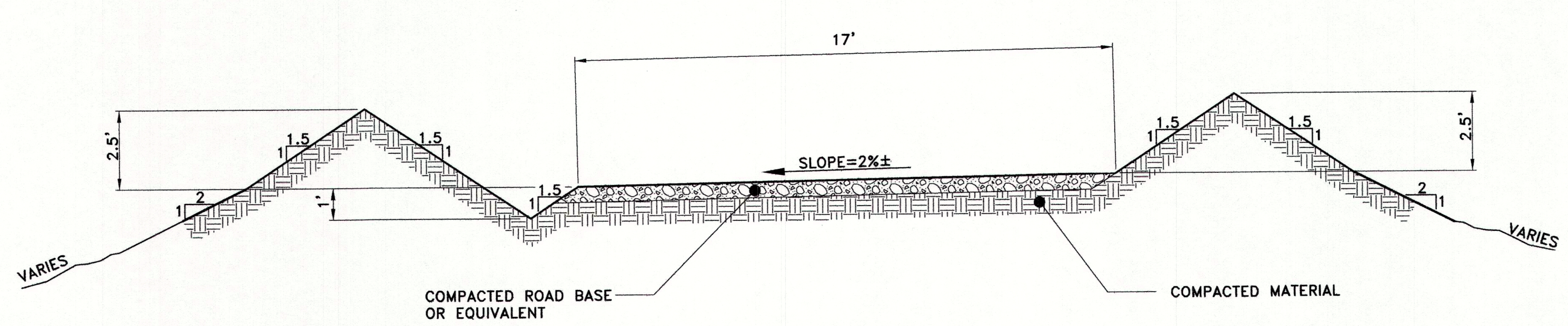
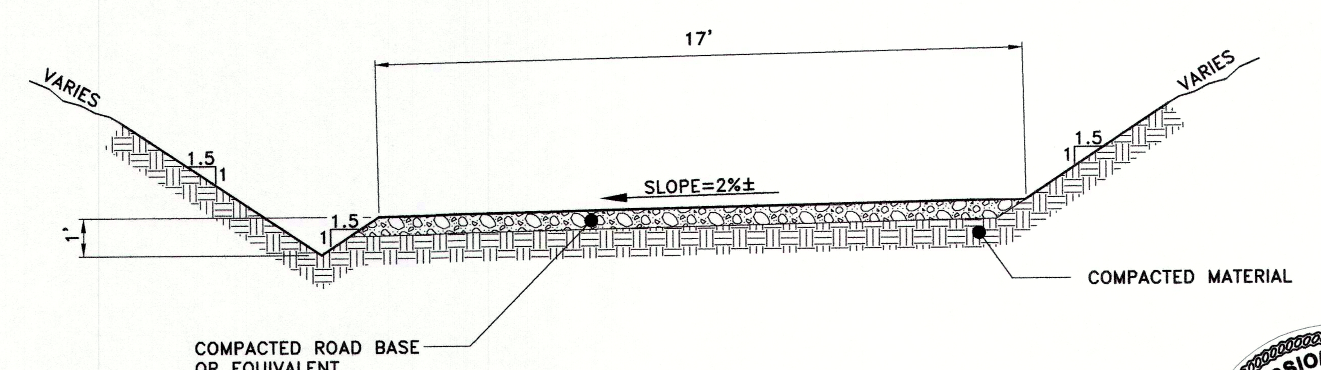


TYPICAL ACCESS ROAD WITH ONE BERM
NTS



TYPICAL ACCESS ROAD WITH TWO BERMS
NTS



TYPICAL ACCESS ROAD WITHOUT BERMS
NTS

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A. JIMENEZ
1/26/2016
STATE OF UTAH

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

AS SHOWN

SEAL:

DATE	No.	REVISIONS

SWENS CANYON
SHAFT
CROSS SECTIONS AND ROAD PROFILE

Canyon Fuel Company, LLC
Skyline Mines

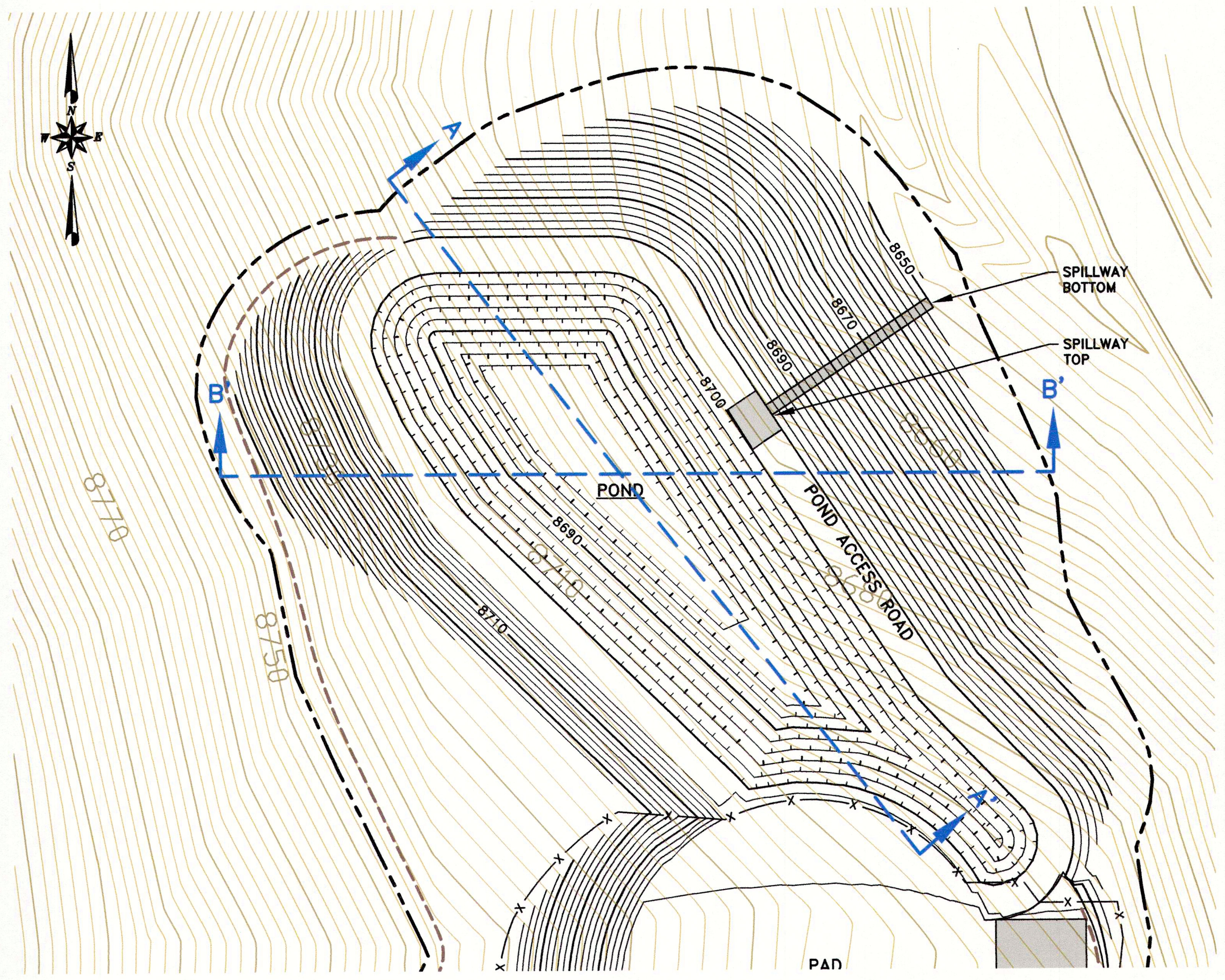
P.O. BOX 719 HELPER, UTAH 84526 801-637-7925
CAD FILE: C:\UC1547/01/DWG/SHEET 1

DATE: JAN, 2016	CK.BY:TAJ	REVISION:
SCALE: AS SHOWN	DR.BY:SWF	1
DWG. NO.: 3.2.4-4B	SHEET 2	

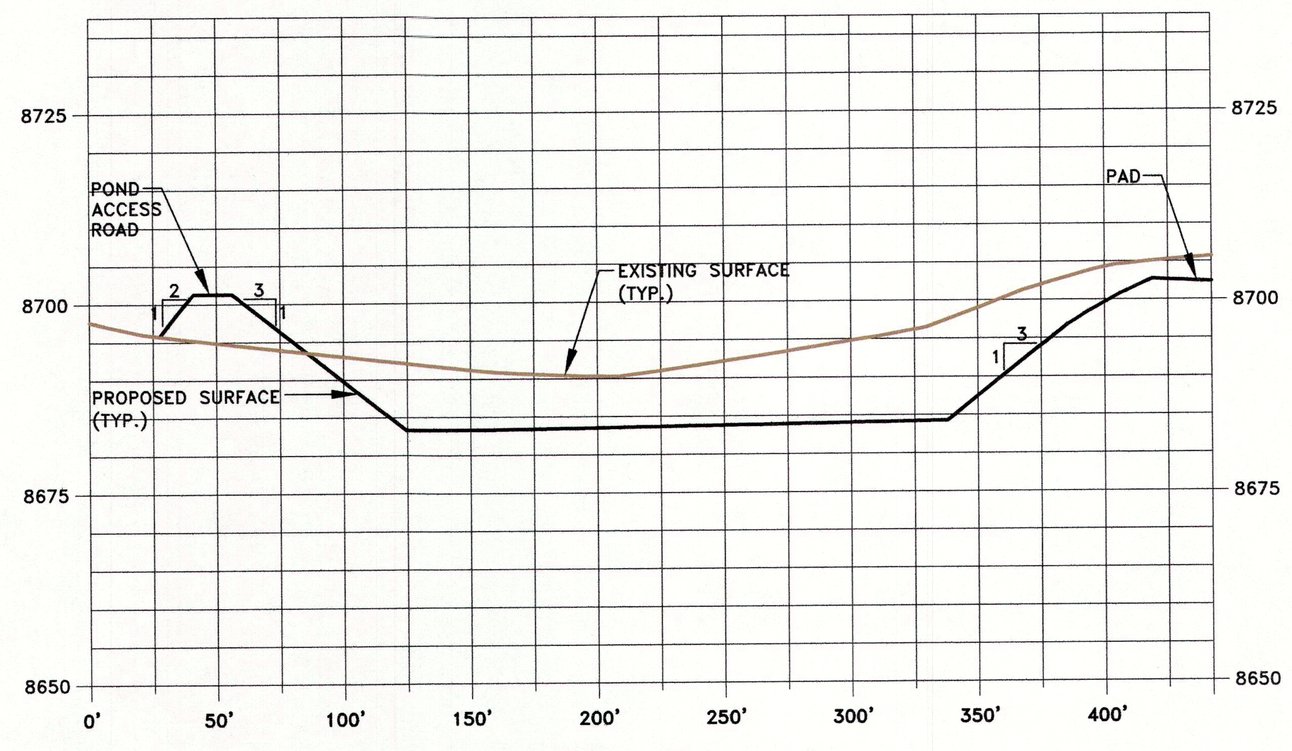
C:\UC1547\01 - Swens Canyon pad design\DWG\Swen CanyonFinal 1-26-16\SHEET 2.dwg, 1/26/2016 12:26:27 PM

LEGEND

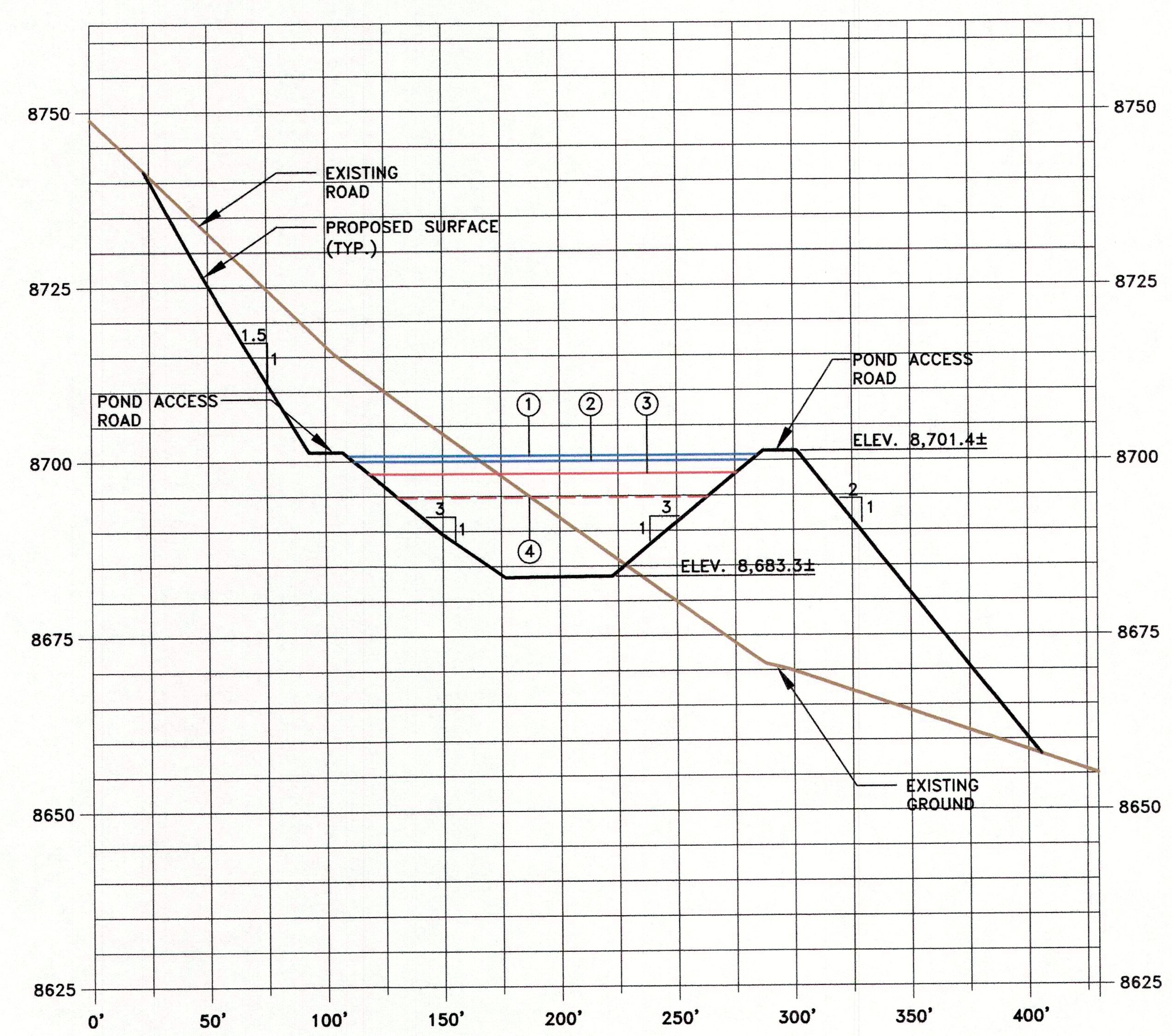
- 8140 — EXISTING GROUND MAJOR CONTOUR (10 FOOT)
- EXISTING GROUND MINOR CONTOUR (2 FOOT)
- 8140 — OPERATIONAL GROUND MAJOR CONTOUR (10 FOOT)
- OPERATIONAL GROUND MINOR CONTOUR (2 FOOT)
- OPERATIONAL GROUND DEPRESSION CONTOUR
- EXISTING ROAD
- EXISTING PAVED ROAD
- PROPOSED ROAD
- DISTURBED AREA BOUNDARY
- PROPOSED BERM OR SILT FENCE
- PROPOSED DITCH
- PROPOSED FENCE
- A — A' OPERATIONAL CROSS SECTION LOCATION



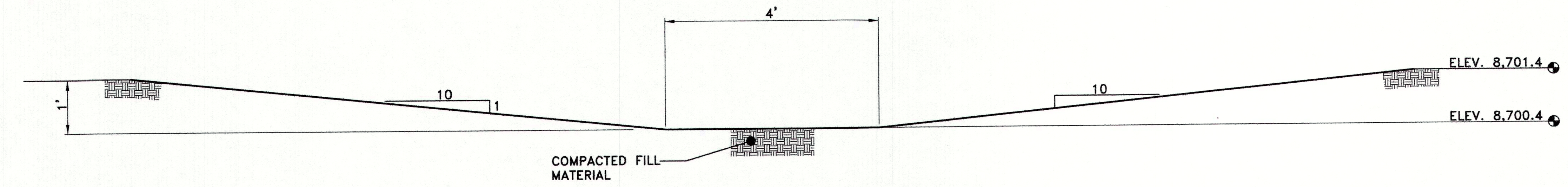
POND PLAN
SCALE:1"=60'



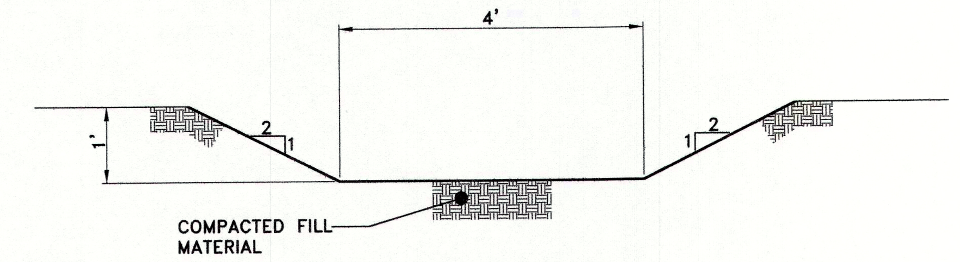
POND SECTION A–A'
SCALE: HORZ. 1"=60'
VERT. 1"=20'



POND SECTION B–B'
SCALE: HORZ. 1"=60'
VERT. 1"=20'



POND SPILLWAY TOP DETAIL
NTS

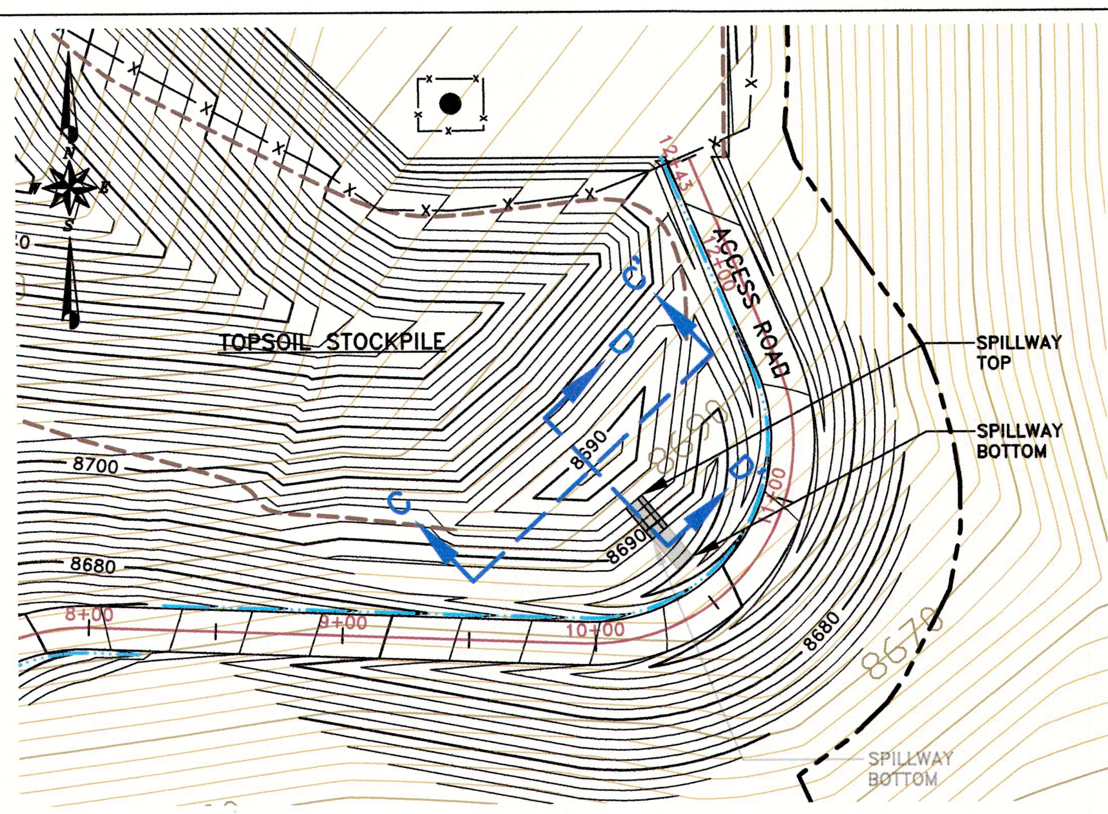


POND SPILLWAY BOTTOM DETAIL
NTS

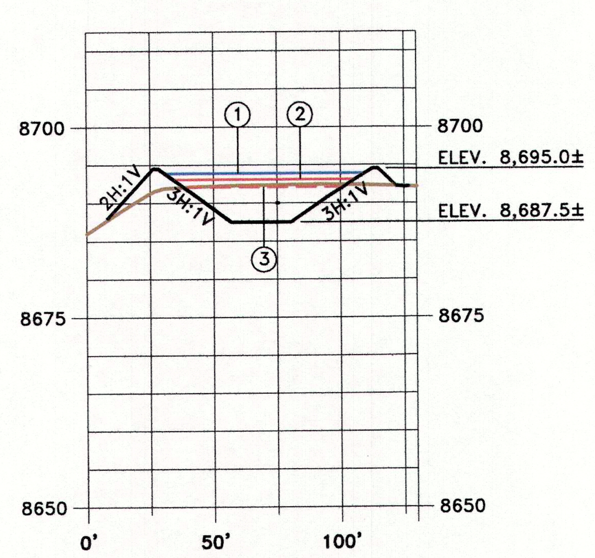
POND SECTION B-B' KEY NOTES:

1. 650 CY OF STORM WATER STORAGE ELEV. 8,700.4±.
2. 13,320 CY OF MAXIMUM SEDIMENT/CUTTINGS STORAGE. ELEV. 8,700.0±.
3. 4,100 CY OF SEDIMENT STORAGE WHEN CUTTINGS ARE DRY (60% CLEANOUT) ELEV. 8,698.2±.
4. 6,500 CY OF DRY CUTTING STORAGE 8,694.8±.

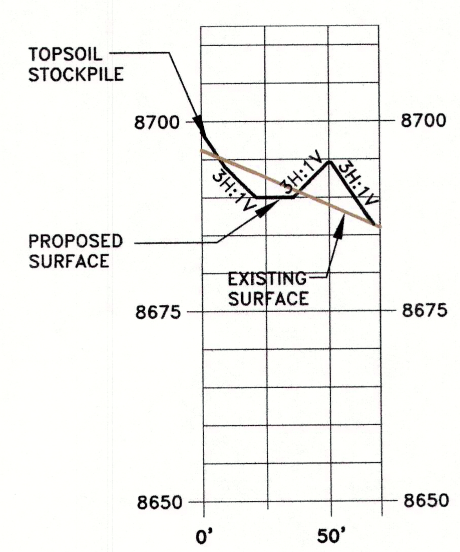
NOTE:
CUTTINGS WILL CONSIST OF AN APPROXIMATELY 50% WATER AND 50% SOLID MATERIAL BLEND. THE MAXIMUM WET CUTTINGS VOLUME IS ANTICIPATED TO BE 13,000 CY, THE MAXIMUM CALCULATED SEDIMENT YIELD IS 320 CY. THEREFORE, THE MAXIMUM CUTTINGS AND SEDIMENT STORAGE IS 13,320 CY. THE WET CUTTINGS WILL BE ALLOWED TO DRY CREATING AN ADDITIONAL 6,500 CY. OF SEDIMENT STORAGE.



SEDIMENT BASIN PLAN
SCALE:1"=60'



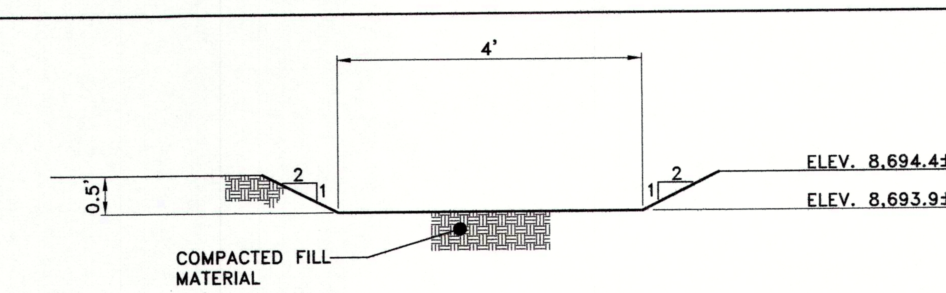
BASIN SECTION C–C'
SCALE: HORZ. 1"=60'
VERT. 1"=20'



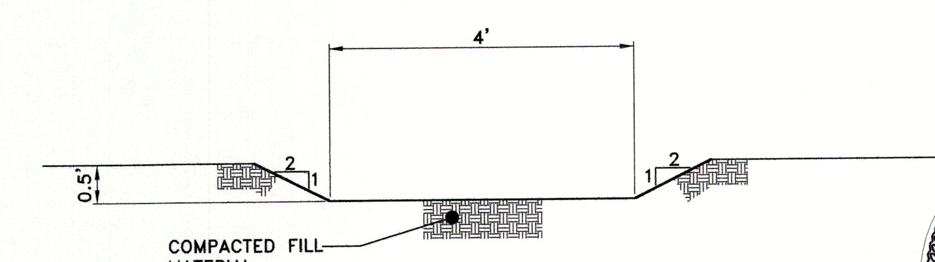
BASIN SECTION D–D'
SCALE: HORZ. 1"=60'
VERT. 1"=20'

BASIN SECTION C-C' KEY NOTES:

1. 176 CY OF STORM WATER STORAGE ELEV. 8,694.6±
2. 194 CY OF MAXIMUM SEDIMENT STORAGE. ELEV. 8,693.05±
3. 116 CY OF SEDIMENT STORAGE (60% CLEANOUT) ELEV. 8,692.05±



SEDIMENT BASIN SPILLWAY TOP DETAIL
NTS



SEDIMENT BASIN SPILLWAY BOTTOM DETAIL
NTS

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A. JIMENEZ
1/26/2016
STATE OF UTAH

EarthFax Engineering, Inc.
Engineers/Scientists

AS SHOWN

SEAL:

DATE	No.	REVISIONS

SWENS CANYON
SHAFT
POND AND SEDIMENT BASIN DRAINAGE PLAN

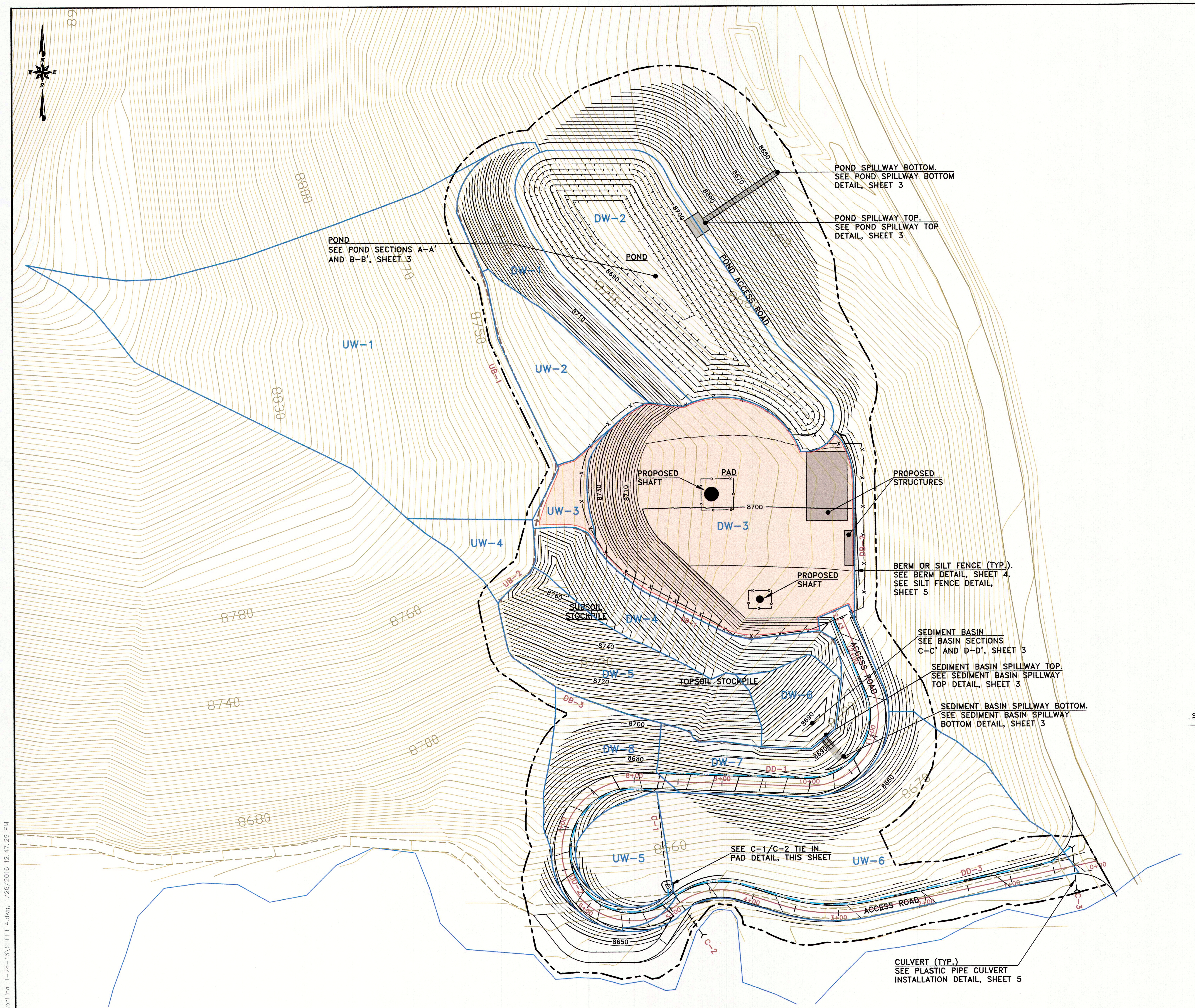
Canyon Fuel Company, LLC
Skyline Mines

P.O. BOX 719 HELPER, UTAH 84526 801-637-7925

DATE: JAN, 2016	CK.BY: TAJ	REVISION: 1
CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: AS SHOWN	DR.BY: SWF
DWG. NO.: 3.2.4-4C		SHEET 3

LEGEND

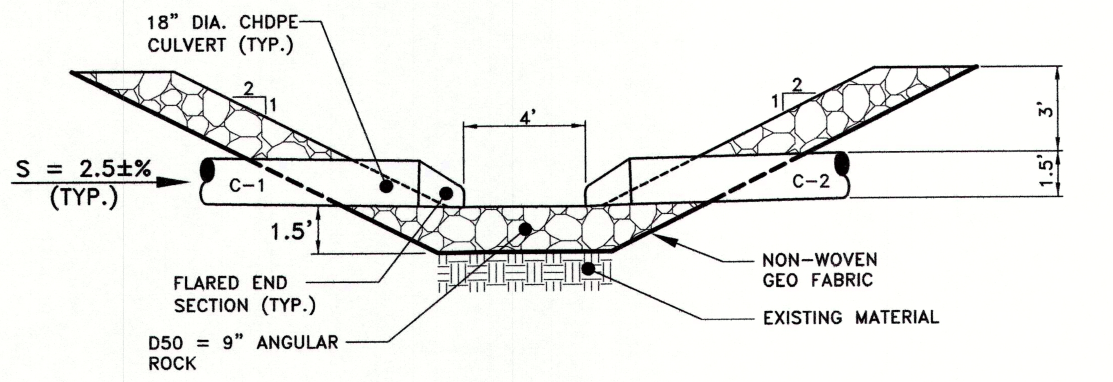
- 8140 — EXISTING GROUND MAJOR CONTOUR (10 FOOT)
- EXISTING GROUND MINOR CONTOUR (2 FOOT)
- 8140 — OPERATIONAL GROUND MAJOR CONTOUR (10 FOOT)
- OPERATIONAL GROUND MINOR CONTOUR (2 FOOT)
- OPERATIONAL GROUND DEPRESSION CONTOUR
- EXISTING ROAD
- EXISTING PAVED ROAD
- PROPOSED ROAD
- DISTURBED AREA BOUNDARY
- PROPOSED BERM OR SILT FENCE
- PROPOSED DITCH
- PROPOSED FENCE
- DB-1 — DEVELOPED BERM
- UB-1 — UNDEVELOPED BERM
- DD-1 — DEVELOPED DRAINAGE DITCH
- UD-1 — UN DEVELOPED DRAINAGE DITCH
- DW-1 — DEVELOPED WATERSHED
- UW-1 — UNDEVELOPED WATERSHED
- PROPOSED ASCA



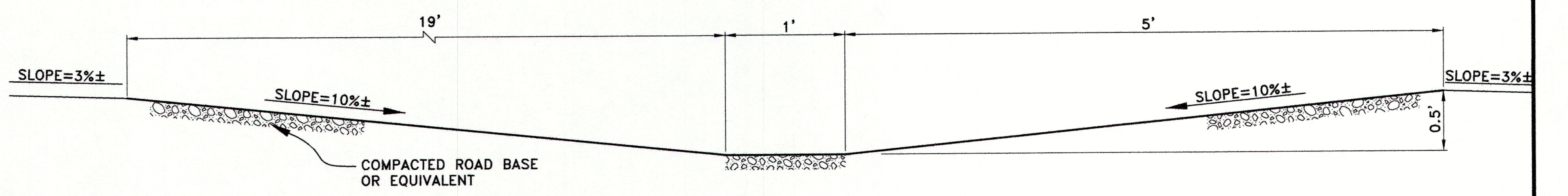
PLAN
SCALE:1"=60'
CONTOUR INTERVAL = 2'

CULVERT TABLE					
CULVERT	TYPE	DIAMETER	APPROX. LENGTH*	INV. IN*	INV. OUT*
C-1	CHDPE	18"	120'	8,670.0'±	8,648.0'±
C-2	CHDPE	18"	60'	8,647.9'±	8,646.0'±
C-3	CHDPE	18"	50'	8,636.0'±	8,634.0'±

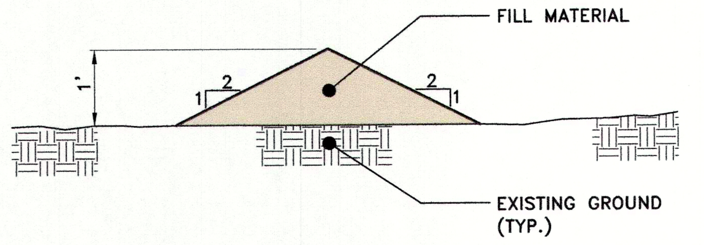
*ELEVATIONS AND LENGTHS MAY CHANGE TO FIT FIELD CONDITIONS. THESE CHANGES SHALL BE APPROVED BY THE ENGINEER.



C-1/C-2 TIE IN PAD DETAIL
NTS



SWALE DETAIL
NTS



BERM DETAIL
NTS

NOTES:
1. WHERE DB-2 SLOPES ARE GREATER THAN 1H:6V THE BERM SHALL BE ARMORED WITH 2" DIAMETER ROCK WITH A DEPTH OF 6".
2. WHERE UB-1 SLOPES ARE GREATER THAN 1H:5V THE BERM SHALL BE ARMORED WITH 2" DIAMETER ROCK WITH A DEPTH OF 6".

PROFESSIONAL ENGINEER No. 9501032 TIMOTHY A. JIMENEZ 1/26/2016 STATE OF UTAH

SEAL:

DATE	No.	REVISIONS

SWENS CANYON
SHAFT
WATERSHED AND DRAINAGE DETAILS

Canyon Fuel Company, LLC
Skyline Mines

P.O. BOX 719 HELPER, UTAH 84526 801-637-7925	DATE: JAN, 2016	CK.BY:TAJ	REVISION: 1
CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: AS SHOWN	DR.BY:SWF	
DWG. NO.: 3.2.4-4D		SHEET 4	

AS SHOWN

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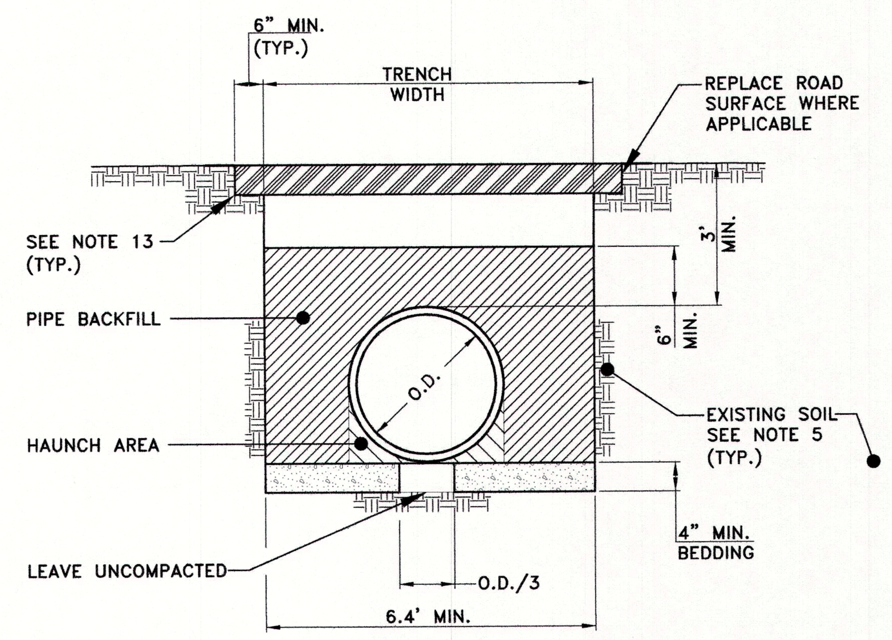
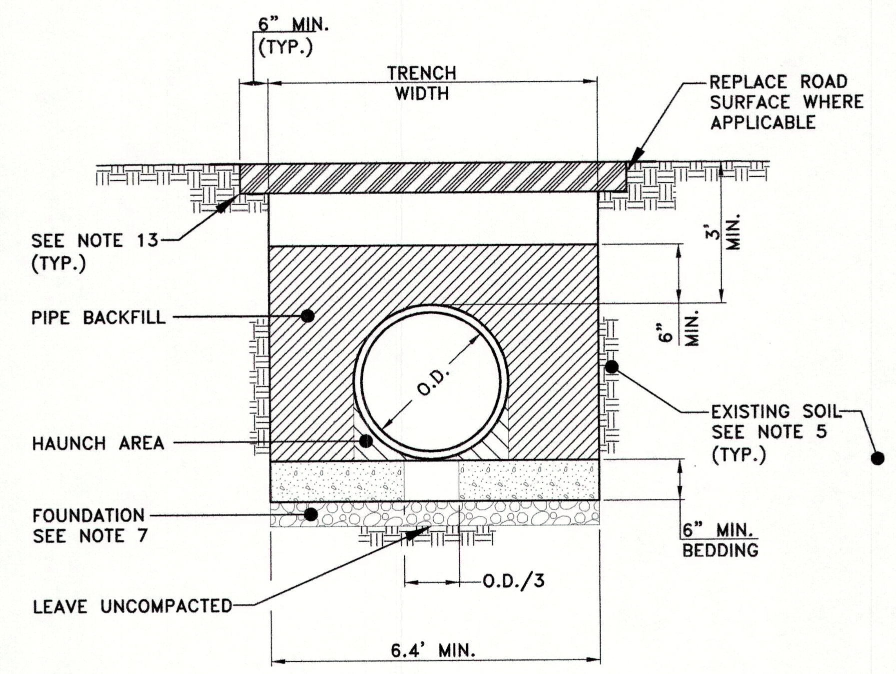
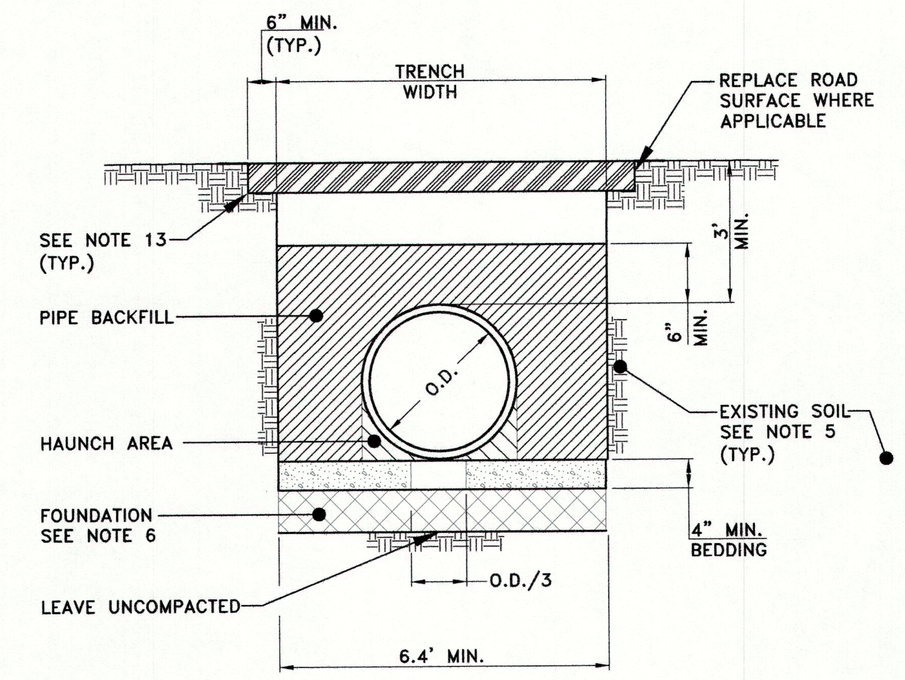


STABLE FOUNDATION SOILS DETAIL "A"



UNYIELDING FOUNDATION SOILS DETAIL "B"

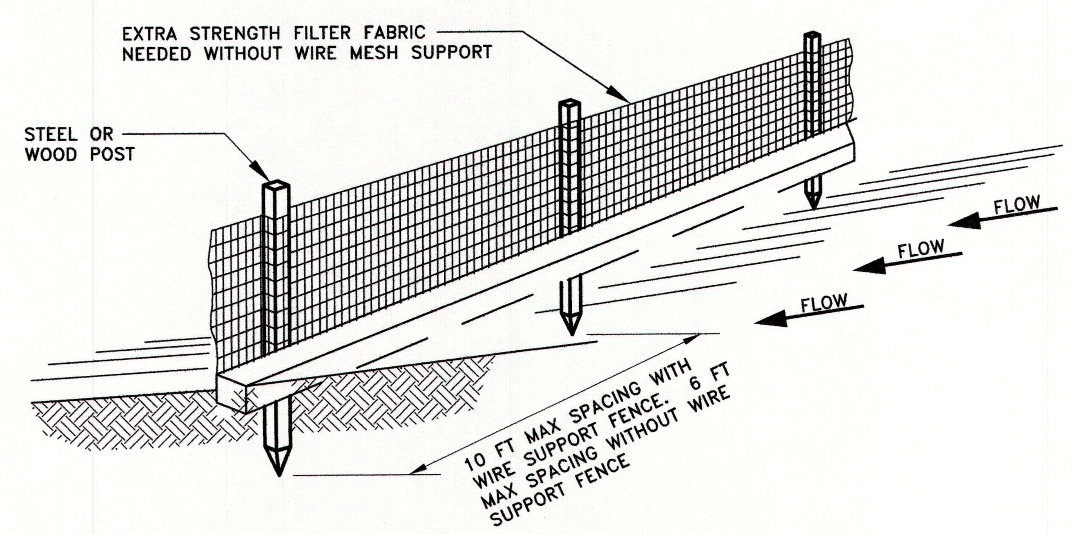


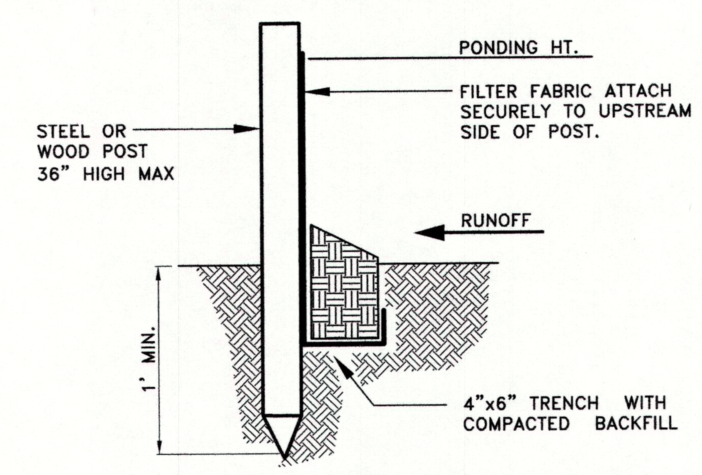
UNSUITABLE FOUNDATION SOILS DETAIL "C"

NOTES:

1. ALL COUPLINGS TO BE WATER TIGHT FOLLOWING INSTALLATION.
2. MINIMUM TRENCH SAFETY STANDARDS SHALL COMPLY WITH ALL APPLICABLE STATE AND FEDERAL REQUIREMENTS.
3. PLACE THE OUTSIDE EDGE OF THE PIPE NO CLOSER THAN 2 TIMES ITS DIAMETER TO THE EMBANKMENT FILL SLOPE WHEN INSTALLED ADJACENT TO THE SLOPE FACE.
4. FOLLOW AASHTO STAMDARD T 99 WITH DENSITY NOT LESS THAN 90 PERCENT OF LABORATORY DENSITY FOR COMPACTION ACCEPTANCE OF FOUNDATION, BEDDING AND BACKFILL MATERIALS. REMOVE BOULDERS OR ROCKS WITHIN BEDDING AREA.
5. EXCAVATE A TRENCH OF EQUAL OR GREATER WIDTH THAN SHOWN ABOVE. INCREASE THE TRENCH WIDTH TO 2 FT MINIMUM ON EACH SIDE OF THE PIPE WHEN THE SURROUNDING MATERIAL IS UNSUITABLE.
6. OVER-EXCAVATE UNSUITABLE PIPE FOUNDATION MATERIAL AND REPLACE WITH SUITABLE MATERIAL.
7. EXCAVATE ROCK OR UNYIELDING MATERIAL FROM THE BOTTOM OF THE TRENCH AND PROVIDE 6 INCHES MINIMUM BEDDING MATERIAL.
8. RECESS THE BEDDING TO RECEIVE PIPE JOINTS WHERE APPLICABLE.
9. DO NOT DISTURB THE INSTALLED PIPE OR EMBEDMENT OR LEAVE VOIDS WHEN USING TRENCH BOXES AND SHIELDS.
10. SEAL THE OPENING AROUND THE PIPE AND THE DRAINAGE STRUCTURE.
11. PROTECT PIPE DURING CONSTRUCTION. DO NOT EXCEED DESIGN STRENGTH.
12. MEASURE MAXIMUM FILL HEIGHT FROM TOP OF PIPE TO TOP OF ROAD SURFACE AT HIGHEST FILL SECTION.
13. ON ROADSIDES BACKFILL WITH TOPSOIL TO GRADE.
14. INSTALL CHDPE PIPE WITH A DIAMETER OF 18" MIN.

PLASTIC PIPE CULVERT INSTALLATION DETAIL
NTS





NOTE:

1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT SEE PLAN VIEW.

SILT FENCE DETAIL
NTS

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A. JIMENEZ
1/26/2016
STATE OF UTAH

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AS SHOWN

SEAL:

DATE	No.	REVISIONS

SWENS CANYON
SHAFT
DRAINAGE DETAILS

Canyon Fuel Company, LLC
Skyline Mines

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CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: AS SHOWN	DR.BY:SWF	1
DWG. NO.: 3.2.4-4E		SHEET 5	

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0 60' 120'
CONTOUR INTERVAL = 2'

SEAL:

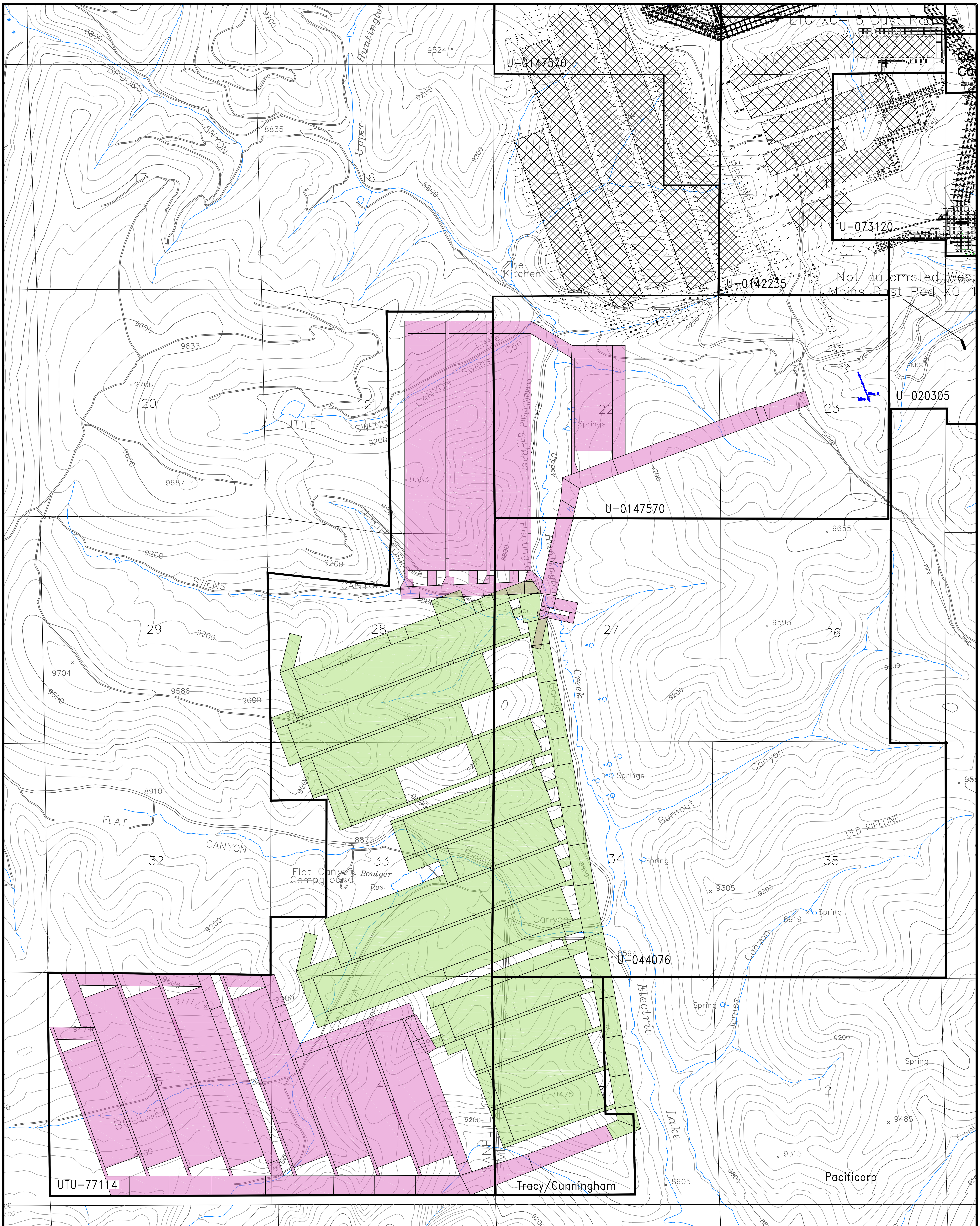
DATE	No.	REVISIONS

SWENS CANYON
SHAFT
TOPSOIL REMOVAL PLAN

Canyon Fuel Company, LLC
Skyline Mines

P.O. BOX 719 HELPER, UTAH 84526 801-637-7925
CAD FILE: G:\UC1547/01/DWG/SHEET 1

DATE: JAN, 2016	CK.BY: TAJ	REVISION:
SCALE: 1" = 60'	DR.BY: SWF	1
DWG. NO.: 3.2.4-4F	SHEET 6	



LEGEND

LOB SEAM

LOA/FLAT CANYON SEAM

PREVIOUSLY MINED AREA

NOTES:
1. COORDINATE BASE ON MINE GRID DATA.
2. MAP DIGITIZED FROM 1:24000 USGS QUADRANGLE MAPS, SCOFIELD, UTAH AND FAIRVIEW LAKES, UTAH.
3. MINE FACILITY, CONVEYOR, AND NEW ECCLES CANYON ROAD LOCATIONS FROM EXISTING RECORD DATA AND INCORPORATED TO MAP IN BEST FIT LOCATIONS.
4. UTM GRID TICK VALUES SHOWN ARE IN METERS.

SEE PLATE 1.6-3 FOR PERMIT AND ADJACENT AREAS

N W E S

1000' 0' 500' 1000'

CONTOUR INTERVAL: 80 Feet

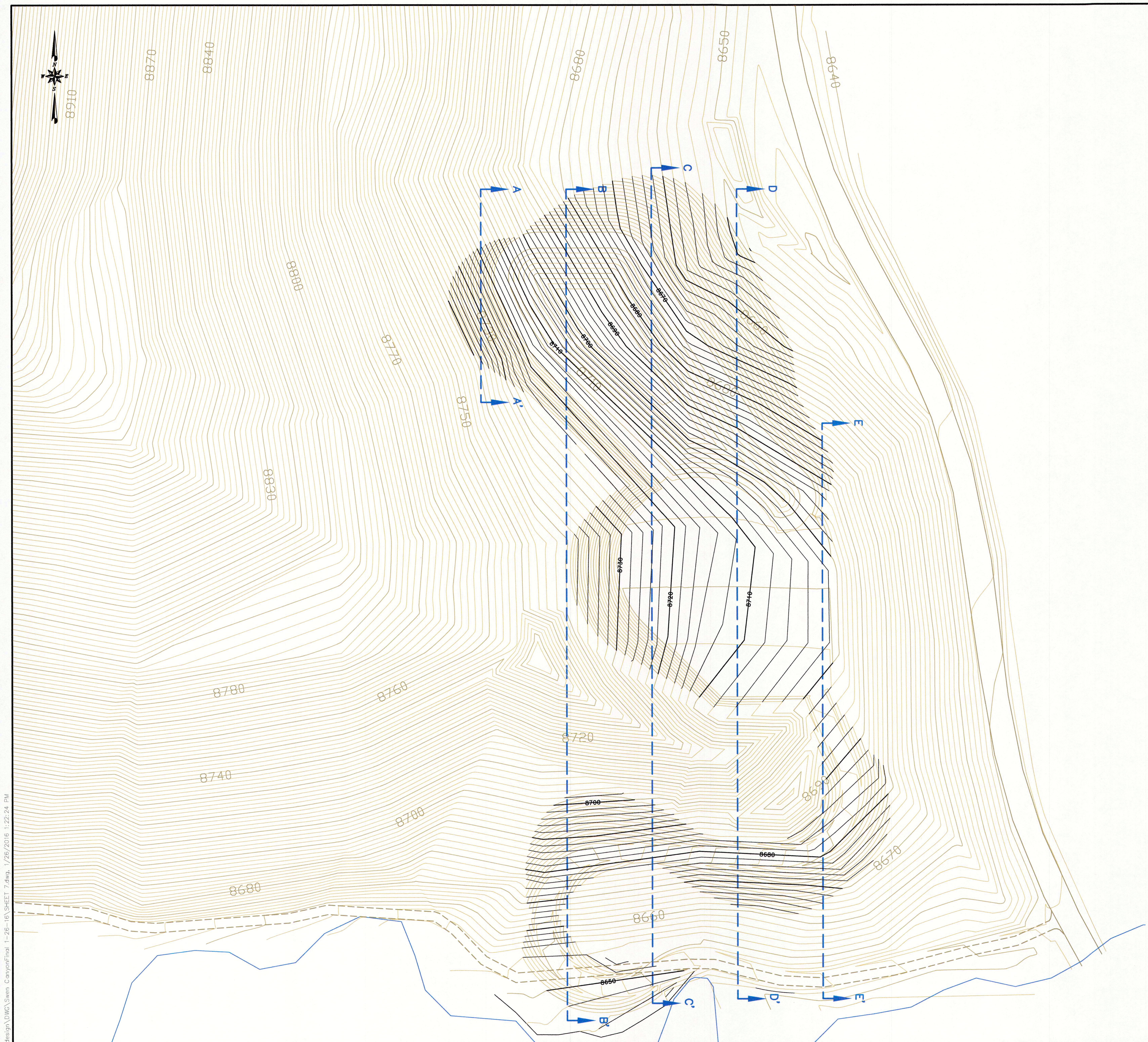
BASE PREPARED BY INTERMOUNTAIN AERIAL SURVEYS, SALT LAKE CITY, UTAH – M96147

DATE	No.	REVISIONS	DR. / CHKD.

SKYLINE MINE
MINE 4
COAL SEAM PLAN

Canyon Fuel Company, LLC
HC35 BOX 380, HELPER, UTAH 84526
435-448-6463
Skyline Mines

SCALE: 1"=1000'	DATE: 12/30/15	CK.BY: GGalecki	REVISION:
DWG. NO.: 3.3-4		DR.BY: BBailey	0
CAD FILE: 3.3-4 Rev 0.dwg			12/30/2015



LEGEND

8140	OPERATIONAL GROUND MAJOR CONTOUR (10 FOOT)
	OPERATIONAL GROUND MINOR CONTOUR (2 FOOT)
8140	RECLAMATION GROUND MAJOR CONTOUR (10 FOOT)
	RECLAMATION GROUND MINOR CONTOUR (2 FOOT)
	EXISTING ROAD
	EXISTING PAVED ROAD
A A'	RECLAMATION CROSS SECTION LOCATION (SEE SHEET 8 FOR CROSS SECTIONS)

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0 60' 120'
CONTOUR INTERVAL = 2'

SEAL:

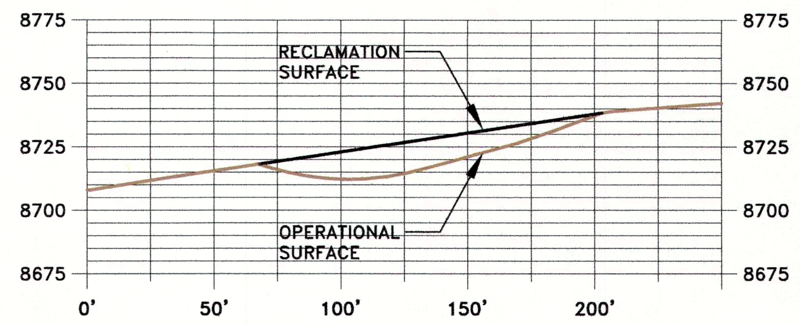
DATE	No.	REVISIONS

SWENS CANYON
SHAFT
RECLAMATION PLAN

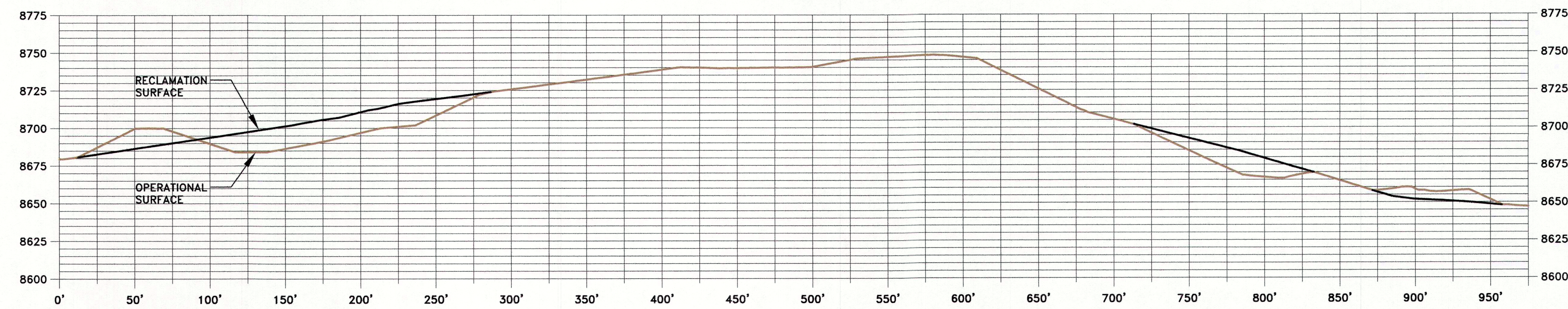
Canyon Fuel Company, LLC
Skyline Mines

P.O. BOX 719 HELPER, UTAH 84526 801-637-7925	DATE: JAN, 2016	CK.BY:TAJ	REVISION: 1
CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: 1" = 60'	DR.BY:SWF	
DWG. NO.: 4.4.2-4A		SHEET 7	

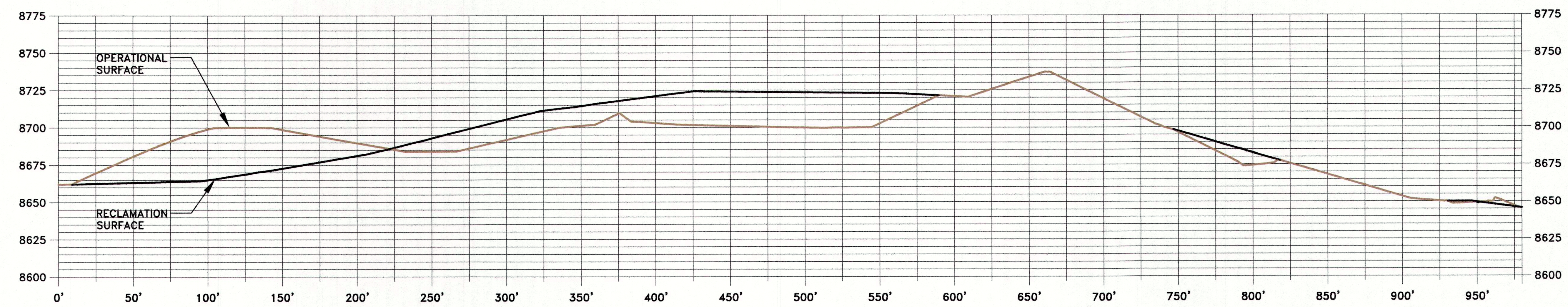
G:\UC1547\01 - Swens Canyon pad design\DWG\Swen CanyonFinal 1-26-16\SHEET 7.dwg, 1/26/2016 1:22:24 PM



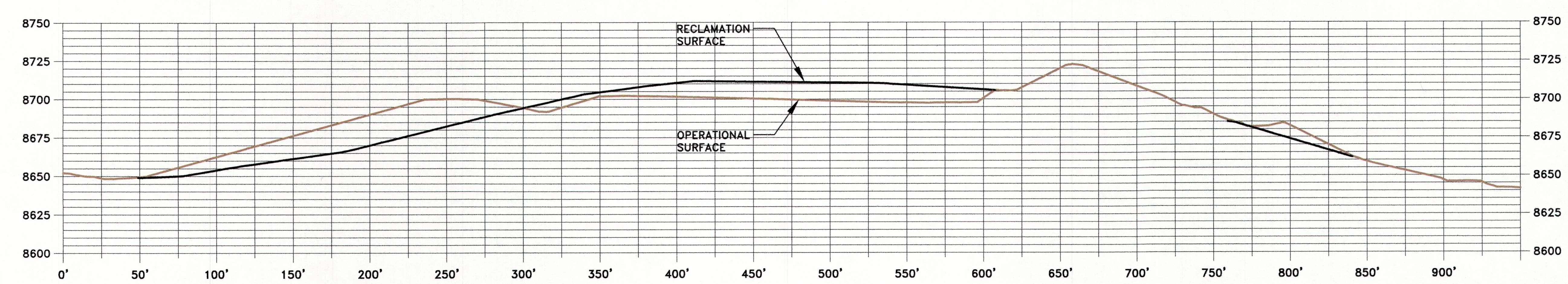
SECTION A-A'



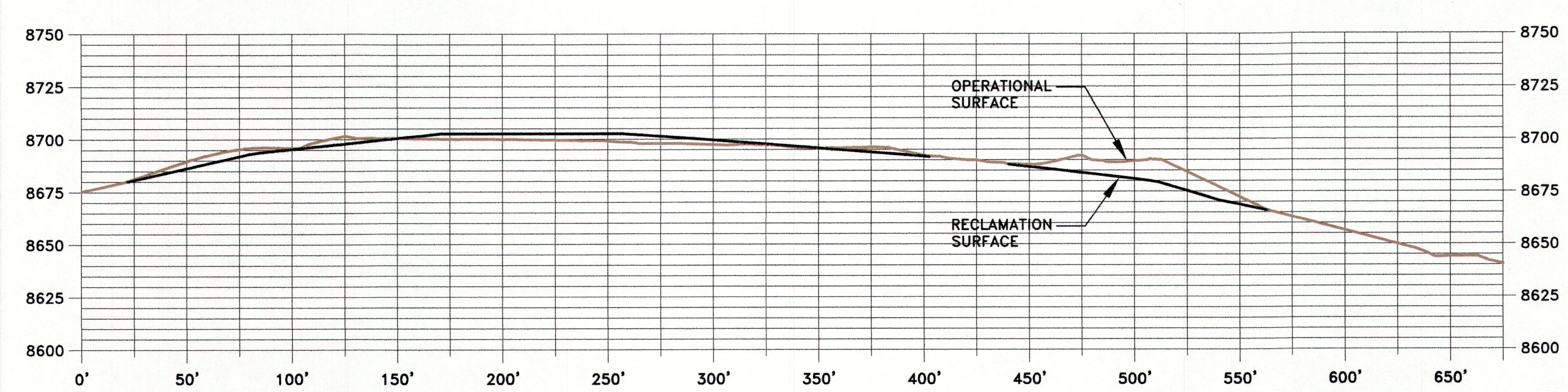
SECTION B-B'



SECTION C-C'



SECTION D-D'



SECTION E-E'

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A. JIMENEZ
1/26/2016
STATE OF UTAH

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EarthFax

0 60' 120'
HORZ. AND VERT.

SEAL:

DATE	No.	REVISIONS

SWENS CANYON
SHAFT
RECLAMATION CROSS-SECTIONS

Canyon Fuel Company, LLC
Skyline Mines

P.O. BOX 719 HELPER, UTAH 84526 801-637-7925	DATE: JAN, 2016	CK.BY: TAJ	REVISION:
CAD FILE: G:\UC1547/01/DWG/SHEET 1	SCALE: 1" = 60'	DR.BY: SWF	1
DWG. NO.: 4.4.2-4B		SHEET 8	

G:\UC1547\01 - Swens Canyon pad design\DWG\Swen CanyonFinal 1-26-16\SHEET 8.dwg, 1/26/2016 1:24:16 PM

CUTTINGS ✓	**Utah Fuel Company**		PAGE 1 OF
CORE			LOCATION
OUTCROP			

PROJECT West Tract DATE 9-20-95 HOLE NO. 95-28-1

LOGGED BY M. Bunnell RUN INTERVAL

Length Cored Length Recovered % Recovery

Observations

Depth Adjustment

Sec. TnShp. Rng.

N. 485,014

E. 2,069,144

Elev. 8777

SAMPLE No.	Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							0				0-10 Ss, v lt gy - or gy, f gr, noncalc, friable 2 gpm H_2O @ ~9.0'
							10				10-20 95% Ss, a/a 5% sltst, dk gy, carb
							20				20-30 a/a w/occ rounded streamfill, coal frags
							30				30-40 80% sltst, m gy, carb, calc 10% clyst, lt gy 10% Ss, a/a
							40				40-50 70% Ss, lt gy - v lt gy, f-vf gr, calc, w srtd 30% sltst, a/a Contains sluff material from upper hole
							50				50-60 90% Ss, a/a 10% sltst a/a w/ sluff material or gy ss
	← Box No. 1 →						60				60-70 90% clyst, m lt gy, slty 10% Ss, a/a sluff mat. a/a
							70				70-80 70% Ss, lt gy, vf gr, calc 30% clyst, a/a sluff mat. a/a
							80				80-90 90% sltst, m lt gy, calc 10% Ss, a/a sluff mat. a/a
							90				90-100 70% Ss, m lt gy, vf gr, calc, carb str. 20% clyst, lt ol gy, slty 10% sltst, a/a
					Bit dropped several inches -- possible fracture zone →		100		← * Est 40-50 gpm water @ 104 ft.		100-110 95% Ss, a/a 5% sltst a/a Abund. sluff from upper hole -- due to high water flow
							110				

HOLE NO. 95-28-1 PAGE 1 OF

GE4A003=coredril

CUTTINGS	✓
CORE	
OUTCROP	

Utah Fuel Company

PAGE 2 OF ___

LOCATION

Sec. ___ TnShp. ___ Rng. ___
N. ___
E. ___
Elev. 8777

PROJECT ___ DATE 9-20-95 / 9-21-95 HOLE NO. 95-28-1
LOGGED BY ___ RUN ___ INTERVAL ___
Length Cored ___ Length Recovered ___ % Recovery ___
Observations ___
Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFSS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
	← Box No. 1 →						110				110-120 90% ss, lt-m gry, yel-gry, or-yel, m-f grn, non-calc to calc, FeO3 stn + cmnt ip. 10% sltst, m gry, occas carb frag uphole sluffing
							120				120-130 95% ss, a/a 5% sltst, a/a
							130				130-140 98% ss, a/a 2% sltst, a/a uphole sluffing
							140				140-150 95% ss, lt-m gry, yel-or-red, f-vf gr, calc to non calc, FeO3 5% sltst, m-dk gry, sndy, occas carb frag uphole sluffing
							150				150-160 98% ss, a/a 2% sltst, a/a occas. coal frags uphole sluffing
							160				160-170 50% ss, a/a 50% sltst a/a occ. coal frags uphole sluffing
							170				170-180 80% ss a/a 20% sltst a/a
							180				180-190 60% ss a/a 40% sltst a/a
							190				190-200 50% ss a/a 50% sltst a/a occ coal frags
							200				200-210 80% SNDSTN a/a 20% SLTSTN a/a occ coal FRAGS
							210				210-220 95% SNDSTN vf-fn grn, lt gry, carb lam 5% SLTSTN a/a
							220				

GE4A003=coredril

CUTTINGS	X
CORE	
OUTCROP	

Utah Fuel Company

PAGE 3 OF ____

LOCATION

PROJECT West Tract DATE 9-22-95 HOLE NO. 95-28-1

LOGGED BY W. A. Koontz RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

Sec. 28 TnShp. 13S Rng. 6E

N. ____

E. ____

Elev. 8877

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, USS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
	← Box No. 1 →						220				220 - 230 80% SNDSTN a/a 15% SHL - DK GRY - SL CARBY 5% SLTSTN
							230				230 - 240 50% SHL a/a 35% SNDSTN a/a 15% SLTSTN a/a
							240				240 - 250 80% SNDSTN a/a 15% SHL a/a 5% SLTSTN a/a
							250				250 - 260 60% SHL a/a 30% SS a/a 10% SLTSTN a/a V. Small Sample
							260				260 - 270 65% SHL a/a 30% SS a/a 5% CARB FRAGS V. Small Sample
							270				270 - 280 40% SHL a/a 40% SLTSTN a/a 20% SNDSTN a/a V. Small Sample
							280				280 - 290 75% SHL a/a 15% SLTSTN a/a 10% SNDSTN a/a V. Small Sample
							290				290 - 300 75% SHL a/a 25% SNDSTN
							300	No Sample			300 - 330 No Sample Presumed to Be close to This Interval
							310				Somehow, Some way 30 ft of sample got lost when drillers ran out of bags. Interval 300 - 390 Thought to Be Correct.
							320	No Sample			Interval 390 onward should Be Correct
							330				

HOLE NO. 95-28-1 PAGE ____ OF ____

GF4A003--coredril

CUTTINGS	X
CORE	
OUTCROP	

Utah Fuel Company

PAGE 4 OF ____

LOCATION

Sec. 28 TnShp. 13S Rng. 6E

N. ____

E. ____

Elev. 8777

PROJECT West Tract DATE 9-22-95 HOLE NO. 95-28-1

LOGGED BY ____ RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFSS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							330				330-340 70% Sndstn 20% sltstn 10% SHL
							340				340-350 40% SS lt gry fn grn 40% SHL Dk Gry carby 20% sltstn m.lt gry
							350				350-360 100% SHL Grysh Blk carby, fissil
							360				360-370 90% SHL a/a 10% SS fn grn, lt gry
							370				370-380 50% SS a/a 40% SHL a/a 10% sltstn a/a
	← Box No. 1 →						380				380-390 60% SHL M-M Dk Gry occ carby 30% SS a/a 10% sltstn a/a
							390				390-400 70% SHL dk gry-grysh blk 25% sltstn lt gry-brnsh gry 5% SS a/a
							400				400-410 65% sltstn, sl sndy lt greenish gry 30% SHL a/a 5% SS a/a Small sample
							410				410-420 50% SS lt gry vfn-fn grn calc 25% SHL a/a 25% sltstn a/a small sample
							420				420-430 60% SHL Grysh blk sl carby 40% SS fn grn, lt gry
							430				430-440 60% SHL a/a 30% SS a/a 10% sltstn lt gry coal frags
							440				

HOLE NO. ____ PAGE ____ OF ____

GE4A003=coredril

CUTTINGS	✓
CORE	
OUTCROP	

Utah Fuel Company

PAGE 5 OF ____

LOCATION

Sec. 28 TnShp. 13S Rng. 6E

N. ____

E. ____

Elev. 8777

PROJECT West Tract DATE 9-22-95 HOLE NO. 95-28-1

LOGGED BY ____ RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFSS, FGSS, MGSS, CGSS, PEB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
	← Box No. 1 →						440				440-450 50% SHL Grysh Blk carby, fissil 40% SS lt gry, fn grn 10% SLTSTN
							450				450-460 - 70% SHL a/a 30% SNDSTN a/a
							460				460-470 80% SS vfn-fn grn lt gry, occ carb lam 20% SHL a/a
							470				470-480 100% SHL Dk Gry - Grysh Blk occ carby, fissil, soft
							480				480-490 75% SHL a/a 25% SS m lt - lt gry fn grn
							490				490-500 80% SHL Grysh Blk w/ carb frags 20% SS a/a
							500				500-510 95% SS vfn-fn grn v. lt. - lt gry. 5% SHL a/a
							510				510-520 40% SS a/a 40% SHL Grysh blk, w/carb minor coal frags 20% SLTSTN sl sndy, m. gry
							520				520-530 70% SHL, M gry - dk gry slty, occ carby 20% SLTSTN a/a 10% SS a/a
							530				530-540 70% SHL Grysh Blk, carby 30% SS a/a
							540				540-550 80% SS lt - m gry Fe_2S on fracs? 20% SHL a/a
							550				

HOLE NO. ____ PAGE ____ OF ____

GE4A003=coredril

CUTTINGS	✓
CORE	
OUTCROP	

Utah Fuel Company

PAGE 6 OF ____

LOCATION

Sec. ____ TnShp. ____ Rng. ____

N. ____

E. ____

Elev. ____

PROJECT West Tract DATE 9-22-95 HOLE NO. 95-28-1

LOGGED BY W.A. Koontz RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

Box No. 2

DEPTH Scale	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
550–560	550-560 50% SS a/a 50% SHL a/a
560–570	560-570 60% SHL Grysh Blk carby, fissil 40% SS vfn-fn grn lt gry, sl slty
570–580	570-580 50% SS a/a 40% SHL a/a 10% SLTSTN
580–590	580-590 60% SS a/a 40% SHL a/a
590–600	590-600 50% SS a/a 50% SHL a/a
600–610	600-610 80% SS vfn grn lt. brn - v lt. gry 20% SHL a/a (from above?) DID NOT WASH SAMPLE MUCH
610–620	610-620 90% SS a/a 10% SHL a/a (from above?) COAL FRAGS DID NOT WASH SAMPLE MUCH
620–630	620-630 95% SS, lt-m gry, f-vf gr, few carb frags, non-calc to calc 5% SltSt, dk gry, gry-brn, sev carb frags, sndy
630–640	630-640 95% SS, a/a 5% SltSt, a/a
640–650	640-650 100% SS, lt gry, m-f gr, fairly well rnded, mod sorted not washed
650–660	650-660 95% SS, a/a 5% SltSt, gry-brn not washed

HOLE NO. ____ PAGE ____ OF ____

GE4A003=coredril

CUTTINGS	
CORE	
OUTCROP	

Utah Fuel Company

PAGE 7 OF ____

LOCATION

Sec. ____ TnShp. ____ Rng. ____
N. ____
E. ____
Elev. ____

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

LOGGED BY ____ RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEB)	Sorting (POOR, MOD, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
	← Box No. 2 →										660-670 95% SS, lt-medk gry, f-vf, sev carb frags, calc 5% sltst, dk gry, gry brn few coal frags
											670-680 90% SS, a/a 10% sltst, a/a
											680-690 99% SS, lt gry, m-f gr, frly well rnded, mod sorted 1% sltst, a/a sev coal frags not washed
											690-700 80% SS, a/a 20% sltst, gry-brn, carb frags few coal frags
											700-710 99% SS, a/a 1% sltst, a/a
											710-720 80% SS, a/a 10% sltst, a/a 10% clyst, m-gry
											720-730 95% SS, lt-m gry, gry-brn, f-vf, calc 5% sltst, gry-brn, carb frags
											730-740 70% SS, a/a 30% sltst, a/a carb. few coal frags
											740-750 99% SS, lt gry, f grn 1% sltst, m gry not washed
											750-760 a/a not washed
											760-770 40% SS, a/a 60% sltn, dk gry, gry brn carb, snoy

HOLE NO. ____ PAGE ____ OF ____

CUTTINGS
CORE
OUTCROP

Utah Fuel Company

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LOCATION

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

Sec. ____ TnShp. ____ Rng. ____

LOGGED BY ____ RUN ____ INTERVAL ____

N. ____

Length Cored ____ Length Recovered ____ % Recovery ____

E. ____

Observations ____

Elev. ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size CLAY / MUD / SILT / UFS / FGS / MGS / CGS / PEB	Sorting POOR / MOD / GOOD	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
											770-780 50% SS, lt-m gry, gry-brn, f-vf 30% Sltst, gry-brn, carb 5% clyst, m-gry 15% COAL
											780-790 65% SS, a/a 25% Sltst, a/a 5% clyst, a/a 5% COAL
											790-800 60% SS, lt-m gry, brn, f-vf 40% Sltst, m-gry, gry-brn, carb ip.
											800-810 95% SS, lt gry, f-g 5% Sltst, brn-gry occas coal frags Not washed
											810-820 a/a Not washed
	← Box No 2 →										820-830 90% SS, lt-m gry, f-g 10% Sltst, m-gry, brn gry, SNDY
											830-840 a/a
											840-850 a/a partially washed
											850-860 50% SS, lt-m gry, gry-brn, f-vf 50% sltst, brn-gry, carb occas coal frag
											860-870 70% SS, a/a 30% Sltst, a/a
											870-880 40% SS, a/a 60% Sltst, a/a

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GE4A003=coredril

CUTTINGS	
CORE	
OUTCROP	

Utah Fuel Company

LOCATION

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

Sec. ____ TnShp. ____ Rng. ____

LOGGED BY ____ RUN ____ INTERVAL ____

N. ____

Length Cored ____ Length Recovered ____ % Recovery ____

E. ____

Observations ____

Elev. ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size: CLAY / MUD / SILT / UFSS / FGSS / MGSS / CGSS / PEB	Sorting: POOR / MOD / GOOD	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
											880-890 40% ss, a/a 50% sltst, a/a 10% sh, dk gry
											890-900 a/a
											900-910 a/a
											910-920 20% ss, lt gry, f-vf 70% sltst, brn-gry, olv-gry, carb 10% sh, olv-gry, carb
											920-930 100% ss, lt gry, f-g friable, fairly well rnded, mod sorted not washed
	← Box No. 2 →										920-930 100% ss, a/a not washed
											930-940 90% ss, a/a 10% sltst, brn-gry, carb olv-gry not washed
											940-950 a/a not washed
											950-960 90% ss, a/a 5% sltst, a/a 5% sh, dk gry, bk, carb not washed
											960-970 a/a not washed
											970-980 a/a not washed

GE4A003=coredril

CUTTINGS	
CORE	
OUTCROP	

Utah Fuel Company

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LOCATION

Sec. ____ TnShp. ____ Rng. ____

N. ____

E. ____

Elev. ____

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

LOGGED BY P. Truex, W.A. Koontz RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFSS, FGSS, MGSS, CGSS, PEB)	Sorting (POOR, MOD, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							980				980-990 90% SS, a/a 5% Sltst, a/a 5%, sh, a/a not washed
							990				990-1000 a/a not washed
							1000				1000-1010 a/a not washed
							1010				1010-1020 10% SS, a/a 90% Sltst, dk gry, brn-gry, olv-gry, carb frags
							1020				1020-1030 10% SS, a/a 90% Sltst, a/a
	← Box No. 2 →						1030				1030-1040 25% SS, lt gry, f-g, calc 75% Sltst, dk gry, brn-gry, carb frags
							1040				1040-1050 70% SS, lt-m gry, brn, f-vfg, calc 25% sltst, brn-gry, sandy 5% sh, dk gry-brn, carb few coal frags
							1050				1050-1060 a/a occas coal frag
							1060				1060-1070 95% SS, lt-m gry, brn-gry, f-g, "salt + pepper", calc 5% Sltst, brn-gry, SNDY
							1070				1070-1080 60% SS a/a 20% SLTSTN a/a 10% SHL DK GRYSH BRN, fissil
							1080				1080-1090 70% SS a/a 30% SLTSTN a/a
							1090				

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GE4A003=coredril

CUTTINGS	X	**Utah Fuel Company**	PAGE 11 11 OF
CORE			LOCATION
OUTCROP			

PROJECT West Tract DATE 9-23-95 HOLE NO.

Sec. 28 TnShp. 13S Rng. 6E

LOGGED BY W. A Koontz RUN INTERVAL

N.

Length Cored Length Recovered % Recovery

E.

Observations

Elev. 8777

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, SILT, VFS, FS, MS, CS, VCS, PEB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
	2						1090				1090-1100 85% SS, lt-m gry, f grn "Salt & Pepper" texture acc carb lam 10% SLTSTN, lt gry - brnsh gry 5% COAL FRAGS
							COAL STRKS				
							1100				1100-1110 50% SS a/a 40% SHL, DK Gry-Grysh Blk acc carby, sl. slty 10% SLTSTN a/a
							1110				1110-1120 40% SHL a/a 30% SS a/a 30% SLTSTN a/a minor coal frags
							1120				1120-1130 80% SNDSTN v.fn grn, lt. tan gry 20% SHL a/a DID NOT WASH SAMPLE MUCH
							1130				1130-1140 35% SS fn grn, lt gry S. & P. text, carb lams 35% SHL grysh blk, carby 20% COAL FRAGS, brt, 10% SLTSTN
							COAL →				
	← Box No. 3 →						1140				1140-1150 60% SHL grysh blk, sl carby sl slty 40% SS a/a minor COAL Frags
							1150				1150-1160 50% SHL Grysh Blk 20% COAL, brt, 20% SS a/a 10% SLTSTN
					10?	2' 1' 4'	COAL 1160				1160-1170 40% COAL 30% SS a/a 30% SHL, Grysh blk, carby
							1170				1170-1180 70% SNDSTN a/a 25% SHL a/a 5% COAL (from above?)
						1'?	1180				1180-1190 80% SNDSTN, v.fn grn lt tan gry 10% SHL Grysh blk 10% COAL (from above?) DID NOT WASH SAMPLE MUCH
			End Cutting Log Begin Core Log								
Run # 1	Box 4			Scale Change	1" = 2'		1190				CORE RUN No. 1 (1190 - 1206.70 SNDSTN)
							1192				

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GE4A003=core

CUTTINGS	
CORE	✓
OUTCROP	

Utah Fuel Company

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LOCATION

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

LOGGED BY W.A Koontz RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

Sec. 28 TnShp. 13S Rng. 6E

N. ____

E. ____

Elev. 8777

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH 1"=2' Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, VFSS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
Run # 1 TOTAL RECOV. LNGTH 19.65 FT	Box 4						1192				Core Run #2 Done (1190 - 1206.70 Sndstn) 1190.0 - 1198.25 SS, lt-m gry, f-g, sev minor carb sh + coal strks, lams + blebs, non-calc, some bioturb, mottling
							1194				1191.75 - 1194.25 near vert fracture w/ some calc infill
							1196				1197.70 - 1198.0 some coal "rooting"
							1198				1198.25 - 1203.95 SS, lt-dk gry, m-g, alting lt + dk lams throughout, "salt+pepper" x-bedding
							1200				
	Box 5						1202				1203.65 - 1203.95 - coal "rooting"
							1204				1203.95 - 1206.70 SS, lt-m gry, f-vf gr, sev sltst, sh + carb lams, some bioturb 1203.95 - 1204.35 sm vert animal burrows? 1205.35 - 1205.65 - microfaulting or micro slumping
							1206				1206.0 - 1206.70 more silty 1206.70 - 1208.90 Sh, blk, carb, w/ strks + lams of coal, ip
			End Run #1	1209.65			1208				1208.90 - 1209.65 SS, lt gry, f-g w/ sltst + sh interbed lams, some bioturb
CORE RUN # 2	BOX 6			Start Run #2 WK 12/27/95 1210.75 - 1210.35 shl 1211.35 - 1211.45 - SS 1211.45 - 1219.7 coal	1210.00		1210 1212				1210.00 - 1210.80 SS, M. GRY, F-VFG, Non calc, some coal strks, some bioturb (1210.80 - 1219.70 - COAL) 1210.80 - 1211.05 - COAL, CRUSHED, CLYST LAM 1211.05 - 1217.50 - COAL

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GE4A003=coredril

CUTTINGS	
CORE	✓
OUTCROP	

Utah Fuel Company

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LOCATION

PROJECT West Tract DATE 9-23-95 HOLE NO. 95-28-1

Sec. 28 TnShp. 13S Rng. 6E

LOGGED BY W.A. Koontz RUN ____ INTERVAL ____

N. ____

Length Cored ____ Length Recovered ____ % Recovery ____

E. ____

Observations ____

Elev. 8777

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH 1½" Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, VFSS, FSS, MGSS, CGSS, PEB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
CORE RUN #2 (20.0' RECOVERY)	BOX 6						1212				CORE RUN #2 CONT
											1211.05-1217.50 COAL, BLK, SHINY, RESINOUS, INTACT GOOD CLEAT
					LOB?	8.2	1214				
							1216				1217.50-1218.10 - COAL, CRUSHED
							1218				1218.10-1218.70 - COAL, INTACT, a/a
											1218.70-1218.95 - COAL, w/ CLYST PARTINGS
											1218.95-1219.70 - COAL, INTACT, a/a
	BOX 7						1220				(1219.70-1229.75 SS)
											1219.70-1222.35 SS, lt gry, f-cg, GRADES FROM C at bot to F at top
							1222				1222.35-1222.40 COAL PARTING
											1222.40-1229.75 SS, lt-m gry, f-mg, mottled, bioturb, w/ carb lams near bot
							1224				1227.40-1229.35 - vert fract.
							1226				
							1228				1229.75-1230.00 Sh, dk gry, carb
				End Run #2							
CORE RUN #3	BOX 8			Start Run #3			1230				CORE RUN #3
											1230-1250 SS, lt-m gry, f-g, sl calc, some bioturb, some scattered carb lams, few coal strks or blebs, slty ip w/ few sm shale, carb partings
							1232				1230.75-1231.15 - Sh parting
											1233.90-1234.30 Sh parting
							1234				

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GE4A003-coredril

CUTTINGS	
CORE	X
OUTCROP	

Utah Fuel Company

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LOCATION

Sec. ____ TnShp. ____ Rng. ____

N. ____

E. ____

Elev. ____

PROJECT West Tract DATE 9-24-95 HOLE NO. 95-28-1

LOGGED BY ____ RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

Grain Size: CLAY, MUD, SILT, VFSS, FGSS, MGSS, CGSS, PEB

Sorting: POOR, MED, GOOD

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
CORE RUN #3 (20.0' RECOVERY)	BOX 8						1234		CORE RUN #3 CONT.
									1234.80-1234.90 sh parting
							1236		1236.40-1236.55 sh parting
	BOX 9						1238		1238-1250 SS, lt-m gry, f-g, sl calc, some bioturb, some scattered carb lams, few coal strks or blebs, slty ip w/ few sev carb sh partings; also some leaf impressions
							1240		
							1242		1243.30-1243.40 - sh parting
							1244		1244.00-1244.05 sh parting
							1246		
	BOX 10						1248		1248.75-1250.00, SS, a/a, fractured + broken (caused by putting too much in 20' core barrel)
				END RUN #3			1250		
CORE RUN #4				START RUN #4					CORE RUN #4
									1250.0-1269.20 SS, lt-m gry, c-f gr, calc, carb lams ip, occas coal strks, bioturb ip, x-bdings, some pea size gravel ip; w/ sev dk gry carb sh and dk gry sltst interbds
							1252		1250.30-1252.80 vert fract
							1254		
									1256.0-1357.0 Pea size pebbles + clasts
							1256		

HOLE NO. ____ PAGE ____ OF ____

GE4A003=coredril

CUTTINGS	
CORE	X
OUTCROP	

Utah Fuel Company

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LOCATION

Sec. ____ TnShp. ____ Rng. ____
N. ____
E. ____
Elev. ____

PROJECT West Tract DATE 9-24-95 HOLE NO. 95-28-1

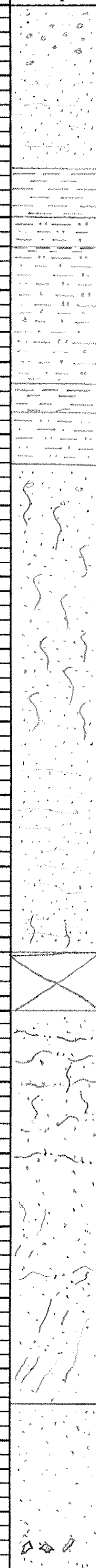
LOGGED BY ____ RUN ____ INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEB)	Sorting (POOR, MOD, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
CORE RUN #4 (19.20' RECOVERY)	BOX 11						1256				
							1258				1258.35-1259.00 sh parting, broken
											1259.00-1259.40 sltst parting, sltst/sh ...
											1259.40-1259.55 sh parting
							1260				1259.55-1261.30 sltst parting
											1261.30-1261.70 sh parting
											1261.70-1262.20 sltst parting
							1262				1262.2-1275.3 Ss, v ltgy to ltgy, vfgr, calc, burrowed w/ 20% sltst in lam
							1264				
							1266				
	BOX 12					13.1					
							1268				
				END RUN #4							
							1270				
CORE RUN 5 (20.0' Recovered 100% Rec)				START RUN #5							CORE RUN #5
							1272				
							1274				
	BOX 13						1276				1275.3-1285.8 Ss, vltgy, vf to fgr, friable, calc, w srtd, rip ups (clyst) at base
							1278				



GE4A003=coredril

CUTTINGS	
CORE	✓
OUTCROP	

Utah Fuel Company

LOCATION

Sec. ____ TnShp. ____ Rng. ____

N.

E.

Elev.

PROJECT WEST TRACT DATE 9-24-95 HOLE NO. 95-28-1

LOGGED BY ________ RUN 5 & 6 INTERVAL 1278-1300

Length Cored ________ Length Recovered ________ % Recovery ________

Observations

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH 1"=2' Scale	LITH Graph	Grain Size: CLAY / MUD / SILT / UFSS / FGSS / MGSS / CGSS / PEBB	Sorting: POOR / MOD / GOOD	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
RUN 5 REC=100% (20 Ft)	BOX 13					10.5	1278–1285.8				
	BOX 14					2.5	1285.8–1288.3				1285.8-1288.3 Sltst, m gy, calc, burrowed, w/ fossil shell mat. @ 1286.6, w/ 10% Ss intlam
RUN 6 REC=100% (20 ft)	BOX 14, BOX 15			Frac-Inclined, med rough		21.3	1288.3–1300				1288.3-1309.6 Ss, v lt to lt gy, vf to f gr, calc, w clyst ripups @ 1288.6-1290.0, w/ clyst intlam as follows: 0.05' @ 1290.6; 0.05 @ 1290.7; 0.05 @ 1299.2; w/ sltst intbed - 0.20 @ 1307.0; coal intlam - 0.05 @ 1306.9 (vit); rooting @ 1299.0 & 1306.1; pyrite frac filling @ 1300.0 ft.

Depth scale marks: 1278, 1280, 1282, 1284, 1286, 1288, 1290, 1292, 1294, 1296, 1298, 1300

GE4A003=coredril

Utah Fuel Company

CUTTINGS	
CORE	✓
OUTCROP	

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LOCATION

Sec. ____ TnShp. ____ Rng. ____

N. ____

E. ____

Elev. ____

PROJECT ____ DATE ____ HOLE NO. 95-28-1

LOGGED BY M Bunnell RUN 6 & 7 INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEB)	Sorting (POOR, MOD, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
RUN 6	BOX 16			Frac - near vert, med rough, Pyrite filling			1300				
							1302				
				Frac - med rough			1304				
							1306				
							1308				1309.6 - 1310.0 Clyst, m dk gy, carb, slty, w/occ coal stringers
CORE RUN #7 (20.00' RECOVERY)				START RUN 7			1310				1310.00 - 1311.80 SS, m-gry, f-vf g calc, w/scattered sm coal strks 1311.80 - 1312.80 sh, dk gry, carb, w/ interlams of coal
	BOX 17						1312				1312.80 - 1316.00 SS, a/a w/ biolog burrows, w/ thin interlams of sh at partings
							1314				
							1316				1316.0 - 1317.40 sh, dk gry-blk, carb, w/ interlams of coal, broken up
							1316				1317.40 - 1324.60 SS, lt-m gry, f-vf g, calc, w/ bioturb burrowing, coal strks w/ sm interbeds of sltst, dk gry, + minor interlams of sh.
							1316				
							1318				

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GE4A003=coredril

CUTTINGS		**Utah Fuel Company**	PAGE 18 OF
CORE	X		LOCATION
OUTCROP			

PROJECT West Tract DATE 9-25-95 HOLE NO. 95-28-1

Sec. ____ TnShp. ____ Rng. ____

LOGGED BY ____ RUN ____ INTERVAL ____

N. ____

Length Cored ____ Length Recovered ____ % Recovery ____

E. ____

Observations ____

Elev. ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SLT, UFSS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MOD, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
CORE RUN #7	BOX 17						1318				
							1320				
							1322				
	BOX 18						1324				1324.60 - 1325.40 sh, dk gry-blk, carb w/ interlams of coal 1325.40 - 1330.00 ss, lt-m gry, f-vf gr (drg), non-calc, some bioturb, some coal strks @ 1325.40 - 1325.90 - 1/8"-1/4" interbeds of coal @ 1328.00 - .15 carb sh @ 1328.30. .10 carb sh @ 1329.30 - 1330.00 Incr'ing sh + coal interlams
							1326				
							1328				
RUN #8 (100% Rec) (20 ft.)				END RUN #7 BEG RUN 8			1330				1330.0 - 1339.1 Sltst, v lt gy to m lt gy, sndy, calc, w/ 40% Ss intlam, bioturbated throughout, occ coal rooting, w/ shale intlam as follows: 0.2' @ 1331.1; 0.3' @ 1338.0
							1332				
	BOX 19					9.1	1334				
				Planar Fracs - Calcite-filled			1336				
							1338				1339.1 - 1339.8 Clyst, m gy, slty, abund fossil plant frags
						0.7	1340				

HOLE NO. ____ PAGE ____ OF ____

GE4A003=coredril

CUTTINGS	
CORE	
OUTCROP	

Utah Fuel Company

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LOCATION

PROJECT WEST TRACT DATE 9-25-95 HOLE NO. 95-28-1

Sec. ____ TnShp. ____ Rng. ____

LOGGED BY M Bunnell RUN ____ INTERVAL ____

N. ____

Length Cored ____ Length Recovered ____ % Recovery ____

E. ____

Observations ____

Elev. ____

Depth Adjustment

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, VFSS, FGSS, MGSS, CGSS, PEBB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
RUN #8	Box 20					1.78	1340				1339.8-1341.58 Carb Sh - vdkgy to blk, slty, w/ 30% vitrain intlam, resin blebs at base
				Inclined Joint Planes; some clet filling		6.42'	1342				1341.58-1348.00 COAL: 6.42' 1341.58-1341.76-Fusain, dull 1341.76-1345.78-Clarain w/ 30% vitrain intlam 1345.78-1346.00-Fusain, dull 1346.00-1346.10-Ss, lt brgy, noncalc, possible spar
							1344		Pyrite		1346.10-1346.90 - Clarain, w/10% vitrain intlam 1346.90-1347.05 Bone -- carb Clyst
							1346		SPAR ??; BONE		1347.05-1348.00 Clarain, w/ 20% vitrain intlam. Occ Resin blebs throughout coalbed Well Devel. cleating Pyrite nodule @ 1345.2
				END RUN 8		2.0'	1348				1348.00-1350.0 Clyst, lt olgy, slty, abund plant frags, rooted
RUN 9 (100% Rec) (20 ft.)	Box 21			BEG RUN 9		0.5	1350				1350.0-1350.5 Clyst, a/a 1350.5-1353.3 sltst/ss, intlam, calc, vltgy-mgy, bioturbated w/ clyst parting @ 1352.1
						2.8	1352				1353.3-1355.2 Ss, vltgy, vfgr, calc, w/occ sltst intlam, occ coal stringers
						1.9	1354				1355.2-1357.2 sltst/ss intlam, vlt to mgy, calc, bioturb, w/ 0.1' clyst @ 1356.6
						2.0	1356				
						0.3					1357.2-1357.5 clyst, mgy, slty
	Box 22						1358				1357.5-1357.7 - Carb Sh, vdkgy, coal intlam 1357.70-1365.40 COAL: 7.70 1357.70-1362.60- Clarain w/ 30% vitrain intlam
				Inclined Joint Plane		7.70	1360				1362.60-1362.95 Fusain, Dull, blocky 1362.95-1365.40 Clarain w/ 30% vitrain intlam
							1362				

HOLE NO. ____ PAGE 19 OF ____

GE4A003=coredril

CUTTINGS	✓
CORE	✓
OUTCROP	

Utah Fuel Company

PAGE 20 OF ____

LOCATION

PROJECT West Tract DATE 9-25-95 HOLE NO. 95-28-1

LOGGED BY M Bunnell RUN 9 INTERVAL ____

Length Cored ____ Length Recovered ____ % Recovery ____

Observations ____

Depth Adjustment

Sec. ____ TnShp. ____ Rng. ____

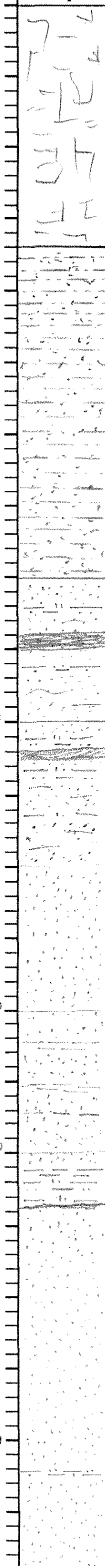
N. ____

E. ____

Elev.

Grain Size: CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEB | Sorting: POOR, MOD, GOOD

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							1362		well cleated, clean
				Frac - clet filled - planar			1364		
Run 9	Box 23					4.6	1366		1365.40 – 1370.0 sltst/ss interlam, lt-mgy, calc, bioturb, rooted
							1368		
				Begin Rotory 1" = 10'			1370		1370-1380 80% SS, lt gry, brn-gry, f-g, non-calc; 10% sltst, brn-gry, carb, shaly ip; 10% COAL FRAGS
							1380		1380-1390 70% SS, a/a; 25% sltst, a/a; 5% COAL FRAGS
							1390		1390-1400 100% SS, lt gry, f-m gr, frly well rnded, mod sorted, friable, occas coal frag
							1400		1400-1410 85% SS, a/a; 15% sh, dk gry, slty
							1410		1410-1420 80% SS, lt gry, lt brn, f-g; 15% sltst, brn gry, carb; 5% sh, dk gry; few coal frags (above ?)
				STORRS ? TONGUE			1420		1420-1430 100% SS, lt gry-m-f gr, "salt + pepper", frly well rnded, mod sorted, calc, few coal frags (above)
							1430		1430-1440 95% SS, a/a; 5% sltst, dk gry-brn, blk
							1440		



HOLE NO. ____ PAGE 20 OF ____

CUTTINGS	X
CORE	
OUTCROP	

Utah Fuel Company

LOCATION

PROJECT West Trait DATE 9-26-95 HOLE NO. 95-28-1

Sec. ____ TnShp. ____ Rng. ____

LOGGED BY ____ RUN ____ INTERVAL ____ N. ____

Length Cored ____ Length Recovered ____ % Recovery ____ E. ____

Observations ____ Elev. ____

Depth Adjustment

Grain Size: CLAY, MUD, SILT, UFS, FGS, MGS, CGS, PEB — Sorting: POOR, MED, GOOD

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							1440	1440-1450 95% SS, a/a 5% sltst, a/a w/ occas coal frag
							1450	1450-1460 95% SS, lt-m gry, f-g, calc 5% sltst, gry-brn
							1460	1460-1470 100% SS, a/a occas coal frag (Above?) more indurated near bottom (last 3')
							1470	1470-1480 80% SS, a/a, carb 18% slst, gry-brn, carb ~2% COAL
							1480	1480-1490 99% SS, lt gry, f-m gr, frly well rnded, mod sorted 1% sltst, a/a few coal frags (above?)
							1490	1490-1500 95% SS, a/a 5% sltst, olv-gry, gry-brn sev coal frags (above?)
							1500	1500-1510 90% SS, a/a 10% sltst, a/a
							1510	1510-1520 Missed Sample at Shift change
							1520	1520-1530 90% SS, aa 10% sltst, aa sev coal frags
							1530	1530-1540 90% SS, lt gry, f-m g, sl calc 10% sltst, m gry, olive-gry sev coal frags
							1540	1540-1550 90% SS, a/a 10% sltst, dk gry-brn.
							1550	

HOLE NO. ____ PAGE ____ OF ____

CUTTINGS	X
CORE	
OUTCROP	

Utah Fuel Company

PROJECT West Tract DATE 9-26-95 HOLE NO. 95-28-1

LOGGED BY ______ RUN ______ INTERVAL ______

Length Cored ______ Length Recovered ______ % Recovery ______

Observations ______

Depth Adjustment

LOCATION

Sec. ____ TnShp. ____ Rng. ____

N. ______

E. ______

Elev. ______

SAMPLE No.	SAMPLE Box	ROCK STRENGTH 1 2 3 4	Dip TCA	DISCONTINUITIES Description	DISCONTINUITIES Graph	Thick	DEPTH Scale	LITH Graph	Grain Size (CLAY, MUD, SILT, UFSS, FGSS, MGSS, CGSS, PEB)	Sorting (POOR, MED, GOOD)	LITHOLOGIC DESCRIPTION (Bedding Contacts, Color Fossils, Structures Etc.)
							1550				1550-1560 95% SS, a/a 5% sltst, dkgry, olv-gry
							1560				1560-1570 95% SS, m-dk gry, f-vfg, "dirty", calc 5% sltst, dk gry
							1570				1570-1580 a/a
							1580				1580-1590 60% SS, aa 30% sltst, blk, carb 7% sh, blk, carb, boney ~3% coal, shiny, dull
							1590				1590-1600 50% SS, aa 40% sltst, aa 5% sh, aa 5% COAL
				Panther Tongue?			1600				1600-1610 97% SS, lt brn, m-g, fairly well rnded, well sorted, friable 3% COAL FRAGS (Above?)
							1610				1610-1620 40% SS, lt gry, f-m g 60% sltst, olv-gry
							1620				1620-1630 90% SS, a/a calc 10% sh, blk, carb.
							1630				1630-1640 97% SS, a/a 2% sh, a/a 1% COAL FRAGS
							1640				1640-1650 100% SS, a/a w/few coal-ish frags.
				T.D. 1650'			1650				

HOLE NO. ____ PAGE ____

AFFIDAVIT OF PUBLICATION

STATE OF UTAH)

ss.

County of Carbon,)

I, Jenni Fasselin, on oath, say that I am the Publisher of the Sun Advocate, a twice-weekly newspaper of general circulation, published at Price, State of Utah a true copy of which is hereto attached, was published in the full issue of such newspaper for 4 (Four) consecutive issues, and on the Utah legals.com website, the first publication was on the 27th day of October, 2015, and that the last publication of such notice was in the issue of such newspaper dated the 17th day of November 2015.

Jenni Fasselin

Jenni Fasselin – Publisher

Subscribed and sworn to before me this 17th day of November, 2015.

Linda Thayn

Notary Public My commission expires January 10, 2019 Residing at Price, Utah

Publication fee, $ 436.80

LINDA THAYN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 680835
COMM. EXP. 01-10-2019

LEGAL NOTICE

Canyon Fuel Company, LLC, has filed a complete application with the Division of Oil, Gas, and Mining for a revision of the existing Mining and Reclamation Plan, C/0070005 for the Skyline Mine. Canyon Fuel Company, LLC operates the Skyline Mines with surface facilities located in Eccles Canyon which is approximately 4 miles southwest of the town of Scofield, Utah. The revision includes the addition of a power line approximately 3 miles in length providing power to a ventilation facility located in Upper Huntington Canyon.

Underground coal mining will take place in coal reserves owned or leased by Canyon Fuel Company, LLC. A legal description of the proposed areas for these new surface facilities is described as follows:

Proposed Additional Areas Authorized for Coal Mining and Reclamation Activities

Township 12 South, Range 6 East, SLBM

Section 23:	Portions of E1/2E1/2, SW1/4SE1/4
Section 24:	Portions of N1/2
Section 25:	Portions of S1/2S1/2
Section 26:	Portions of NW1/4NE1/4, N1/2NW1/4, SW1/4NW1/4
Section 27:	Portions of S1/2NE1/4, S1/2NW1/4

Total acres within the affected area: 4.8 acre power line and 9.7 acre ventilation facility

The address of the applicant is: Canyon Fuel Company, LLC
225 North 5th Street, Suite 900
Grand Junction, CO 81501

After filing, copies of this permit application will be available for inspection at the following location: Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City Utah, and the Division of Oil, Gas, and Mining website under the Coal Permit files.

Written comments or requests regarding this permit renewal must be made within 30 days of the last publication of this notice, and may be addressed to the Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114-5801.
Published in the Sun Advocate October 27, November 3, 10 and 17, 2015.

AFFIDAVIT OF PUBLICATION

STATE OF UTAH)

ss.

County of Emery,)

I, Jenni Fasselin, on oath, say that I am the Publisher of the Emery County Progress, a weekly newspaper of general circulation, published at Castle Dale, State of Utah and County aforesaid, and that a certain notice, a true copy of which is hereto attached, was published in the full issue of such newspaper for 4 (Four) consecutive issues, and on the Utah legals.com webwsite; the first publication was on the 27th day of October, 2015, and that the last publication of such notice was in the issue of such newspaper dated the 17th day of November, 2015.

Jenni Fasselin

Jenni Fasselin – Publisher

Subscribed and sworn to before me this 17th day of November 2015.

Linda Thayn

Notary Public My commission expires January 10, 2019 Residing at Price, Utah

Publication fee, $ 312.00

LINDA THAYN
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 680835
COMM. EXP. 01-10-2019

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Section 25: Portions of S1/2S1/2
Section 26: Portions of NW1/4NE1/4, N1/2NW1/4, SW1/4NW1/4
Section 27: Portions of S1/2NE1/4, S1/2NW1/4

Total acres within the affected area: 4.8 acre power line and 9.7 acre ventilation facility

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Written comments or requests regarding this permit renewal must be made within 30 days of the last publication of this notice, and may be addressed to the Utah Division of Oil, Gas, and Mining, 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114-5801.

Published in the Emery County Progress October 27, November 3, 10 and 17, 2015.

A CULTURAL RESOURCES INVENTORY FOR THE SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT, CARBON AND EMERY COUNTIES, UTAH

Prepared for:

Canyon Fuel Company, LLC
A Subsidiary of Bowie Resource Partners, LLC

For Submittal to:
U.S. Department of Agriculture
U.S. Forest Service
Manti-La Sal National Forest

Prepared by:

Andrew T. Yentsch, M.S., RPA

Environmental Planning Group, LLC
208 East 800 South
Salt Lake City, Utah 84102

Utah Public Lands Policy Office Permit No. 89

Utah Antiquities Project No. U-14-EO-0753f

EPG Cultural Resources Report No. SLC-2014-06

October 7, 2014

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ABSTRACT

In June of 2013, Canyon Fuel Company, LLC, a subsidiary of Bowie Resource Partners, LLC, requested Environmental Planning Group, LLC (EPG) of Salt Lake City, Utah, to complete Class III cultural resources inventories of four discontinuous parcels in Carbon and Emery Counties, Utah, for the Skyline Mine Expansion and Transmission Line Construction Project. The survey areas are located on U.S. Forest Service (Manti-La Sal National Forest) administered land. The inventories were conducted in anticipation of a proposed mine expansion and construction of two new, 12.5-kilovolt transmission lines. The inventories were conducted to meet the requirements of Section 106 of the National Historic Preservation Act for the proposed activity. The purpose of this inventory was to identify, record, and determine the extent and significance of cultural resources within the Project area.

A Class I cultural resources file search was completed for the four parcels, as well as for a 1-mile area surrounding each parcel. Class III cultural resources inventories were completed for 245 acres (99.15 hectares) of U.S. Forest Service (Manti-La Sal National Forest) administered land located approximately 5 miles (8.05 kilometers) west of Scofield, Utah. The Project area encompasses portions of Sections 26, 27, 34, and 35, Township 12 South, Range 6 East; and Sections 13, 23, 24, 26, and 27, Township 13 South, Range 6 East. The cultural resources surveys were conducted by EPG archaeologists on August 7, 2014, and September 29, 2014. All cultural resources work was carried out under authority of Utah State Antiquities Project Number U-14-EO-0753f and Public Lands Policy Coordination Office Permit Number 89 (Andrew T. Yentsch).

Five Isolated Occurrences (IO1 through IO5) and three new cultural resources sites (42CB3253, 42CB3254, and 42EM4583) were identified, documented, and evaluated for eligibility for inclusion in the National Register of Historic Places (NRHP). None of the sites are recommended eligible for inclusion in the NRHP. Therefore, the Project will have no adverse effect on those sites.

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LIST OF ACRONYMS

AERC	Archaeological Environmental Research Corporation
B.P.	Before the present
BLM	Bureau of Land Management
BYU-OPA	Brigham Young University-Office of Public Archaeology
CMT	Culturally modified tree
CFR	Code of Federal Regulations
EPG	Environmental Planning Group, LLC
GLO	General Land Office
GPS	Global positioning system
IMACS	Intermountain Antiquities Computer System
IO	Isolated occurrence
MOAC	Montgomery Archaeological Consultants
NAD83	North American Datum, 1983
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
SHPO	State Historic Preservation Office
SWCA	SWCA Environmental Consultants
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator

INTRODUCTION

In June of 2013, Canyon Fuel Company, LLC, a subsidiary of Bowie Resource Partners, LLC, requested Environmental Planning Group, LLC (EPG) of Salt Lake City, Utah, to complete Class III cultural resources inventories of four discontinuous parcels in Carbon and Emery Counties, Utah, for the Skyline Mine Expansion and Transmission Line Construction Project (Project). The inventories were conducted in anticipation of a proposed mine expansion and construction of two new, 12.5-kilovolt transmission lines. The survey areas consist of four non-contiguous parcels located on U.S. Forest Service (USFS) (Manti-La Sal National Forest) administered land. The inventories were conducted to meet the requirements of Section 106 of the National Historic Preservation Act for the proposed activity. The purpose of the inventories was to identify, record, and determine the extent and significance of all observable cultural resources in the Project area to assist in the identification of locations requiring protection, additional treatment, or mitigation.

Prior to conducting fieldwork, a Class I cultural resources file search was completed for four non-contiguous parcels, as well as for a 1-mile area surrounding each parcel. This file search was conducted primarily to determine whether or not known cultural resources had been previously documented within the boundaries of the Project area, and secondarily to assess the type or types of cultural resources that may be encountered during the investigation.

Class III cultural resources inventories were completed for 245 acres (99.15 hectares) of USFS (Manti-La Sal National Forest) administered land located approximately 5 miles (8.05 kilometers) west of Scofield, Utah. The Project area encompasses portions of Sections 26, 27, 34, and 35, Township 12 South, Range 6 East; and Sections 13, 23, 24, 26, and 27, Township 13 South, Range 6 East.

The cultural resources surveys were conducted by EPG archaeologists on August 7, 2014, and September 29, 2014. EPG archaeologist Andrew T. Yentsch served as principal investigator and directed the Project. He was assisted by John Curl and Suzy Eskenazi. All cultural resources work was carried out under authority of Utah State Antiquities Project Number U-14-EO-0753f and Public Lands Policy Coordination Office Permit Number 89 (Andrew T. Yentsch). All field notes and photographic materials from the Project are on file at EPG's office in Salt Lake City, Utah.

Five Isolated Occurrences (IO1 through IO5) and three new cultural resources sites (42CB3253, 42CB3254, and 42EM4583) were identified, documented, and evaluated for eligibility for inclusion in the National Register of Historic Places (NRHP). None of the sites are recommended eligible for inclusion in the NRHP. Therefore, the Project will have no adverse effect on those sites.

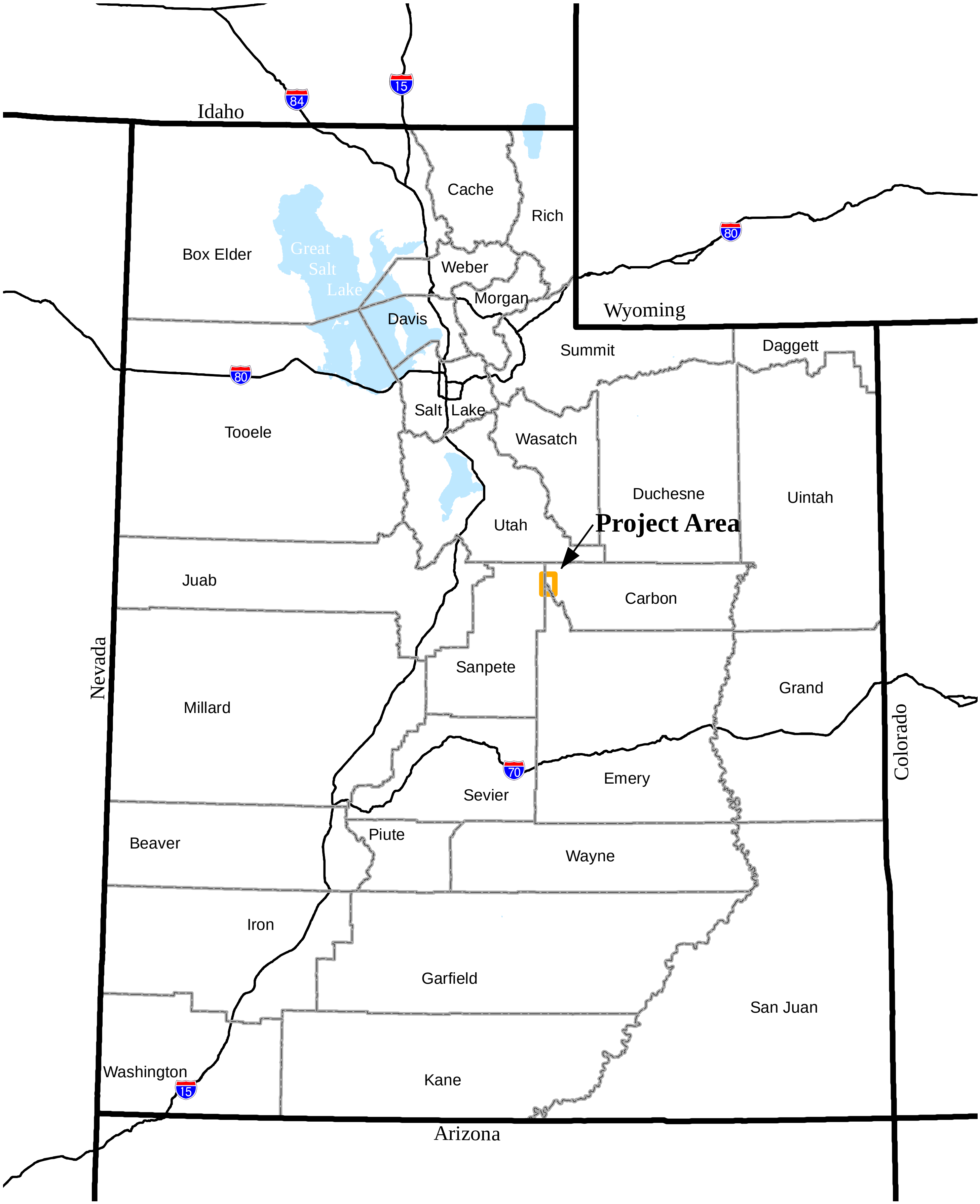
Project Description

The Skyline Mine Expansion and Transmission Line Construction Project area, hereafter referred to as the Project area, is located in south-central Utah, approximately 5 miles (8.05 kilometers) west of the community of Scofield, Utah (Figure 1). The Project area consists of three non-contiguous, disconnected block parcels and one linear corridor centered roughly on the Skyline Mine in Eccles Canyon. The survey locations are presented in Figures 2-1 and 2-2. Topographic map coverage of the Project area is provided by the Scofield Reservoir, Utah (1991); and Scofield, Utah (1991) 7.5-minute U.S. Geological Survey (USGS) quadrangles.

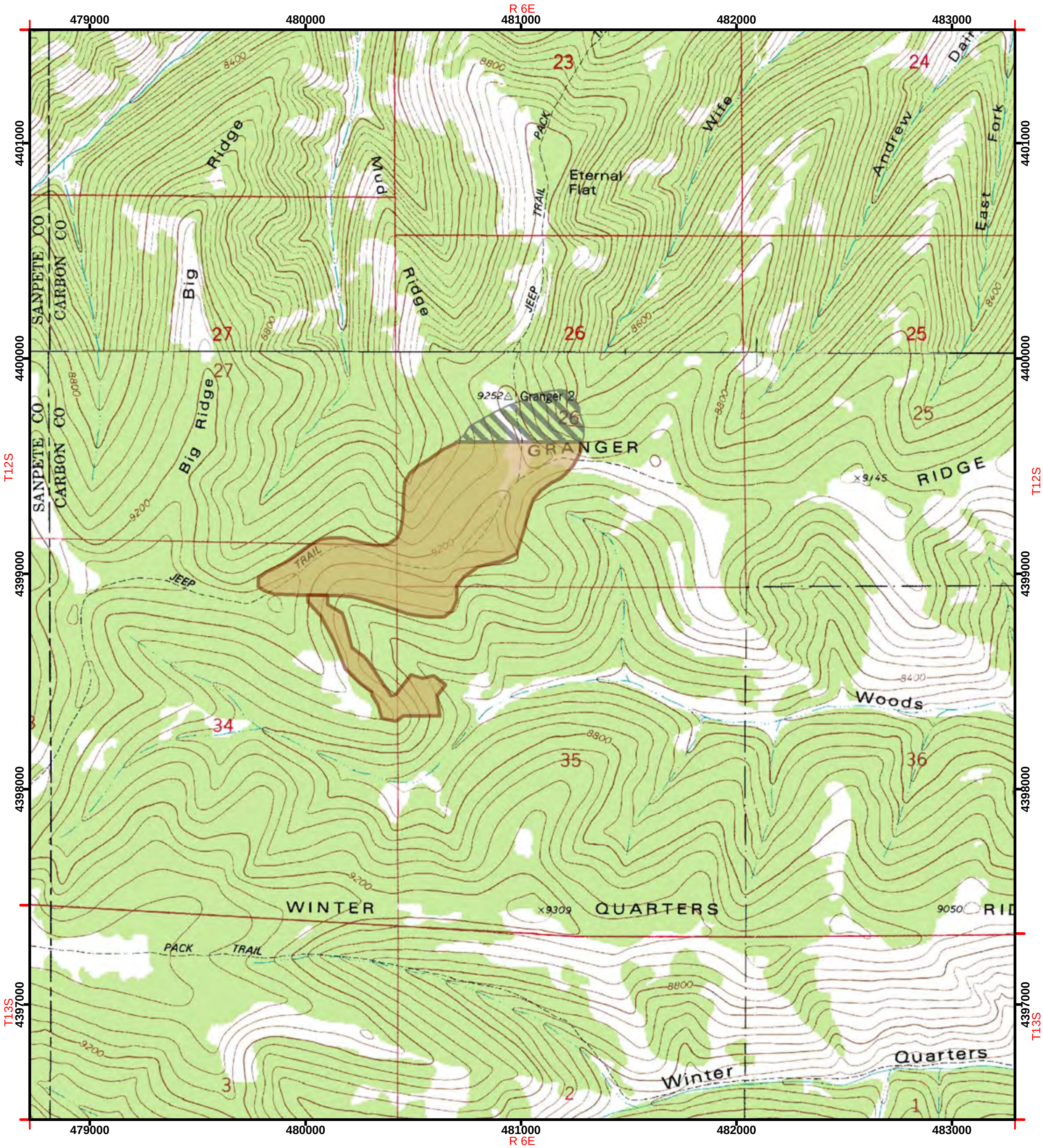
The first parcel consists of a 160.53-acre (64.96 hectare) area for a new Bleeder Shaft pad covering portions of Sections 26, 27, 34, and 35, Township 12 South, Range 6 East. Due to signage forbidding access and sheep grazing at the time of the survey, approximately 24.01 acres (9.72 hectares) were not surveyed in the northernmost portion of this parcel (refer to cross-hatched area in Figure 2-1). The second parcel consists of an area covering 7.75 acres (3.14 hectares) for a new Stacker Tube Mine Site Expansion area due west of the existing facilities at the Skyline Mine. This facility covers portions of the southwest corner of Section 13, Township 13 South, Range 6 East. The third parcel consists of a 2.7-mile-(4.3 kilometer) long transmission line running from the Skyline Mine facility to Swen's Canyon to the southwest. This linear corridor encompasses portions of Sections 13, 23, 24, 26, and 27, Township 13 South, Range 6 East. Per discussions with the USFS (Manti-La Sal National Forest) archaeologist, a 200-foot (61 meter) wide corridor was surveyed; a total of 64.12 acres (25.95 hectares). The fourth and final parcel consists of a 12.99-acre (5.26 hectare) area for a new pad at the mouth of Swen's Canyon. This facility covers a portion of the northwest corner of Section 27, Township 13 South, Range 6 East.

ENVIRONMENTAL OVERVIEW

The Project area lies in the Wasatch Plateau Section of the Basin and Range – Colorado Plateau Transition Physiographic province (Stokes 1986:247). This Transition Zone exhibits characteristics of both the Basin and Range and Colorado Plateau Physiographic provinces. The Basin and Range Province is characterized by broad flat desert valleys and basins divided by parallel, north-south trending mountain ranges; while the Colorado Plateau Province includes higher elevations and a generally more mountainous environment (Fenneman 1931). The Wasatch Plateau is the largest of eight elevated tablelands that trend north-to-south through central and southern Utah, known collectively as the High Plateaus of Utah (Geary 1996:2). The Wasatch Plateau is the only one capped entirely by sedimentary rocks (Stokes 1986:247). The Price/Spanish Fork Rivers form the northern boundary of the Plateau, and Salina Canyon marks the southern border. The Wasatch Plateau is an erosional remnant undergoing geological removal along a ragged eastern margin and a summit protected by thin resistant Paleocene-age Flagstaff Limestone (Stokes 1986:247). The eastern edge is a continuation of the Book Cliffs. The western edge of the Wasatch Plateau is marked by an abrupt descent of beds along the Wasatch Monocline (Stokes 1986:247). Huntington Creek, south and west of the Project area, is one of several permanent streams traversing the Plateau. Elevations in the Project area range from about 8,700 feet (2,652 meters) to more than 9,655 feet (2,943 meters) above mean sea level.



General Project Location
Figure 1



Legend

Project Reference

Location of Areas Surveyed

Location of Areas Not Surveyed
Access Denied

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Scofield Reservoir; Scofield

1:24,000

UTM 12 North

North American 1983

FIGURE 2-1 DETAILED PROJECT LOCATION MAP

BOWIE RESOURCES - SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT

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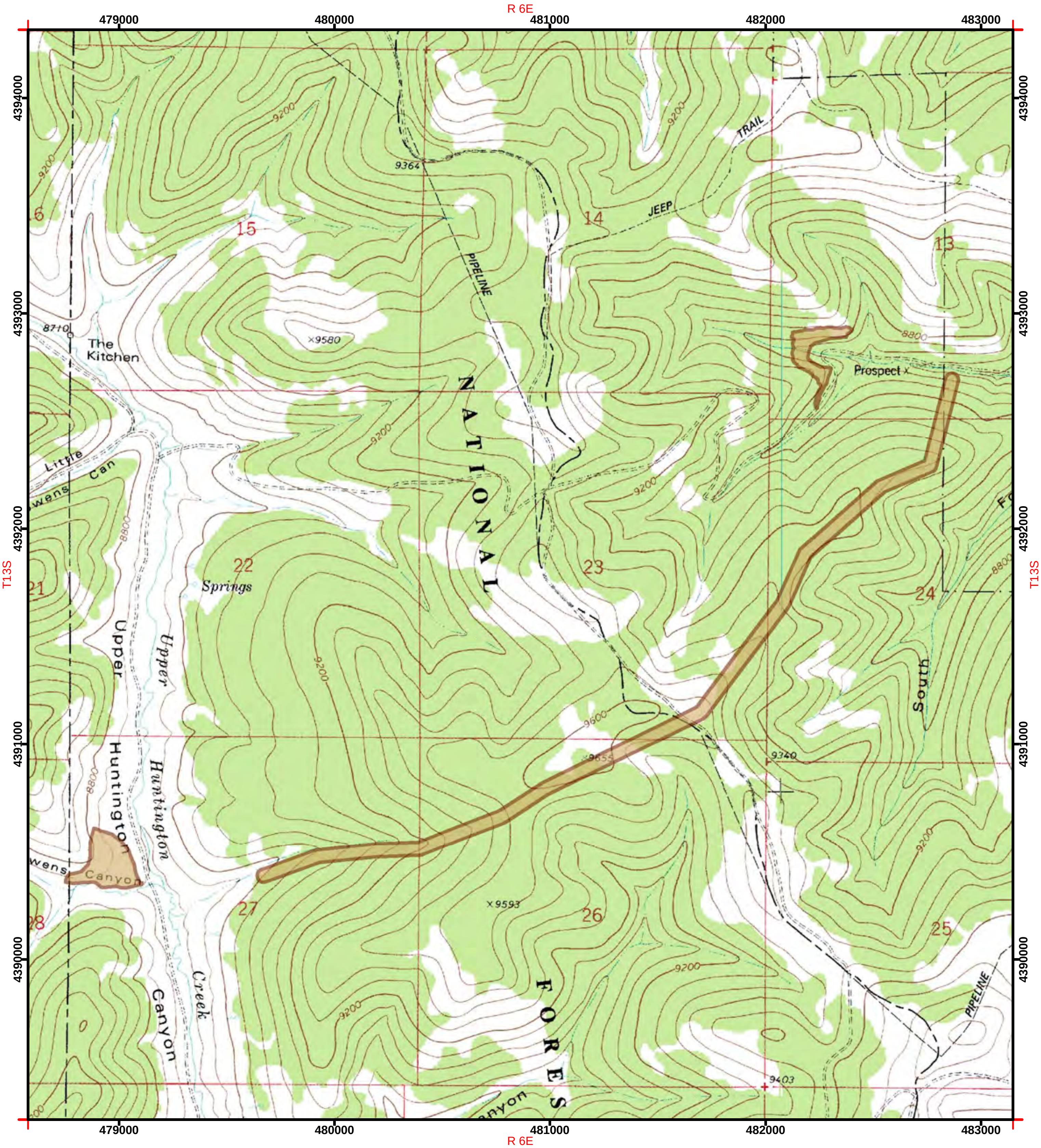

Legend

Project Reference

Location of Areas Surveyed

Location of Areas Not Surveyed
Access Denied

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Scofield

1:24,000

UTM 12 North

North American 1983

FIGURE 2-2 DETAILED PROJECT LOCATION MAP

BOWIE RESOURCES - SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT

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Soils

Sediments consist predominantly of well-drained sandy and stony loams of the Curecanti family-Pathead complex, as well as stony and clay loams of the Trag-Croydon complex (Natural Resources Conservation Service [NRCS] 2014).

These sediments occur on mountain slopes and flanks and are composed mostly of colluvium and/or slope alluvium over residuum derived from weathered sandstone and shale (NRCS 2014).

Vegetation

Plant communities occurring in and immediately surrounding the Project area contain taxa characteristic of the Canadian Life Zone (Cronquist et al. 1972). Vegetation is dominated by species associated with the Greasewood/Shadscale vegetation community. Observed plants include quaking aspen (*Populus tremuloides*), Engelmann spruce (*Picea engelmanii*), sagebrush (*Artemisia* spp.), yarrow (*Achillea millefolium*), grasses, and herbaceous plants. Non-native Russian thistle (*Salsola* spp.) was also observed throughout the Project area.

The vegetation communities here have been subjected to more than 100 years of grazing activities that have altered the natural distribution of plants in the area. Visible disturbances consist of road construction and maintenance and grazing trails associated with ranching and grazing activities.

CULTURAL OVERVIEW

The prehistory of the eastern Great Basin and northern Colorado Plateau is commonly divided into several periods, each thought to represent a distinct subsistence strategy and way of life. While terminology sometimes differs between researchers, the basic periods are (1) Paleoindian (12,000 to 9,000 B.P. [Before the present]); (2) Archaic (8,500 to 1,500 B.P.); (3) Formative (1,500 to 600 B.P.); and (4) Late Prehistoric (600 to 150 B.P.). Many descriptions of the prehistoric archaeological complexes of the region have appeared elsewhere, and should be consulted for a fine-grained and comprehensive description of each (Aikens and Madsen 1986; Madsen and Simms 1998; Marwitt 1986; Kelly 1997; Janetski 1991; Callaway et al. 1986; Jennings 1978; Simms 2008).

The European-American history of the region has also been documented by other researchers (Watt 1997; Geary 1996), whose works should be reviewed for a detailed description of the events and individuals relevant to this period. Briefly, the first Euroamerican settlers in the region consisted of stockmen from Utah Valley—S. J. Harkness, T. H. Thomas, William Burrows, O. G. Kimball, D. D. Green, A. H. Earl, and R. McKecheney who were attracted by the immense ranges for their cattle—who brought their herds to Pleasant Valley (where Scofield Reservoir is today) in 1875 (Dilley 1900).

Coal was discovered in Pleasant Valley in 1875, and 2 years later a small mine was opened on the western slopes of the canyon. The winter of 1877 came early and was very severe, stranding the miners and keeping them snowbound until the following February. The ordeal led the miners to name their forced camp "Winter Quarters," which became one of the first commercial coal mines in the state (Carr 1972:73). Most the first miners at Winter Quarters were Mormon converts from the coal districts of Wales, England and Scotland. The Denver and Rio Grande Western Railroad Company acquired the Pleasant Valley Coal Company in 1882 and undertook the development of a new mine on Mud Creek, a mile from Winter Quarters. As the local Mormon Bishop, David Williams, controlled the local miners, the Pleasant Valley Coal Company brought in Chinese laborers to work the Mud Creek mine. Soon a large contingent of Finns was recruited, along with Italian, Greek, and other Scandinavian workers (Geary 2002). Scofield had a population of roughly 700 people in 1890 (Carr 1972:74).

Mining thrived in Pleasant Valley until 1900, when an errant spark touched off the fine haze of coal dust deep underground, and the Winter Quarters #4 mine exploded (Carr 1972:73; Powell 1994:491). One hundred men were killed instantly, and another ninety-nine died from the poisonous afterdamp, making this one of the worst coal mine disasters in history (Carr 1972:73; Powell 1994:491).

Mining continued, and Scofield, sustained by several mines in Pleasant Valley, was still the largest town in Carbon County. In 1915, Scofield's citizens made an attempt to have the county seat moved to their community from Price, Utah. By the 1920s, however, the coal industry in Pleasant Valley was in decline, and most mines ceased operation, causing the town to lose nearly all 2,000 of its residents. The Winter Quarters mines continued to operate until 1928 (Carr 1972:73).

During this same period, roughly 1875 to the 1950s, the small community of Clearcreek thrived. Located in the southern end of Pleasant Valley, Clearcreek began as a small logging and milling camp supplying timbers for the mines around Winter Quarters and Scofield during the 1870s and 1880s (Carr 1972:75). High quality coal deposits were discovered around 1896 and mine development began immediately. In 1900, the Utah Fuel Company, a subsidiary of the Denver and Rio Grande Western Railroad Company, built 25 homes and duplexes, a hotel, store, hospital, schoolhouse, and water system (Carr 1972:75). Between 1910 and 1920, operations produced roughly 2,000 tons of coal per day, and the town boasted a population of roughly 600 (Carr 1972:75). This production was short-lived, however, and by 1930 only 250 people remained. By the middle 1950s, the town was virtually abandoned. Today, Clearcreek is a quiet summer resort (Carr 1972:75).

The Skyline mine, located in Eccles Canyon south of Scofield, began production in the early 1980s, when Coastal Corporation bought the leases from Energy Fuels Company and developed three sets of mine entries, the #1 mine, #2 mine and #3 mine. The #2 mine closed in the mid to late 1980s and the #1 in the 1990s. The #3 mine has been operating almost the entire time (excerpted from http://geology.utah.gov/utahgeo/energy/coal/coaltour/mines/skyline.htm).

PREVIOUS PROJECTS AND RECORDED CULTURAL RESOURCES

A file search for previously recorded cultural resource sites and previously conducted surveys within 1-mile of the current Project area was conducted on July 14, 2014, by EPG archaeologist

Andy Yentsch at the Utah Division of State History, Utah State Historic Preservation Office (SHPO), in Salt Lake City. In addition, the NRHP, the Utah State Register of Historic Places, the Utah Linear Sites Database, and the historic sites database at the SHPO were examined to determine if additional historic resources, historic structures, or historic sites not in the SHPO archaeological records have been documented in the vicinity of the Project area. The searches identified 55 cultural resources projects and 33 cultural resources sites within 1 mile of the current Project area (Table 1). Five of these projects occur within the current Project area. No previously recorded sites are located in the current Project area.

TABLE 1
PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 1 MILE OF THE PROJECT

State Project No.	Report Title	Organization
U75AF0067	Archaeological Reconnaissance During 1975 in the Scofield Locality	Archaeological Environmental Research Corporation (AERC)
U76AF0179	Access Routes & Drill Stations-Winter Quarters Area	AERC
U76AF0189	Access Roads and Drill Stations on Winter Quarters. P#184.	AERC
U76FS0180	Eccles Canyon Timber Sale	USFS
U79AF0477	Archaeological Reconnaissance in the Vicinity of Eccles Canyon	AERC
U79AF0478	Archeological Survey in the Eccles Canyon Locality	AERC
U80AF0705	Whiskey Creek Canyon-Pleasant Valley Project Area	AERC
U80AF0711	Archeological Surface Evaluations in the Skyline Project	AERC
U80BL0710	Cultural Investigation of Two USGS Drill Sites	Bureau of Land Management (BLM)
U81AF0924	Cultural Resources Evaluations above Huntington Canyon/Scofield Reservoir	AERC
U81AF0925	Road Realignment in the Eccles Canyon Locality	AERC
U81AF0983	Six Seis Lines in the Upper Eccles Canyon Vicinity	AERC
U81BC0950	Husky Oil Brooks Fed. 9-33 Road Upgrade	BYU - Office Of Public Archaeology (BYU-OPA)
U81BC0951	Soldier Summit/Clear Creek Coastal Coal Mine Tap	BYU-OPA
U82BC0838	Husky Oil Brooks Fed. 6-35 Road and Drill Site	BYU-OPA
U84AF0474	Four Proposed Coal Exploration Wells/Winter Quarters Ridge	AERC
U84AK0060	Cultural Resources Inventory near Clear Creek for Valley Camp of Utah	Archaeological Research Consultants
U84DF0396	Hist Coal Mining in Bear Canyon, Scofield, and along Gordon Creek	Desert West
U88AF0323	Mine Portal Breakout in Eccles Canyon	AERC
U89DH0594	Mainline #41 Reroute: Questar Skyline Mine	Dames and Moore
U90AF0463	Conveyor Corridor in Eccles Canyon	AERC
U90AF0480	3 Wells & Access-Winter Quarters Canyon/Granger Ridge	AERC
U90AF0488	Conveyor Corridor--Eccles Canyon--No. 2	AERC
U90FS0451	Addendum Questar Pipeline Main Line #41	USFS
U90FS0452	Addendum Questar Pipeline Main Line	USFS
U92AF0380	Two Seismic Lines in the Skyline Lease Area	AERC
U92FS0240	Eccles Sheep and Goat Allotment Spring Development	USFS
U93FS0404	1993 Price District Spring Developments	USFS
U93FS0426	Burnout Gate & Pontown/Paradise Structures	USFS
U94FS0347	Price District Water Trough and Guzzlers	USFS
U94FS0452	Huntington Canyon Interpretive Sites	USFS

TABLE 1 PREVIOUS CULTURAL RESOURCES PROJECTS WITHIN 1 MILE OF THE PROJECT		
State Project No.	**Report Title**	**Organization**
U95AF0252	Drill/Seismic Investigations-Upper Huntington & Winterquarters CB/EM/SP	AERC
U95FS0577	CRI of 8 Communication Sites	USFS
U96AF0524	Winter Quarters Canyon Drill Holes & Access Routes	AERC
U97AF0422	2 Drill Holes & Access in Upper Huntington Canyon	AERC
U97AF0586	Maxon Technologies Skyline Mine Drill Holes	AERC
U97SC0457	Anschutz Access	Senco-Phenix
U99MM0366	Ruby Pipeline	Metcalf Archaeological Consultants
U99SC0569	Skyline Mine Subsidence Area and Access Road	Senco-Phenix
U99ST0355	Questar Main Line 104 Pipeline 40/41 Loop	SWCA
U00ST0740	Williams Pipeline	SWCA
U01EP0728	Upgrade of the Powerline Near Boardinghouse Canyon For Skyline Coal	Earth Touch
U01FS0580	Boardinghouse Canyon Gas Well Access Road	USFS
U01FS0581	Boardinghouse Canyon Coal Subsidence Reclam.	USFS
U01MQ0458	Talon Scofield Coal Mine Survey	Montgomery Archaeological Consultants (MOAC)
U01MQ0459	Canyon Fuels Flat Canyon Coal Inventory	MOAC
U01MQ0543	Canyon Fuels James Canyon Drill Location	MOAC
U02EP0409	Winter Quarters	Earth Touch
U02FS0480	Water Measuring Device Cleveland Reservoir Telemetry Station Electric Lake	USFS
U03EP0760	Three drill locations for winter quarters SUFCO mine	Earth Touch
U05EP0710	Winter Quarters Drilling	Earth Touch
U05FS1530	West Scofield	USFS
U06EP0818	Winter Quarters 2006 Drilling	Earth Touch
U06EP1857	Woods Canyon 2007 Drilling	Earth Touch
U09EP0054	Woods Canyon Drilling - Skyline	Earth Touch

GENERAL LAND OFFICE MAPS REVIEW AND FIELD INVESTIGATION

As part of the records search, a search of the General Land Office (GLO) survey plats available at the BLM Internet public access site (www.ut.blm.gov/ LandRecords/search_plats.cfm) was conducted on July 15, 2014. All available GLO maps for the Project area were reviewed for the presence of historic features and transportation routes (GLO 1883a, 1883b, 1894, 1896, 1938, and 1939). The purpose of these record searches was to identify potential historic resources (e.g., features, transportation routes, and telecommunications lines) that could be encountered during the field inventory. The review identified no historic resources located in the Project area.

METHODOLOGY

Intensive-level (Class III) cultural resources inventories were completed for 245 acres (99.15 hectares) of USFS (Manti-La Sal National Forest) administered property in Carbon and Emery Counties, Utah, centered roughly on the Skyline Mine, west of the community of Scofield, Utah.

The Project area was identified using a differentially correctable Trimble GeoXT GeoExplorer 2008 Series handheld global positioning system (GPS) unit in conjunction with aerial photographs, topographic landforms, access roads, and Project maps as points of reference.

The Class III pedestrian survey was completed by two archaeologists walking parallel transects spaced no more than 15 meters (50 feet) apart. Ground surface visibility was at or near 100 percent over the entire Project area.

For the purposes of this inventory, the criteria set forth in the BLM Guidelines (BLM 2002:6) were used to define sites and isolated occurrences (IOs). A site was defined as 10 or more artifacts representing a single artifact class in a 30-foot (10-meter) area, or at least 15 artifacts representing two artifact classes in a 30-foot (10-meter) area, that date prior to 1964. IOs were defined as a group of nine or fewer artifacts located in a 30-foot (10-meter) area and dating prior to 1964.

All archaeological sites more than 50 years old encountered during the inventory were documented on Intermountain Antiquities Computer System site forms (IMACS 1992). Pursuant to Utah SHPO guidelines, all sites were photographed using color digital photography. Photographs were taken of diagnostic artifacts, cultural features, and site overviews. Cultural resources site boundaries, cultural features, and notable natural topographic features were mapped.

Recordation of IOs included the collection of Universal Transverse Mercator (UTM) coordinates, a brief description of any defining attributes or characteristics, and a description of any distinguishing trademarks. IOs also were photographed to aid in further analysis.

All site and isolate locations were documented in the field with a differentially correctable Trimble GeoXT, GeoExplorer 2008 Series GPS unit using North American Datum, 1983 (NAD83) coordinates. After differential correction and plotting, the data is presented in units based on NAD83. GPS data were post-processed using GPS Pathfinder Office version 5.30 software. Maps were created by projecting sites onto geo-referenced 7.5 minute USGS quadrangle maps using ESRI ArcGIS 10 software.

National Register of Historic Places Evaluation Criteria

Cultural resources include archaeological, historical, or architectural sites, districts, buildings, structures, places, and objects. The significance of a cultural resource depends on whether or not it contains data, or the potential for data, of importance to either current archaeological method and theory or regional prehistory or history. Sites are evaluated by applying the criteria outlined in 36 Code of Federal Regulations (CFR) 60.4, which states:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> (A) are associated with events that have made a significant contribution to the broad patterns of our history; or

(B) are associated with the lives of persons significant in our past; or

(C) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) have yielded, or may be likely to yield, information important in prehistory or history.

Recommendations regarding site eligibility for the NRHP were made based on retention of historic integrity and the four criteria outlined above. Based on experience and professional judgment, sites found not to retain integrity and/or meet these criteria are recommended not eligible for the NRHP. Those sites found to retain integrity and meet one or more of the four criteria, as set forth in 36 CFR 60.4, are recommended eligible for the NRHP. Individual site NRHP recommendations, based on the four criteria, are provided in the site discussion.

INVENTORY RESULTS AND RECOMMENDATIONS

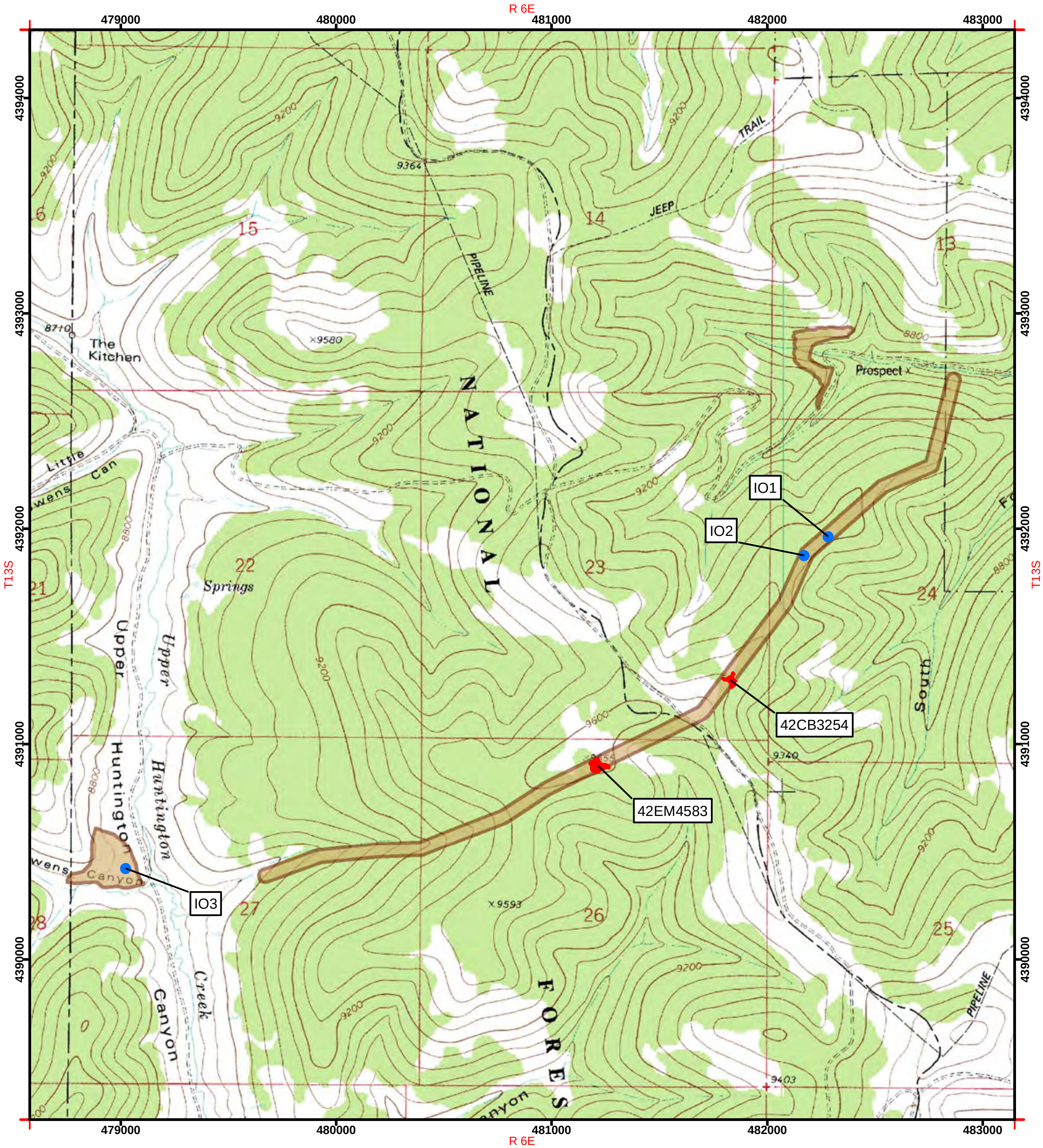
Class III cultural resources inventories were completed for the Project by EPG archaeologists Andy Yentsch and John Curl on August 7, 2014; and by Andy Yentsch and Suzy Eskenazi on September 29, 2014. The purpose of the cultural resources inventories was to locate, record, and assess the significance of all cultural resources located in the Project area. Three new cultural resources sites (42CB3253, 42CB3254, and 42EM4583) and five IOs were encountered and documented during the pedestrian surveys completed for the Project (Figures 3-1 and 3-2).

Isolated Occurrences

Five IOs (IO1 through IO5) were identified, documented, and mapped *in situ* during the pedestrian surveys (Table 2; Figures 3-1 and 3-2). These items do not meet the standards for a site as defined in the *Guidelines for Identifying Cultural Resources* (BLM 2002:6). Recordation consisted of a description of the items, including type and measurements, and photographs were taken. Object locations were mapped based on UTM data gathered using a differentially correctable Trimble GeoXT, GeoExplorer GPS unit, and the items comprising IO3 were left *in situ.*

TABLE 2
ISOLATED OCCURRENCES RECORDED IN THE PROJECT AREA

Isolate Number	Description	UTM Easting	UTM Northing
IO1	Single dendroglyph/aspen carving dating 1911.	482284	4391963
IO2	Single dendroglyph/aspen carving dating 1911.	482172	4391874
IO3	Three (3) chert interior core reduction flakes in a 5 meter area.	479021	4390423
IO4	Single dendroglyph/aspen carving dating 1898.	480138	4398661
IO5	Single dendroglyph/aspen carving dating to the 1940s.	480180	4398606



Legend

Project Reference

Isolate	Location of Areas Surveyed
Cultural Site	Location of Areas Not Surveyed Access Denied

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Scofield

1:24,000

UTM 12 North

North American 1983

FIGURE 3-2 - Location of Recorded Historic Properties and Isolates

BOWIE RESOURCES - SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT

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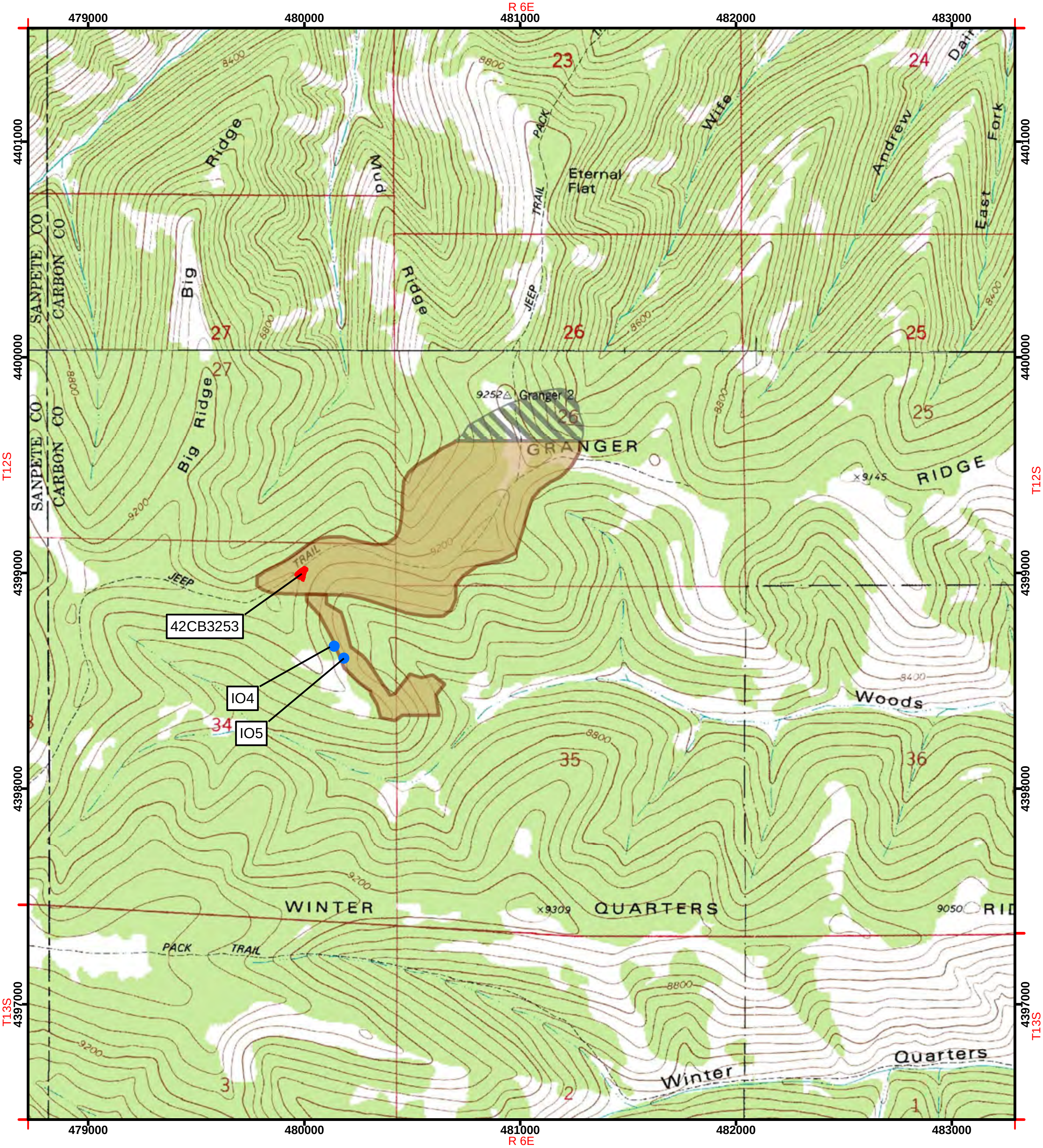

Legend

Project Reference

- Isolate
- Cultural Site
- Location of Areas Surveyed
- Location of Areas Not Surveyed Access Denied

0 100 200 400 600 800 1,000 Meters

0 300 600 1,200 1,800 2,400 3,000 Feet

USGS Quadrangle: Scofield Reservoir; Scofield

1:24,000

UTM 12 North

North American 1983

FIGURE 3-1 - Location of Recorded Historic Properties and Isolates

BOWIE RESOURCES - SKYLINE MINE EXPANSION AND TRANSMISSION LINE CONSTRUCTION PROJECT

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IO1

IO1 consists of a single culturally modified tree (CMT). This tree displays three illegible initials and the date “1911”. The tree measures 135 centimeters in circumference. The inscription measures 32.3 centimeters high and 36.1 centimeters wide. Other, out-of period inscriptions occur on trees in the immediate area.

Photograph 1 Close up of IO1, a single Aspen carving with the date “1911.” Initials not really legible. View is to the southwest.

IO2

IO1 consists of a single CMT. This tree displays three illegible initials and the date “Aug. 31, 1911.” The tree measures 201 centimeters in circumference. The inscription measures 28.2 centimeters high and 47.4 centimeters wide. Other, out-of period inscriptions occur on trees in the immediate area.

Photograph 2 Close up of IO2, a single Aspen carving with the date "Aug. 31, 1911." Initials not really legible. View is to the southwest.

IO3

IO3 consists of three pieces of white-and-brown mottled chert lithic debitage found on the north side of the mouth of Swen's Canyon. All three pieces represent interior core reduction flakes and were found within 5 meters of each other.

Photograph 3 Plan view of IO2, three chert flakes found in a 5-meter area.

IO4

IO4 consists of a single CMT. This tree displays the name “RH Jackson”, carved in print-form, and the date “1898”. The tree measures 141.5 centimeters in circumference. The inscription measures 46.2 centimeters high and 107.5 centimeters wide. No other inscriptions were observed in the immediate area.

Photograph 4 Close up of IO4, a single Aspen carving with the date "1898." View is to the southwest.

IO5

IO5 consists of a single CMT. This tree displays the name "Dale Allred", carved in script, and the date "194_". The last digit in the date is not legible. The tree measures 246.4 centimeters in circumference. The inscription measures 46.2 centimeters high and 82.3 centimeters wide. No other inscriptions were observed in the immediate area.

Photograph 5 Close up of IO5, a single Aspen carving with the date in the 1940s. The last digit in the date is not legible. View is to the southwest.

Cultural Resources Sites

Three new cultural resources sites (42CB3253, 42CB3254, and 42EM4583) were encountered during the present inventory (Table 3 and Figures 3-1 and 3-2), all of which represent clusters of CMTs/aspen carvings. All encountered sites were evaluated for NRHP eligibility. None of the sites are recommended eligible for the NRHP. As such, the present Project will have no adverse effect on the sites and no further action will be needed. Site documentation, including IMACS site forms, photographs, site location maps, site sketch maps, and encoding forms are provided in Appendix A.

TABLE 3
CULTURAL RESOURCES SITES IDENTIFIED

Smithsonian Number	Site Type	NRHP Recommendation	Recordation Type
42CB3253	CMT/aspen carvings	Not eligible	New
42CB3254	CMT/aspen carvings	Not eligible	New
42EM4583	CMT/aspen carvings	Not eligible	New

42CB3253

Site Type:	CMTs/aspen carvings
Cultural/Temporal Affiliation:	1908-1963
Site Dimensions:	65 by 55 m (3,575 m^2)
NRHP Recommendation:	Not eligible

Site Description

Site 42CB3253 consists of an historic sheep camp and several CMTs/aspen tree carvings on a relatively flat, but northeast-trending ridgeline on the south side of Granger Ridge. A well-used bladed road runs through the northern periphery of the site. The site measures 65 m (N-S) by 55 m (E-W). The site consists of one thermal feature (F1), and both historic and modern CMTs located in a large aspen grove on the east-southeast side of a northeast-trending road. Nine in-period inscriptions were noted on eight aspen trees dating between 1908 and 1963. Historic inscriptions consist of individual names, initials, and/or a date. Out-of-period and modern carvings and graffiti were observed on approximately 14 trees. No artifacts were observed. It is unknown whether or not the thermal feature is associated with historic or modern camping activities in the area.

Site Interpretation

Site 42CB3253 represents a seasonal campsite/rest area used by sheep-herders while moving their herds from one area to another during the course of the year. Documented inscriptions demonstrate use of the area between 1908 and 1963 and to the present.

National Register Recommendation

Site 42CB3253 contains several historic and modern CMTs/aspen tree carvings. Although interesting, the carvings consist entirely of names and dates; no artistic images are present. The names represented in the aspen art are not known to be associated with historically significant people in the region. Although the series of carvings demonstrate multiple uses of this location for over 100 years, this site is not likely to provide additional data important to furthering the understanding of the historic occupation of the region. Therefore, site 42CB3253 is recommended not eligible for the NRHP.

42CB3254

Site Type:	CMTs/aspen carvings
Cultural/Temporal Affiliation:	1900-1954
Site Dimensions:	75 by 71 m (5,325 m^2)
NRHP Recommendation:	Not eligible

Site Description

Site 42CB3254 consists of several dendroglyphs/ aspen tree carvings on a relatively flat, but southwest-trending ridgeline northeast of the Trough Springs Ridge Road. The site measures 75 m (N-S) by 71 m (E-W). The site consists of both historic and modern CMTs. Fourteen in-period inscriptions were noted on 12 aspen trees dating between 1900 and 1954. Historic inscriptions consist of individual names, initials, and/or a date. Out-of-period and modern carvings and graffiti were observed on approximately 10 trees. No artifacts, sediment staining, or features were observed.

Site Interpretation

Site 42CB3254 represents a seasonal campsite/rest area used by sheep-herders while moving their herds from one area to another during the course of the year. Documented inscriptions demonstrate use of the area between 1900 and 1954 and to the present.

National Register Recommendation

Site 42CB3254 contains several historic and modern CMTs/aspen tree carvings. Although interesting, the carvings consist entirely of names and dates; no artistic images are present. The names represented in the aspen art are not known to be associated with historically significant people in the region. Although the series of carvings demonstrate multiple uses of this location for over 100 years, this site is not likely to provide additional data important to furthering the understanding of the historic occupation of the region. Therefore, site 42CB3254 is recommended not eligible for the NRHP.

42EM4583

Site Type:	CMTs/aspen carvings
Cultural/Temporal Affiliation:	1896-1955
Site Dimensions:	75 by 91 m (6,825 m^2)
NRHP Recommendation:	Not eligible

Site Description

Site 42EM4583 consists of several dendroglyphs/aspen tree carvings on a relatively flat, but southwest-trending ridgeline southwest of the Trough Springs Ridge Road. The site measures 75 m (N-S) by 91 m (E-W). The site consists of both historic and modern CMTs. Eight in-period inscriptions were noted on eight aspen trees dating between 1896 and 1955. Historic inscriptions consist of individual names, initials, and/or a date. Out-of-period and modern carvings and graffiti were observed on approximately 30 trees in the area. No artifacts, sediment staining, or features were observed.

Site Interpretation

Site 42EM4583 represents a seasonal campsite/rest area used by sheep-herders while moving their herds from one area to another during the course of the year. Documented inscriptions demonstrate use of the area between 1896 and 1955 and to the present.

National Register Recommendation

Site 42EM4583 contains several historic and modern CMTs/aspen tree carvings. Although interesting, the carvings consist entirely of names and dates; no artistic images are present. The names represented in the aspen art are not known to be associated with historically significant people in the region. Although the series of carvings demonstrate multiple uses of this location for over 100 years, this site is not likely to provide additional data important to furthering the understanding of the historic occupation of the region. Therefore, site 42EM4583 is recommended not eligible for the NRHP.

PROJECT SUMMARY

This report has been completed to provide cultural resources clearance for the potential Skyline Mine Expansion and Transmission Line Project in Carbon and Emery Counties, Utah. A total of 245 acres (99.15 hectares) were surveyed for this Project, resulting in the identification of three new cultural resources sites (42CB3253, 42CB3254, and 42EM4583), as well as five isolates (IO1 through IO5). The sites were thoroughly documented and evaluated for eligibility for inclusion in the NRHP. None of the sites are recommended eligible for inclusion in the NRHP. Therefore, the Project will have no adverse effect on those sites. Ultimately, clearance to proceed with the proposed mine expansion and transmission line construction discussed here is subject to agency review of this cultural resources evaluation by the USFS.

These investigations were conducted using techniques considered to be adequate for evaluating cultural resources available for visual inspection, and which could be adversely affected by the Project. However, should additional cultural resources be discovered during the course of construction activities, a report should be made immediately to the lead archaeologist at the appropriate land-management agency.

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1883a [Map for T12S, R6E] Located at the Bureau of Land Management, Salt Lake District Office, Salt Lake City.

1883b [Map for T13S, R6E] Located at the Bureau of Land Management, Salt Lake District Office, Salt Lake City.

1894 [Map for T13S, R6E] Located at the Bureau of Land Management, Salt Lake District Office, Salt Lake City.

1896 [Map for T12S, R6E] Located at the Bureau of Land Management, Salt Lake District Office, Salt Lake City.

1938 [Map for T13S, R6E] Located at the Bureau of Land Management, Salt Lake District Office, Salt Lake City.

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Vegetation of the Powerline Corridor & Swens Canyon Pad

2014

Skyline Mine
Carbon County, Utah

Upper Huntington Creek

Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
P.O. Box 337
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

CANYON FUEL COMPANY, LLC.
Skyline Mines
HC 35 Box 380
Helper, Utah 84526

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INTRODUCTION

Canyon Fuel Company has designed and plans to construct an overland powerline that is approximately 2.6-miles long at the Skyline Mine. The powerline will provide power for mining operations as they move in the southwest direction. The powerline will begin at the mine's facilities area and terminate at Swens Canyon where a pad will be constructed. The pad has been engineered to construct a 16-ft ventilation shaft to provide an exhaust source for the mining operations as well as a 6-ft escape shaft for an evacuation route in case of an emergency.

The proposed new construction will necessitate disturbances to the existing vegetation. This report describes those plant communities that could be impacted and provides qualitative and quantitative data from sampling within them. It also provides data from reference areas that could be used for future revegetation success standards at the time of final reclamation. Lastly, a list of potential threatened, endangered, candidate and sensitive plant species known to occur in the general area has been provided including the potential impacts that could occur from proposed construction activities at Skyline Mine.

METHODS

Quantitative Sampling

Methodologies used for this study were performed in accordance with the vegetation guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM). Quantitative and qualitative data were recorded within the plant communities proposed for disturbance along with their respective reference areas in the growing season of 2014.

Sample Location Placement

Sample locations to record quantitative data were placed on the entire length of the proposed powerline at regular intervals. At each sample site, a random number was used to place the sample quadrats. For the Swens Canyon Pad and reference areas, random transects were first placed in the sample areas. From these transect lines, sample locations were chosen using random numbers on both sides and at right angles to them.

Cover, Frequency & Composition

Cover estimates were made employing ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Plant nomenclature follows *A Utah Flora* (Welsh et al. 2008).

Density

Density estimates for the woody plant species on the proposed disturbed and reference areas were made using a distance method called the point-quarter technique. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

Sample Adequacy

Sample adequacy for cover and density was attempted using the following formula.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Threatened, Endangered, Candidate & Sensitive Species

Inventories of federally listed threatened, endangered and candidate plant species for Carbon and Emery Counties, Utah were consulted prior to field work in the study areas. Additionally, the State of Utah, Department of Natural Resources' biodiversity database was also consulted with regard to threatened, endangered or otherwise sensitive Species (TES) in the area. Finally, the USDA Forest Service Intermountain Region's list of proposed, endangered, threatened and sensitive species for the Manti-LaSal National Forest was consulted for possible impacts to such taxa by the proposed project. When applicable, these information sources would be used to drive sensitive species field surveys if any such species or habitats were known to be at or near the proposed new projects.

Photographs & Study Area Maps

Color photographs were taken of the sample areas and have been included in this report. A map showing the study areas has also been prepared and included herein.

RESULTS

Powerline Corridor

Aspen/Grass (Proposed Disturbed)

Most of the Powerline Corridor was comprised of Aspen/Grass communities. That is, vegetation of the corridor included stands of quaking aspen trees surrounded by more open areas dominated by grasses and forbs. Sample locations were placed along the entire Powerline Corridor and therefore included aspen-dominated stands, grass/forb open areas, and transition zones between the two.

Figure 1: Aspen/Grass Community (Proposed Disturbed)

When the data were combined and summarized, the dominant overstory species by quite a large margin, was quaking aspen (*Populus tremuloides*) and was followed by subalpine fir (*Abies lasiocarpa*). The dominant understory species consisted of mountain brome (*Bromus carinatus*), bluebunch wheatgrass (*Elymus spicatus*), quaking aspen, Sandberg's bluegrass (*Poa secunda*) and slender wheatgrass (*Elymus trachycaulus*). For a list of all species encountered in the sample quadrats, refer to Table 1.

Total living cover of the proposed disturbed Aspen/Grass community was estimated at 82.40%, of which 25.00% was overstory and 57.40% was understory cover (Table 2-A). The understory composition was comprised of 46.66% grasses, 30.07% forbs and 22.78%

trees/shrubs (Table 2-B).

Total woody species density was relatively low at 81 individuals per acre; the dominants here were quaking aspen, subalpine fir, and red elderberry (*Sambucus racemosa*). For the complete list of woody species density values by species along the corridor refer to Table 3.

Aspen/Grass (Reference Area)

The community chosen to represent future revegetation success standards was located in the vicinity of that which has been proposed for disturbance. Called the Aspen/Grass Reference Area, this community's overstory, at least in the sample quadrats, was comprised of only quaking aspen. The understory dominants consisted of mountain brome, Sandberg's bluegrass and slender wheatgrass (Table 4).

Figure 2: Aspen/Grass Community (Reference Area)

Total living cover in this area was estimated at 80.33%; of that total, overstory and understory cover were estimated at 23.17% and 57.17%, respectively (Table 5-A). The composition of the understory here was comprised of 62.39% grasses, 23.07% forbs and 14.54% trees/shrubs (Table 5-B).

Like the community it was chosen to represent for final revegetation success standards, this area also had relatively few woody species per acre. The total woody species density was estimated at 68 plants per acre and consisted of quaking aspen and red elderberry (Table 6).

Conifer (Proposed Disturbed)

Distinct from most of the corridor topography, a relatively small portion of it dropped into Eccles Canyon on a north-facing slope. Consequently, the plant community here was comprised of a coniferous forest. Many of the conifer trees, however, have been greatly impacted (killed, but left standing) by bark beetles.

Figure 3: Conifer Community (Proposed Disturbed)

The most common overstory species in the Conifer community along the corridor were white fir, subalpine fir and Douglas fir (*Pseudotsuga menziesii*). The dominant understory woody species in the area were aspen, wild raspberry (*Rubus idaeus*) and gooseberry current (*Ribes montigenum*); common forbs consisted of saw groundsel (*Senecio serra*) and spurred lupine (*Lupinus caudatus*); the grasses in the area included bluebunch wheatgrass and mountain brome (Table 7).

Total overstory cover in the forest was 34.50%, whereas understory was estimated at 46.50%. The total living cover of these values combined was 81.00% (Table 8-A). The understory composition was comprised of 41.67% trees/shrubs, 39.17% grasses and 19.17% forbs (Table 8-B).

The total woody species density of the area was 417 individuals/acre. The dominant species here was white fir and was estimated at 104 individuals; the remaining species were relatively close in number (Table 9).

Conifer (Spruce Reference Area)

The Skyline Mine has an existing reference area in the conifers that is located relatively close to the conifer area of the proposed Pipeline Corridor. Additionally, the aspect, slope angle, soils and beetle impact were nearly identical to the proposed new disturbed area. The existing reference area, called the Spruce Reference Area, was last sampled by biologists from *Mt. Nebo Scientific* in 2011 using the same methodologies as those in 2014.


Figure 4: Conifer Community (Spruce Reference Area)

The overstory for this area was comprised of Engelmann spruce (*Picea engelmannii*) and white fir. Understory woody species was dominated by Rocky Mountain ash (*Sorbus scopulina*), sticky current (*Ribes viscosissimum*) and golden current (*R. aureum*). Most common forbs in the area consisted of saw groundsel, Lanszwert's sweetpea (*Lathyrus lanszwertii*) and stinging nettle (*Urtica dioica*). Finally, the most common grasses for the area were mountain brome and tall oatgrass (*Arrhenatherum elatius*). For a list of all species encountered in the Spruce Reference Area, refer to Table 10.

The total living cover of this reference area was estimated at 84.50%, with 12.50% coming from overstory and 72.00% from understory cover (Table 11-A). Composition of the understory was comprised of 45.40% grasses, 36.62% trees/shrubs and 17.98% forbs (Table 11-B). Woody species density values were not estimated in 2011.

Swens Canyon Pad

<u>Sagebrush /Grass (Proposed Disturbed)</u>

The proposed disturbed plant community for the Swens Canyon Pad will be restricted to that of a Sagebrush/Grass community. The most common plants in the community by a relatively wide margin were mountain sagebrush (*Artemisia tridentata* var. *vaseyana*) and Sandberg's bluegrass (*Poa secunda*), followed by bluebunch wheatgrass, beard-tongue (*Penstemon* sp.), slender wheatgrass and cushion buckwheat (*Eriogonum ovalifolium*). For a complete list of the plant species present along with their cover and frequency values, refer to Table 12.

Figure 5: Sagebrush/Grass Community (Proposed Disturbed)

Total living cover of the proposed disturbed Sagebrush/Grass community was estimated at 69.83% (Table 13-A). This cover was comprised of 45.06% grasses, 40.74% shrubs and 14.19% forbs (Table 13-B).

Woody species density totaled 6,666 individuals per acre which consisted of mostly mountain sagebrush (Table 14).

Sagebrush/Grass (Reference Area)

A comparable area was sampled near the pad site to represent future revegetation standards. Similar to the proposed disturbed community described above, this community was dominated by mountain sagebrush, Sandberg's bluegrass, bluebunch wheatgrass and beard-tongue (Table 15).

Figure 6: Sagebrush/Grass Community (Reference Area)

The total living cover of the Sagbrush/Grass Reference Area was estimated at 70.50% Table 16-A). The composition here was 44.35% grasses, 39.06% shrubs and 16.59% forbs (Table 16-B).

The total woody species density was estimated to be 7,290 individuals per acre and was exclusively mountain sagebrush (Table 17).

The summary tables referenced above are found on the following pages. Subsequent to the summary tables, the following information has been provided:

- Statistical comparisons data sets,
- An analysis of the threatened, endangered, candidate & sensitive species in the area,
- A final Summary & Discussion of the report,
- Color photographs of the sample areas.
- A map of the study areas.

Data Summary Tables

Table 1: Skyline Mine. Total cover, standard deviation and frequency by species (2014).

POWERLINE CORRIDOR

Aspen/Grass (Proposed Disturbed) n=50

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Abies lasiocarpa	3.10	11.70	8.00
Picea pungens	0.60	4.20	2.00
Populus tremuloides	20.70	21.19	58.00
Pseudotsuga menziesii	0.60	4.20	2.00
UNDERSTORY			
TREES/SHRUBS			
Abies lasiocarpa	3.20	12.44	8.00
Picea pungens	0.50	3.50	2.00
Populus tremuloides	4.20	7.51	26.00
Pseudotsuga menziesii	0.60	4.20	2.00
Ribes viscosissimum	0.10	0.70	2.00
Sambucus racemosa	2.20	6.65	12.00
FORBS			
Achillea millefolium	2.40	5.50	18.00
Capsella bursa-pastoris	0.50	3.50	2.00
Carduus nutans	1.50	8.14	4.00
Cymopteris sp.	0.20	1.40	2.00
Eriogonum sp.	0.30	1.55	4.00
Galium bifolium	0.10	0.70	2.00
Helianthella uniflora	2.20	5.11	18.00
Lathyrus lanszwertii	3.60	7.00	32.00
Rudbeckia occidentalis	6.60	14.23	24.00
Senecio serra	0.30	1.55	4.00
Thalictrum fendleri	0.40	1.69	4.00
GRASSES			
Bromus carinatus	11.40	14.63	50.00
Carex geyeri	0.20	1.40	2.00
Elymus lanceolatus	0.20	1.40	2.00
Elymus spicatus	9.00	18.19	12.00
Elymus trachycaulus	3.10	6.92	20.00
Poa pratensis	1.20	4.75	8.00
Poa secunda	3.20	11.08	18.00

Table 2: Skyline Mine. Total Cover and composition (2014).

POWERLINE CORRIDOR

Aspen/Grass (Proposed Disturbed) n=50

	Mean Percent	Standard Deviation
A. TOTAL COVER		
Overstory Cover (o)	25.00	20.86
Understory Cover (u)	57.40	17.12
Litter	18.74	15.21
Bareground	21.40	18.78
Rock	2.46	9.89
Total Living Cover (o+u)	82.40	17.30
B. % COMPOSITION		
Trees/Shrubs	22.78	29.79
Forbs	30.07	28.82
Grasses	46.66	30.50

Table 3: Skyline Mine. Woody Species Density (2014).

POWERLINE CORRIDOR

Aspen/Grass (Proposed Disturbed) n=50

SPECIES	Number/Acre
Abies concolor	3.23
Abies lasiocarpa	9.29
Populus tremuloides	56.12
Pseudotsuga menziesii	2.83
Ribes viscosissimum	2.02
Sambucus racemosa	7.27
TOTAL	**80.75**

Table 4: Skyline Mine. Total cover, standard deviation and frequency by species (2014).

POWERLINE CORRIDOR

Aspen/Grass (Reference Area) n=30

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Populus tremuloides	23.17	23.43	56.67
UNDERSTORY			
TREES/SHRUBS			
Populus tremuloides	3.50	11.19	10.00
Sambucus racemosa	2.50	7.72	16.67
FORBS			
Achillea millefolium	2.00	5.26	13.33
Cymopteris sp.	0.67	1.70	13.33
Helianthella uniflora	5.17	6.77	46.67
Lathyrus lanszwertii	1.33	2.87	20.00
Orthocarpus tolmiei	0.33	1.80	3.33
Rudbeckia occidentalis	2.83	7.38	13.33
Taraxacum officinalis	0.67	2.13	10.00
Viguiera multiflora	1.00	2.38	16.67
GRASSES			
Bromus carinatus	18.17	17.39	63.33
Elymus lanceolatus	0.17	0.90	3.33
Elymus spicatus	1.50	6.47	6.67
Elymus trachycaulus	8.17	11.65	40.00
Poa secunda	9.17	18.12	16.67

Table 5: Skyline Mine. Total Cover and composition (2014).

POWERLINE CORRIDOR Aspen/Grass (Reference Area)		n=30
	Mean Percent	**Standard Deviation**
A. TOTAL COVER		
Overstory Cover (o)	23.17	23.43
Understory Cover (u)	57.17	17.50
Litter	13.80	5.76
Bareground	25.23	18.88
Rock	3.80	2.79
Total Living Cover (o+u)	80.33	15.65
B. % COMPOSITION		
Trees/Shrubs	14.54	31.53
Forbs	23.07	19.96
Grasses	62.39	29.26

Table 6: Skyline Mine. Woody Species Density (2014).

POWERLINE CORRIDOR Aspen/Grass (Reference Area)	n=30
SPECIES	**Number/Acre**
Populus tremuloides	61.54
Sambucus racemosa	6.84
TOTAL	**68.38**

Table 7: Skyline Mine. Total cover, standard deviation and frequency by species (2014).

POWERLINE CORRIDOR

Conifer (Proposed Disturbed) n=10

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Abies concolor	13.00	24.41	30.00
Abies lasiocarpa	9.00	18.14	20.00
Populus tremuloides	10.00	20.00	10.00
Pseudotsuga menziesii	2.50	5.12	20.00
UNDERSTORY			
TREES/SHRUBS			
Abies concolor	2.00	6.00	10.00
Abies lasiocarpa	1.00	3.00	10.00
Populus tremuloides	4.00	12.00	10.00
Pseudotsuga menziesii	2.00	6.00	10.00
Ribes montigenum	4.00	12.00	10.00
Ribes viscosissimum	0.50	1.50	10.00
Rubus idaeus	4.00	12.00	10.00
Sambucus racemosa	2.50	7.50	10.00
FORBS			
Lathyrus lanszwertii	0.50	1.50	10.00
Lupinus caudatus	2.50	7.50	10.00
Senecio serra	6.00	9.95	30.00
GRASSES			
Bromus carinatus	3.00	9.00	10.00
Elymus spicatus	14.50	21.15	50.00

Table 8: Skyline Mine. Total Cover and composition (2014).

POWERLINE CORRIDOR
Conifer (Proposed Disturbed) n=10

	Mean Percent	Standard Deviation
A. TOTAL COVER		
Overstory Cover (o)	34.50	22.74
Understory Cover (u)	46.50	19.11
Litter	39.50	21.50
Bareground	9.80	11.88
Rock	4.20	1.60
Total Living Cover (o+u)	81.00	10.44
B. % COMPOSITION		
Trees/Shrubs	41.67	40.31
Forbs	19.17	27.40
Grasses	39.17	40.15

Table 9: Skyline Mine. Woody Species Density (2014).

POWERLINE CORRIDOR
Conifer (Proposed Disturbed) n=10

SPECIES	Number/Acre
Abies concolor	104.30
Abies lasiocarpa	41.72
Populus tremuloides	73.01
Pseudotsuga menziesii	20.86
Ribes montigenum	73.01
Ribes viscosissimum	20.86
Rubus idaeus	31.29
Sambucus racemosa	52.15
TOTAL	**417.21**

Table 10: Skyline Mine. Total cover, standard deviation and frequency by species (2011).

POWERLINE CORRIDOR

Conifer (Spruce Reference Area) n=20

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Picea engelmannii	8.75	22.41	20.00
Abies concolor	3.75	11.28	10.00
UNDERSTORY			
SHRUBS			
Picea engelmannii	1.50	4.50	10.00
Ribes cereum	4.75	7.15	35.00
Ribes viscosissimum	7.75	9.68	45.00
Sorbus scopulina	7.75	14.01	25.00
Symphoricarpos oreophilus	2.00	6.00	10.00
FORBS			
Achillea millefolium	0.50	2.18	5.00
Fragaria vesca	1.00	4.36	5.00
Helianthella uniflora	1.25	3.11	15.00
Lathyrus lanszwertii	2.50	7.50	10.00
Osmorhiza depauperata	1.50	3.57	15.00
Rudbeckia occidentalis	1.00	3.00	10.00
Senecio serra	2.75	5.80	20.00
Urtica dioica	2.25	4.60	20.00
GRASSES			
Arrhenatherum elatius	13.00	24.97	40.00
Bromus anamolus	15.50	18.02	70.00
Bromus carinatus	1.00	3.00	10.00
Festuca sp.	0.50	2.18	5.00
Poa fendleriana	4.50	19.62	5.00
Poa pratensis	1.00	3.00	10.00

Table 11: Skyline Mine. Total cover and composition (2011).

POWERLINE CORRIDOR

Conifer (Spruce Reference Area) n=20

	Mean Percent	**Standard Deviation**
A. TOTAL COVER		
Overstory Cover (o)	12.50	23.74
Understory Cover (u)	72.00	17.06
Litter	19.05	14.36
Bareground	4.60	1.43
Rock	4.35	5.74
Total Living Cover (o+u)	84.50	16.58
B. % COMPOSITION		
Trees/Shrubs	36.62	25.33
Forbs	17.98	13.47
Grasses	45.40	28.33

Table 12: Skyline Mine. Total cover, standard deviation and frequency by species (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Proposed Disturbed) n=30

	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
Artemisia tridentata vaseyana	26.50	14.15	93.33
Chrysothamnus nauseosus	1.83	5.24	13.33
Mahonia repens	0.67	3.59	3.33
FORBS			
Achillea millefolium	0.33	1.80	3.33
Antennaria parvifolia	0.33	1.80	3.33
Chaenactis douglasii	0.17	0.90	3.33
Erigeron sp.	0.67	3.59	3.33
Eriogonum ovalifolium	3.17	8.21	13.33
Lathyrus lanszwertii	0.83	2.27	13.33
Leptodactylon pungens	0.50	2.69	3.33
Penstemon sp.	3.67	9.03	20.00
GRASSES			
Bromus carinatus	0.67	2.49	6.67
Elymus spicatus	8.50	13.67	43.33
Elymus trachycaulus	3.50	7.87	20.00
Poa secunda	18.50	15.87	73.33

Table 13: Skyline Mine. Total Cover and composition (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Proposed Disturbed)

n=30

	Mean Percent	Standard Deviation
A. TOTAL COVER		
Total Living Cover	69.83	11.14
Litter	15.30	8.10
Bareground	8.07	6.32
Rock	6.80	6.05
B. % COMPOSITION		
Shrubs	40.74	17.40
Forbs	14.19	17.34
Grasses	45.06	22.19

Table 14: Skyline Mine. Woody Species Density (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Proposed Disturbed) n=30

SPECIES	Number/Acre
Artemisia tridentata var. vaseyana	6333.05
Chrysothamnus nauseosus	333.32
TOTAL	**6666.37**

Table 15: Skyline Mine. Total cover, standard deviation and frequency by species (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Reference Area) n=30

	Mean Percent	Standard Deviation	Percent Frequency
SHRUBS			
Artemisia tridentata var. vaseyana	27.67	8.63	100.00
FORBS			
Achillea millefolium	1.67	5.06	10.00
Erigeron sp.	1.17	4.02	10.00
Eriogonum ovalifolium	0.33	1.80	3.33
Lathyrus lanszwertii	1.67	4.35	16.67
Penstemon sp.	6.00	8.10	36.67
Potentilla glandulosa	0.50	1.98	6.67
GRASSES			
Elymus spicatus	11.17	11.01	70.00
Elymus trachycaulus	4.00	7.12	26.67
Poa secunda	16.33	15.33	70.00

Table 16: Skyline Mine. Total Cover and composition (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Reference Area) n=30

	Mean Percent	**Standard Deviation**
A. TOTAL COVER		
Total Living Cover	70.50	8.10
Litter	15.40	7.67
Bareground	9.23	6.94
Rock	4.87	3.55
B. % COMPOSITION		
Shrubs	39.06	10.77
Forbs	16.59	15.98
Grasses	44.35	16.18

Table 17: Skyline Mine. Woody Species Density (2014).

Swens CANYON PAD SITE

Sagebrush/Grass (Reference Area) n=30

SPECIES	**Number/Acre**
Artemisia tridentata var. vaseyana	7289.99
TOTAL	7289.99

Statistical Analyses

Specific parameters for those plant communities that would be disturbed by the proposed construction activities were compared statistically with reference areas, or those areas that could be used for revegetation success standards following reclamation of the sites.

Powerline Corridor Comparisons

When total living cover of the proposed disturbed **Aspen/Grass** community was compared to the reference area, the difference was not statistically significant (Figure 7-A). Total woody species densities for these two communities were also compared statistically and the differences were again non-significant (Figure 7-B).

Figure 7. STUDENT'S T-TEST - Pipeline Corridor at the Skyline Mine. Total living cover and woody species density comparisons between the proposed disturbed and reference areas (2011 & 2014).

A. Total Living Cover

Aspen/Grass (Proposed Disturbed): $\bar{x}$=82.40; s=17.30; n=50
Aspen/Grass (Reference Area): $\bar{x}$=80.33; s=15.65; n=30
t =0.5365 ; df =78 ; SL= NS

Conifer (Proposed Disturbed): $\bar{x}$=81.00; s=10.44; n=10
Conifer (Reference Area): $\bar{x}$=84.50; s=16.58; n=20
t = 0.6071; df =28 ; SL= NS

B. Woody Species Density

Aspen/Grass (Proposed Disturbed): $\bar{x}$=80.75; s=165.76; n=50
Aspen/Grass (Reference Area): $\bar{x}$=68.38; s=39.98; n=30
t = 0.4009; df =78 ; SL= NS

Conifer (Proposed Disturbed): $\bar{x}$=417.21; s=499.33; n=10
Conifer (Reference Area): $\bar{x}$=n/a; s=n/a; n=n/a
t = n/a; df = n/a; SL= n/a

$\bar{x}$= sample mean
s = sample standard deviation
n = sample size
NS = non-significant
t = Student's t-value
df = degrees of freedom
SL = significance level
p = probability level
n/a = not applicable

When the proposed disturbed **Conifer** community total living cover value was compared with its reference area, the difference was not significant (Figure 7-A). Woody species density values were not available for the reference area data recorded in 2011, but judging from the other parameters, data and observations while sampling, there was little doubt that it would not be much different than the area proposed for disturbance within the corridor.

Swens Canyon Pad Comparisons

When the proposed disturbed **Sagebrush/Grass** community total living cover in Swens Canyon was compared to the reference area chosen, the difference was not statistically significant (Figure 8-A). Likewise, when the total woody species of the two communities were compared, once again the difference was non-significant statistically (Figure 8-B).

Figure 8. STUDENT'S T-TEST - Swens Canyon Pad at the Skyline Mine. Total living cover and woody species density comparisons between the proposed disturbed and reference areas (2014).

A. Total Living Cover

Sagebrush/Grass (Proposed Disturbed): $\bar{x}$=69.83; s=11.14; n=30
Sagebrush/Grass (Reference Area): $\bar{x}$=70.50; s=8.10; n=30
t = 0.2264; df =58 ; SL= NS

B. Woody Species Density

Sagebrush/Grass (Proposed Disturbed): $\bar{x}$=6666.37; s=1851.14; n=30
Sagebrush/Grass (Reference Area): $\bar{x}$=7289.99; s=1885.60; n=30
t = 1.2927; df =58 ; SL= NS

$\bar{x}$= sample mean
s = sample standard deviation
n = sample size
NS = non-significant
t = Student's t-value
df = degrees of freedom
SL = significance level
p = probability level

Threatened, Endangered, Candidate & Sensitive Species

Table 18 provides a list of potential threatened, endangered, candidate and sensitive plant species known to occur in Carbon County and Emery County as well as in the Manti-LaSal National Forest. The table also provides information about the likelihood of occurrence for each species in the proposed new construction sites at the Skyline Mine.

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012).
The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).

ENDANGERED		**SITE-SPECIFIC NOTES**
THREATENED		
Astragalus montii [3]	Heliotrope milkvetch	This endemic plant is known to occur in Utah only on the Flagstaff Limestone formation in Sanpete and Sevier Counties and usually near or above 11,000 ft. elevation. The project area is not within the above-mentioned Utah counties. The study area is well below the elevation range for this species, and Flagstaff Limestone does not occur in the study area. The proposed project will not impact this plant species.
Cycladenia humilis var. jonesii [2]	Jones cycladenia	Although once thought to be more narrowly distributed, this species has been recently collected in several new locations. That said, it is known to occur in desert shrub and juniper communities at elevations ranging from 4,400 ft to 6,000 ft and in geologic formations such as Cutler, Chinle and Summerville. The study area is generally higher in elevation than mentioned above and also has different plant communities and geologic formations. The proposed project will not impact this plant species.
Pediocactus despainii [2]	San Rafael cactus	This small cactus is known mostly in desert environments on gravels in shale, silts and clay substrates of Mancos Shale, Morrison, Carmel and Moenkopi formations

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012). The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).		
		(usually in the San Rafael Swell of Emery County, Utah). Also, experience by the author with field studies/collections of this species resulted in the opinion that there is little or no chance it would be present in the study area. The study area does not have the habitat for this species. The project will not impact this plant.
Pediocactus winkleri [2]	Winkler pincushion cactus	This cactus is closely related to the cactus described above. It has similar desert habitat requirements, but is somewhat geographically and geologically different. This plant will not be impacted by the proposed construction activities.
Penstemon grahamii [1] *(proposed)*	Graham penstemon	Graham penstemon is uncommon and is mostly found on shale and talus ledges in the Green River formation. This formation does not outcrop in the study area. There should be no impacts to this species as a result of proposed construction.
Schoencrambe barnebyi [2]	Barneby Reed-mustard	This endemic plant is found in desert plant communities, usually in Chinle and Moenkopi formations that are not present in study area. Consequently, this plant will not be impacted by the proposed construction activities.

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012).
The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).

Sclerocactus wetlandicus [1]	Uinta Basin fishhook cactus	*Sclerocactus wetlandicus* (also known as *S. glaucus* and *S. whipplei var. roseus*) generally occurs on cobblely, gravelly, or rocky surfaces on river terrace deposits along the White and Green Rivers of Utah. *S. wetlandicus* occurs on varying exposures, but is more abundant on south facing exposures, and on slopes to about 30 percent grade; it is most abundant at the point where river terrace deposits break from level tops to steeper side slopes. Plant communities and species associated with this species are bud sage, shadscale, black sagebrush and horsebrush. The above habitats and geologic formations are not found in the study area. Experience by the author with field studies/collections of this species resulted in the opinion that there is little chance for it to be present in the study area. This plant will not be impacted by the powerline corridor or pad site proposed by the Skyline Mine
Sclerocactus wrightiae [2]		Wright's fishhook cactus is known to be present primarily in salt desert habitats on Mancos Shale, Dakota, Morrison, Summerville and Entrada Sandstone formations. Experience by the author with field studies/collections of this species resulted in the opinion that there is little chance it would be present in the study area. This habitat is not present in the study area. Consequently, there will be no impact to this species as a result of the proposed construction activities.
Townsendia aprica [2]	Last chance townsendia	This plant commonly occurs in saltbush and pinyon-juniper communities on clay and clay-silt substrates on the Mancos Shale formation. The above geologic formation and plant communities are not found in the study area. Also, experience by the author with field studies/collections of this species resulted in the opinion that there is little chance it would be present in the study area.

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012).
The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).

		There should be no impact to this species as a result of construction in the study area.
CANDIDATE		
SENSITIVE		
Allium geyeri var. chatterleyi [3]	Chatterley onion	This plant is a San Juan County, Utah endemic, probably collected in the Manti-LaSal National Forest in the southeast portion of the state. The project area is significantly out of the range of the species. There should be no impact to this species as a result of construction in the study area.
Androsace chamaejasme ssp. carinata [3]	Sweet-flowered rock jasmine	The boreale rockjasmine is an alpine tundra plant and is known to be collected in LaSal Mountains in San Juan and Grand Counties, Utah. The project area is out of the range for the known collections of the species. There should be no impact to this species as a result of construction in the study area.
Aquilegia flavescens var. rubicunda [3]	Link Canyon columbine	Knowing its habitat from experience by the author collecting this species resulted in the opinion that there is very little chance it would be present in the study area. There should be no impact to this species as a result of construction in the study area.
Astragalus iselyi [3]	Isely's milkvetch	The plant is known to occur on the west foothills of the LaSal Mountains in desert shrub and pinyon-juniper communities in Grand and San Juan Counties, Utah – mostly in Mancos Shale, Morrison and Paradox formations. The project area is outside the range for the known collections of the species. There will be no impact to this species as a result of construction in the study area.
Cryptantha creutzfeldtii [3]	Creutzfeldt-flower	This plant has been collected in Mancos Shale, mostly in

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012). The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).

	cryptanth	salt desert communities. The habitat is not found in the study area. Also, experience by the author with field studies/collections of this species resulted in the opinion that there is little chance it would be present in the study area. There will be no impact to this species as a result of construction in the study area.
Cymopterus beckii [3]	Pinnate spring-parsley	The endemic plant is known to occur only in Kane, San Juan and Wayne Counties, Utah, or well beyond the range of the project area. There will be no impact to this species as a result of construction in the study area.
Draba abajoensis [3]	Abajo peak draba	In Utah, this plant has been collected in the Abajo Mountains in the southeast portion of the state, or well beyond the project area. There will be no impact to this species as a result of construction in the study area.
Erigeron abajoensis [3]	Abajo daisy	This plant is an endemic known in Garfield, Piute, San Juan and Wayne Counties and not in Carbon and Emery Counties where the proposed construction is located. There is very little chance this species would occur in the study area so no impact is expected.
Erigeron carringtonae [3]	Carrington daisy	This plant is known to occur almost exclusively on the Flagstaff Limestone formation in Sanpete and Emery Counties. The study area is well below the elevation range of this species and Flagstaff Limestone does not occur in the area. The proposed project will not impact this plant species.
Erigeron kachinensis [3]	Kachina daisy	In Utah, this endemic plant species in known only in hanging gardens in San Juan County. The habitat and range for this species suggested there is

Table 18: Federally listed threatened, endangered and candidate species for Carbon County[1] & Emery County[2], Utah (last updated January 12, 2012).
The table also includes proposed, endangered, threatened and sensitive plant species in the Manti-LaSal National Forest[3] (last updated February 13, 2013).

		almost no chance of impacts to it by the proposed construction.
Hedysarum occidentalis var. canone [3]	Canyon sweetvetch	Experience by the author with field studies/collections of this species resulted in the opinion that there is little chance it would be present in the study area. The study area does not have the habitat for this species. The project will not impact this plant.
Lomatium latilobum [3]	Canyonlands lomatium	In Utah, this plant species in known to occur on Entrada sandstone in Grand and San Juan Counties. The habitat and range for this species suggested there is almost no chance of impacts to it by the proposed construction.
Salix arizonica [3]	Arizona willow	Although this willow could occur relatively close to the project area, it is a riparian species. No impacts to riparian habitat is expected by the proposed construction projects. The proposed project will likely not impact this plant species.
Senecio musiniensis	Musinea groundsel	This endemic plant is known to occur almost exclusively on ridgetops in the Flagstaff Limestone formation on talus slope on Musinea Peak in Sanpete County, Utah. The habitat and range for this species suggested there is almost no chance of impacts to it by the proposed construction.
Silene petersonii	Maguire campion	This endemic plant is known to occur on plateau margins in Flagstaff and Claron formations in Garfield, Iron, Sanpete and Sevier Counties in Utah. The project area is not within the above counties. Also, the geology does not occur within the study area. The proposed project will likely not impact this plant species.

SUMMARY & DISCUSSION

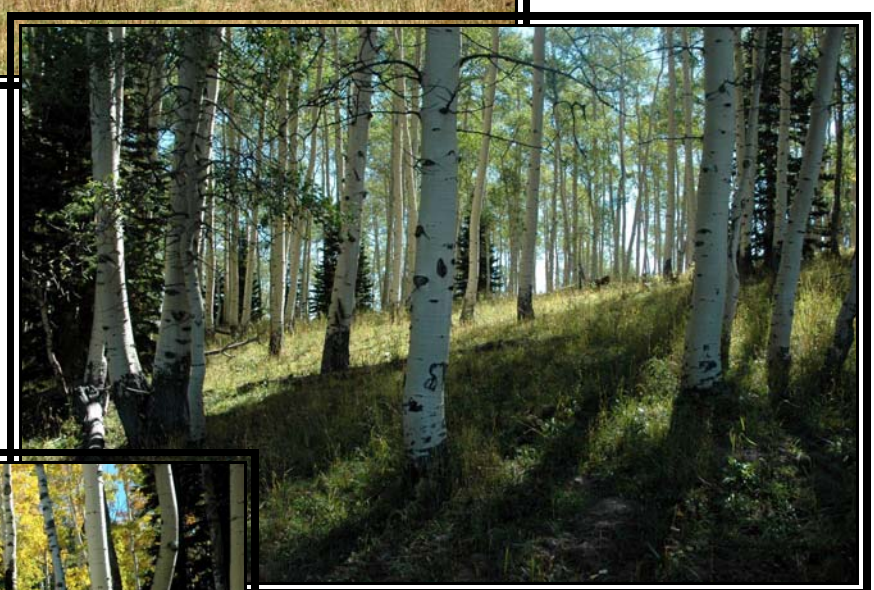
Because the footprint for each powerline single-pole is relatively small and because very little disturbance by vehicular travel between them has been planned, there should be little lasting disturbance caused along the Powerline Corridor as a result of the current proposed construction activities. Nonetheless, sampling was conducted and reference areas chosen for those plant communities if they are significantly impacted. Judging by examination of the data and statistical comparisons between them, the reference areas chosen appear to be appropriate standards for future revegetation success.

There will, however, be significant disturbance to the existing plant community at the Swens Canyon Pad site. Another reference area was chosen nearby and sampled for future success standards. This reference area matches that community proposed for disturbance fairly closely and also should provide appropriate standards at the time of final revegetation. That said, woody species density values for proposed disturbed Sagebrush/Grass and its reference area were quite high at 6,666 and 7,290 plants per acre, respectively. Previous consultations with state wildlife biologists sometimes resulted in suggestions for a lesser woody species density standard because it could provide greater opportunities for increased forb and grass species establishment and could provide greater species diversity in the summer range for the resident wildlife species. This area has been mapped as crucial summer range for deer and elk by Utah, Division of Wildlife Resources (DWR). Consequently, a pre-set woody species value of 2,500 plants per acre may be an appropriate recommendation for a revegetation success standard at the proposed disturbed Sagebrush/Grass area. This is subject to review and approval by biologists from the State of Utah, Division of Oil, Gas and Mining (DOGM).

Finally, the summary table for potential threatened, endangered, candidate and sensitive plant species known to occur in Carbon County and Emery County as well as in the Manti-LaSal National Forest in Utah suggests there will likely be no impact to any of the species listed on that table by the proposed new construction sites at the Skyline Mine.

COLOR PHOTOGRAPHS OF THE SAMPLE SITES

Aspen/Grass Community (Proposed Disturbed)

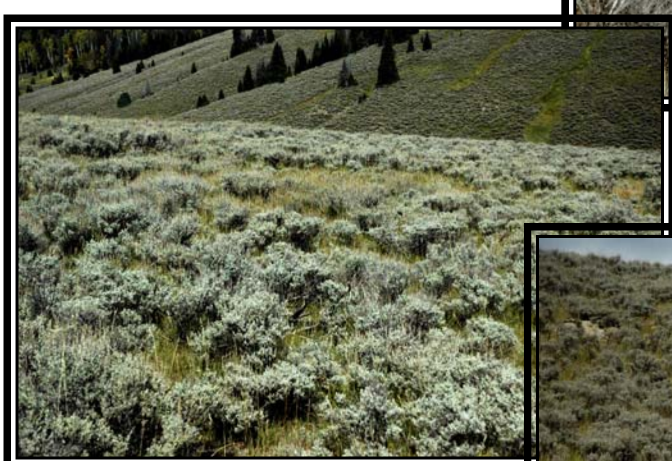


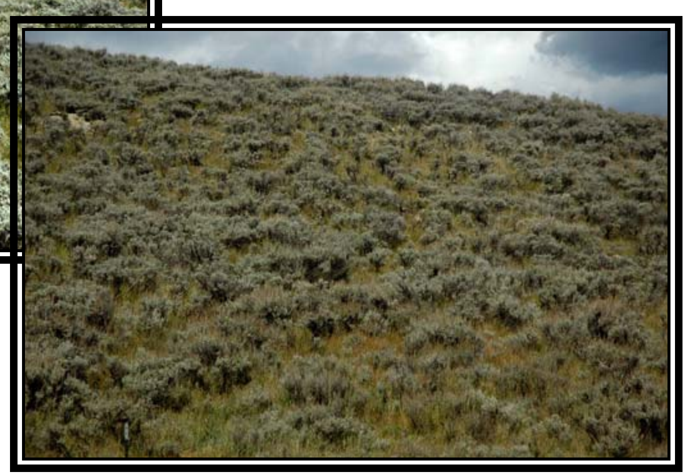
Aspen/Grass Community (Reference Area)

Conifer Community (Proposed Disturbed)

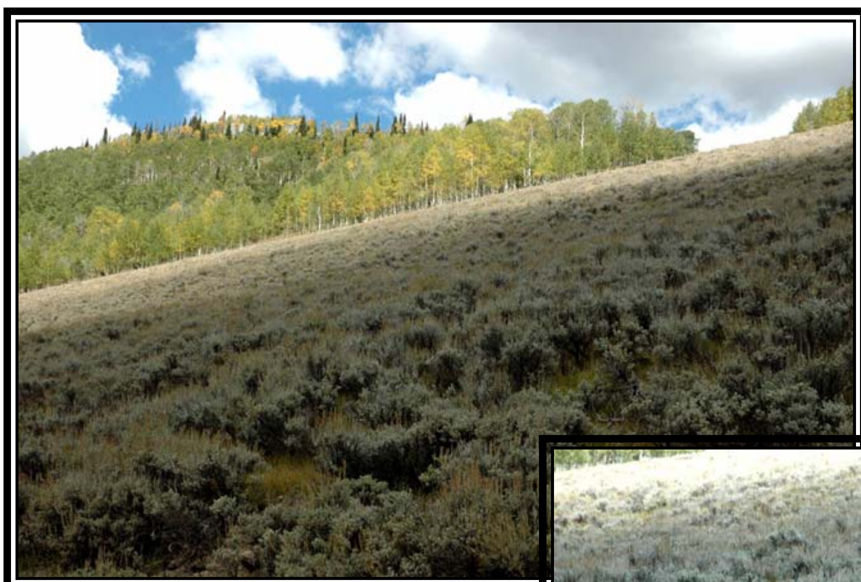
Conifer Community (Spruce Reference Area)

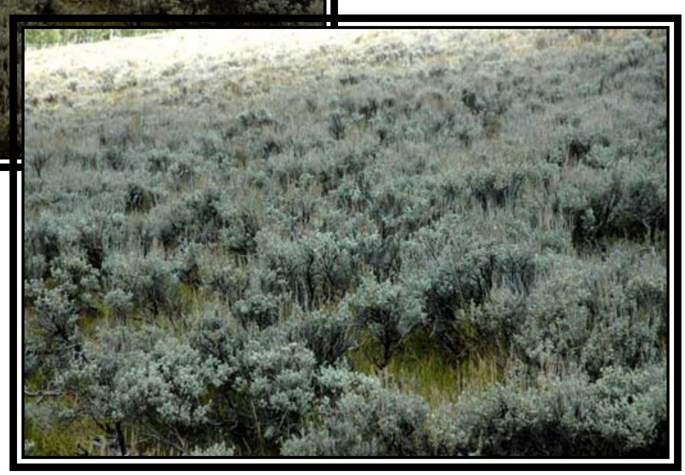
Sagebrush/Grass Community (Proposed Disturbed)

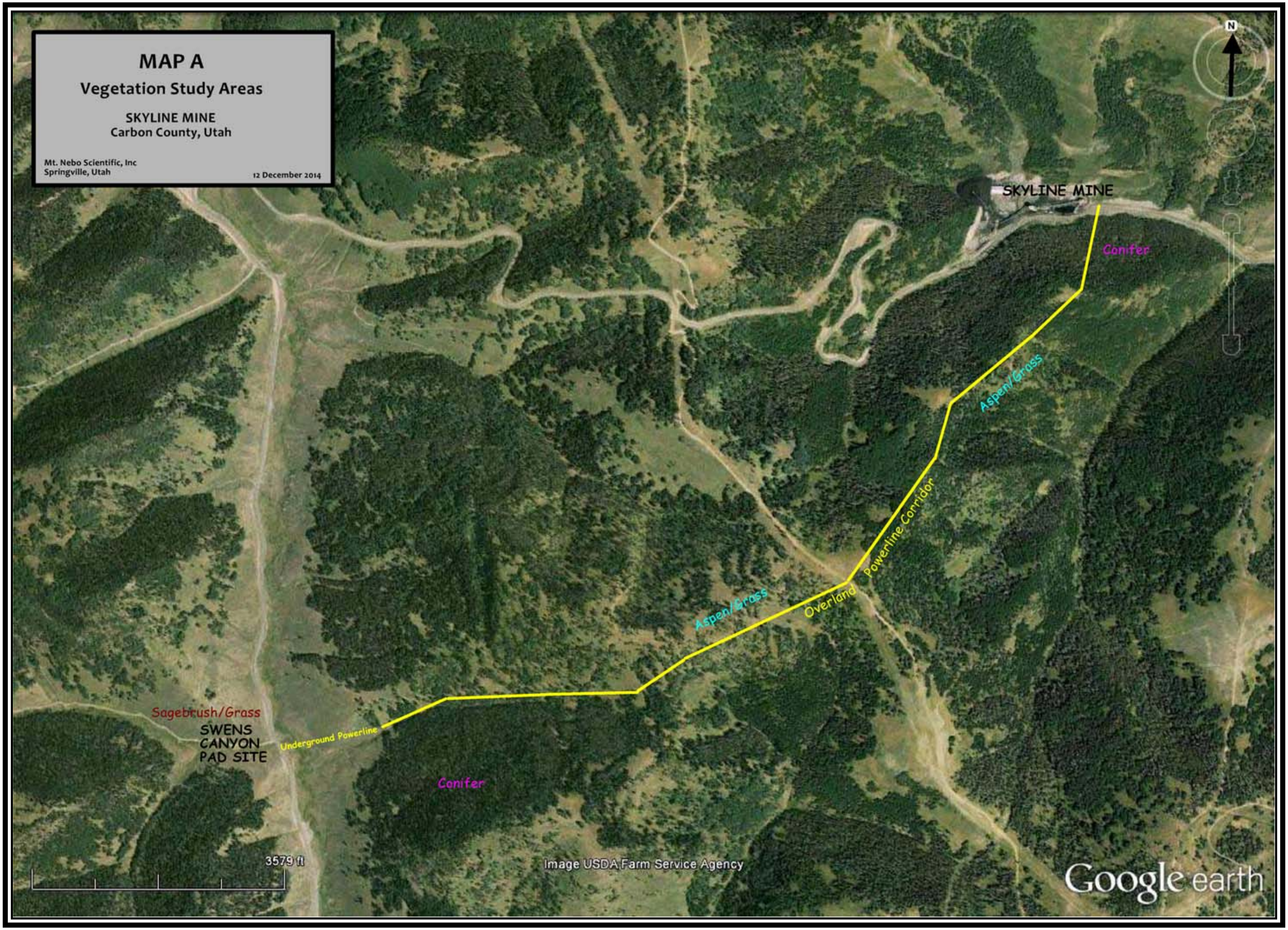




Sagebrush/Grass Community (Reference Area)






MAP A
Vegetation Study Areas
SKYLINE MINE
Carbon County, Utah
Mt. Nebo Scientific, Inc
Springville, Utah
12 December 2014
SKYLINE MINE
Conifer
Aspen/Grass
Powerline Corridor
Overland
Aspen/Grass
Sagebrush/Grass
SWENS
CANYON
PAD SITE
Underground Powerline
Conifer
3579 ft
Image USDA Farm Service Agency
Google earth

Gregg Galecki

From:	Jeremiah Armstrong
Sent:	Monday, August 25, 2014 12:48 PM
To:	Gregg Galecki
Subject:	FW: Prime Farmland
Attachments:	Jeremiah_Armstrong_prime_Farmland.jgw; Jeremiah_Armstrong_prime_Farmland.jpg; Jeremiah_Armstrong_prime_FarmlandLSlp.jgw; Jeremiah_Armstrong_prime_FarmlandLSlp.jpg; UT045_JOIN.dbf; UT045_JOIN.prj; UT045 _JOIN.sbn; UT045_JOIN.sbx; UT045_JOIN.shp; UT045_JOIN.shx

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From: Dyer, Joseph - NRCS, Price, UT <joseph.dyer@ut.usda.gov>
Sent: Thursday, June 19, 2014 12:15 PM
To: Jeremiah Armstrong
Cc: Gardner, Lowell - NRCS, Castle Dale, UT; Miller, Brian - NRCS, Ephraim, UT
Subject: Prime Farmland

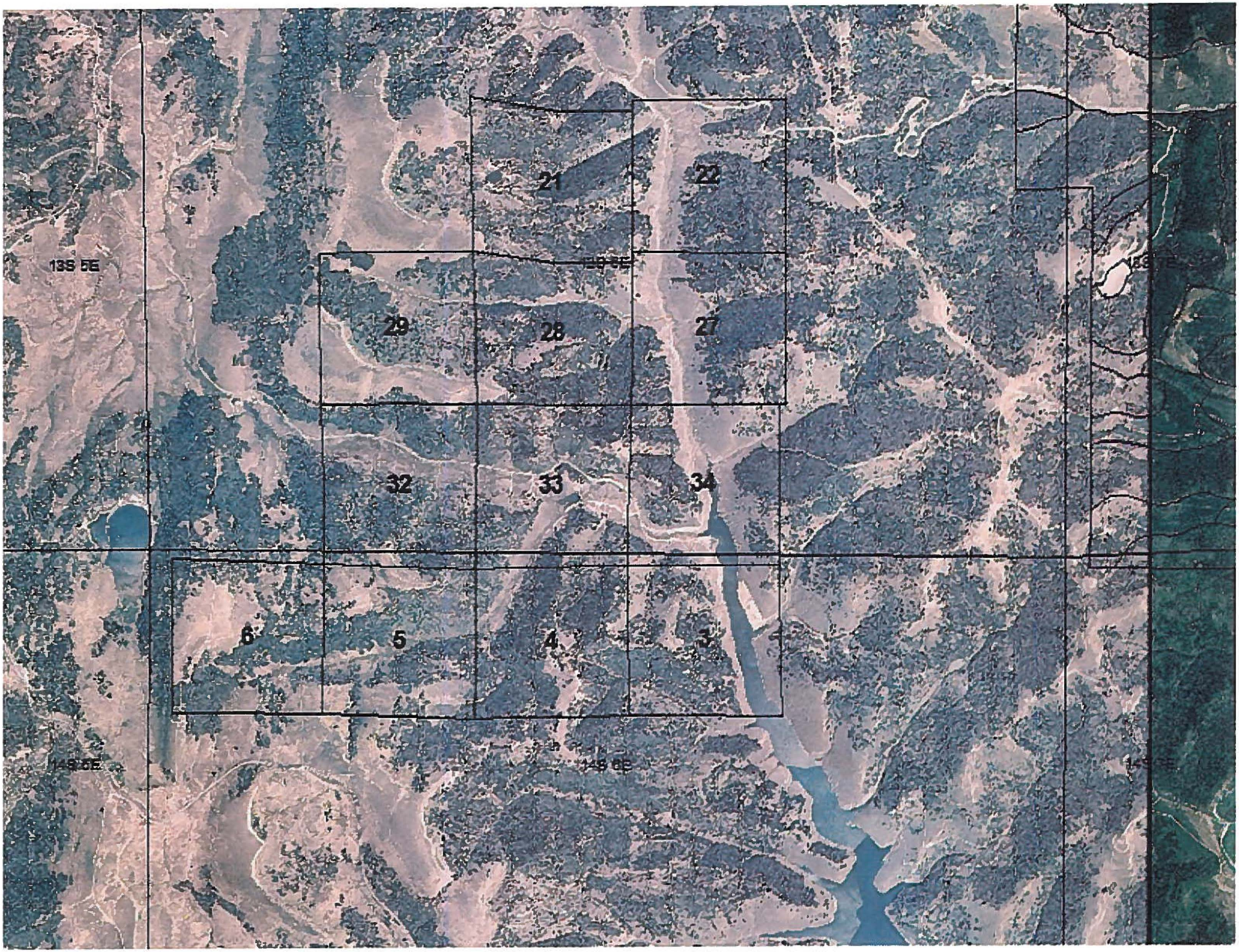
Joseph Dyer
Area Resource Soil Scientist
Office 435 637 0041 ext 102
Cell 435 630 3137

Jeremiah Armstrong
Environmental Engineer – Skyline Mine

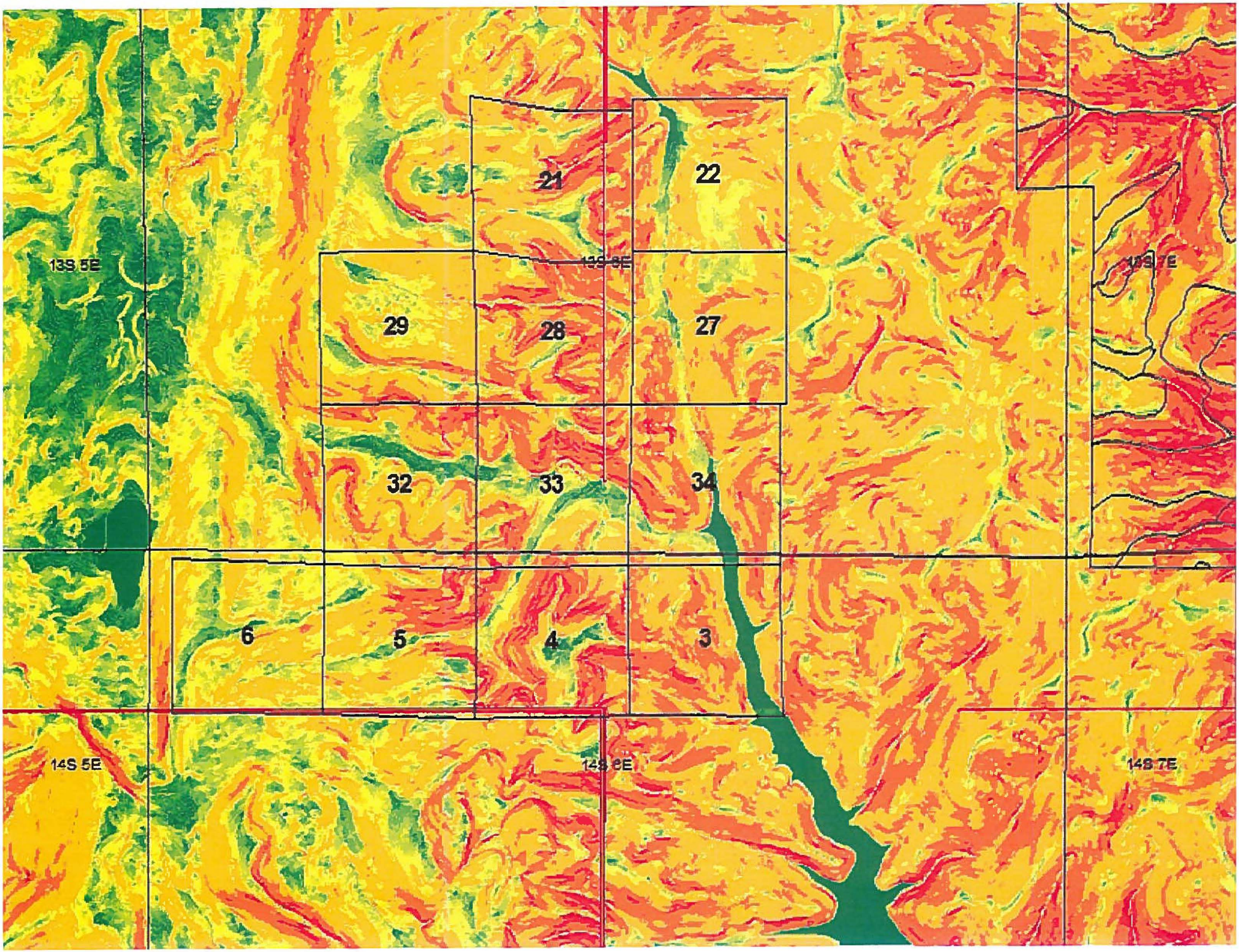
Canyon Fuel Company, LLC
A Subsidiary of Bowie Resource Partners, LLC
HC 35 Box 380
Helper, Utah 84526
O: (435) 448-2645

Jeremiah,

I contacted Robert Davidson from the forest service and got his mapping, unfortunately the soils and concepts are not related to NRCS soils with no OSD's or Prime and unique farmland designation's. I then contacted Lowell Gardner, and Brian Miller, the District Conservationists for this area, and they both agreed there was **no Prime or unique farm lands** in the Area of concern (See attached map) I concur, I see no area that would fit into the definition of Prime and Unique Farm lands. I have attached the soils map for your area to assist your planning efforts. Two of the file are Write world file so if you have Arc map they will self locate the soils file is vector file that will do the same. The jgw is the location file for each picture respectively. UT045_JOIN is the Soils file joined with attributes like Hydrologic Group AWC, Rooting Depth etc as entered by the forest service employees. The area I have considered is:
Township 13S, Range 6E, Sections 21, 22, 27, 28, 29, 32, 33, and 34 and for Township 14S, Range 6E, Sections 3, 4, 5, & 6.

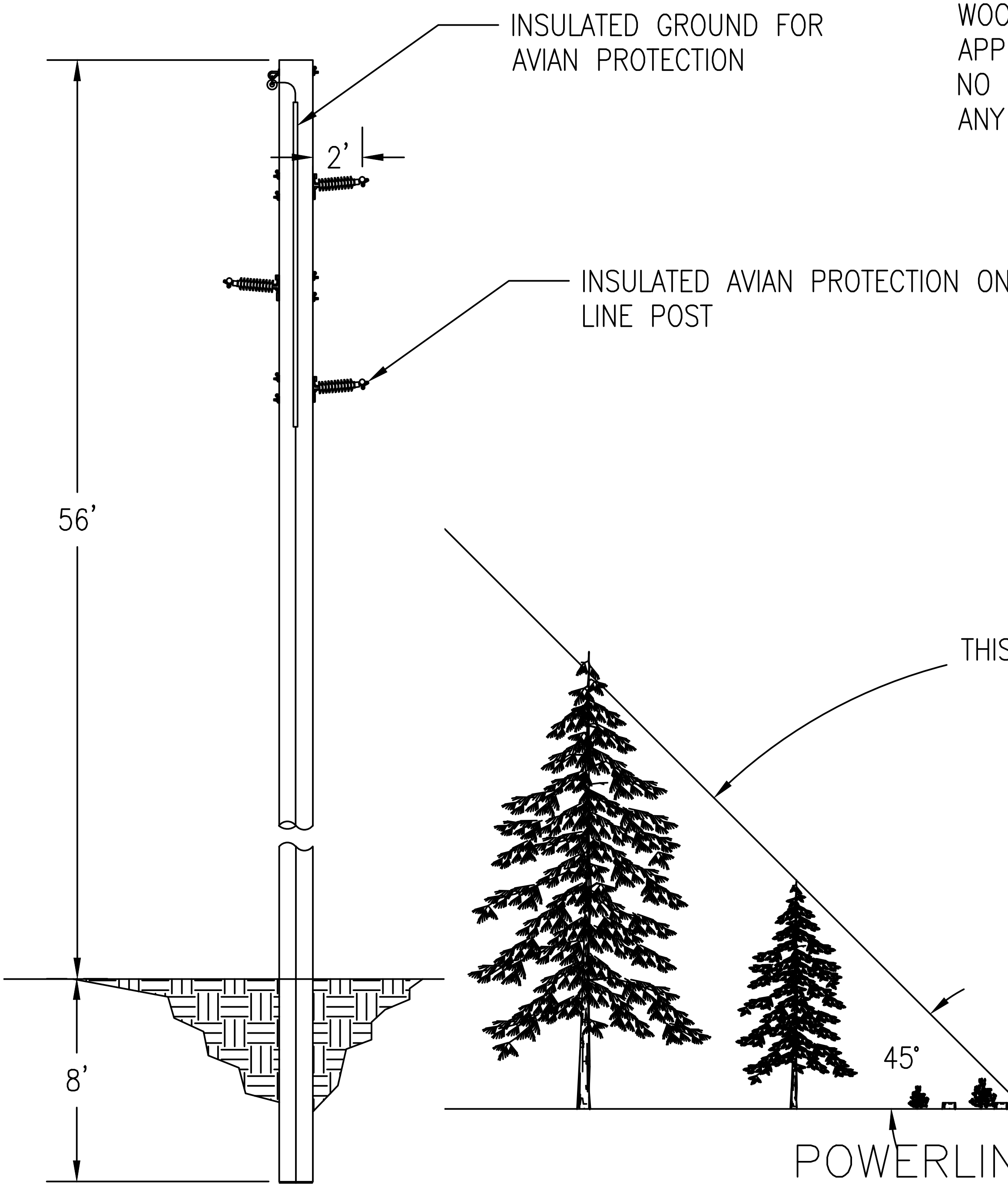


21
22
13S 5E
29
28
27
32
33
34
6
5
4
3
14S 5E
14S 6E



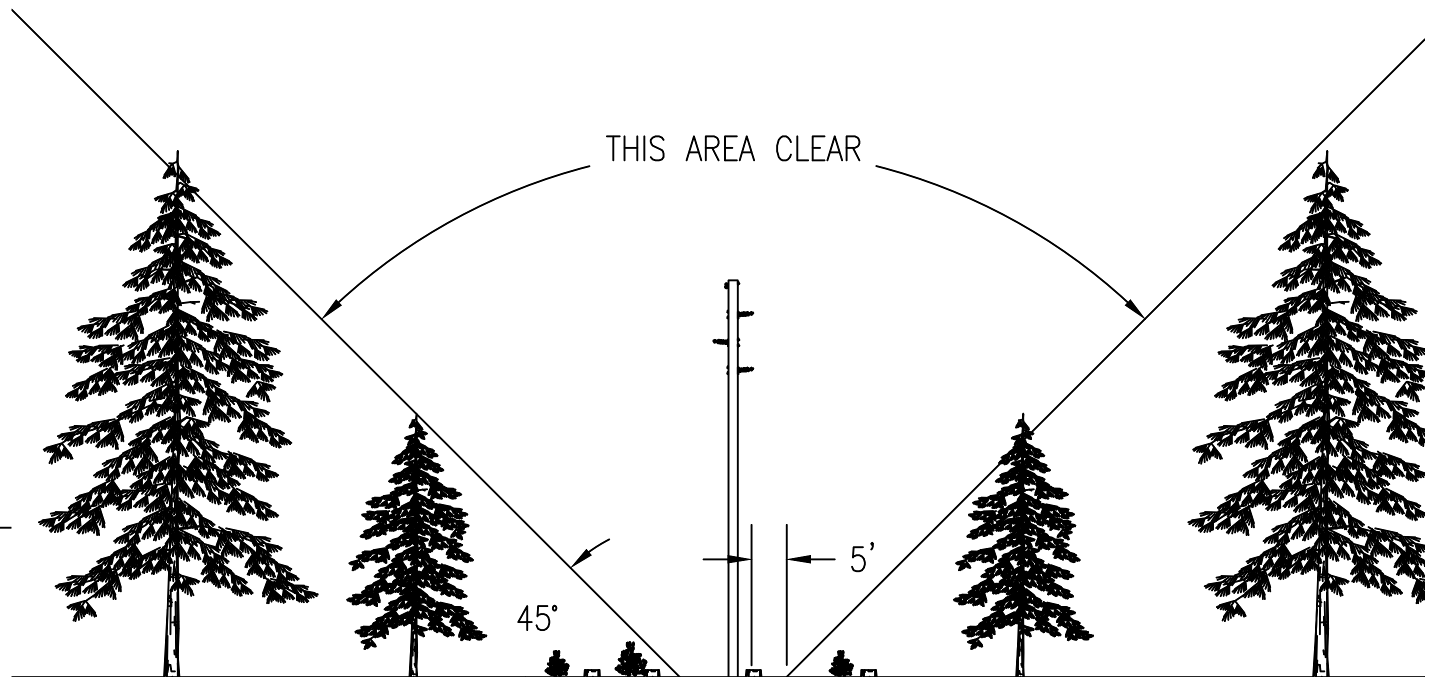
21
22
13S 5E
13S 6E
13S 7E
29
28
27
32
33
34
6
5
4
3
14S 5E
14S 6E
14S 7E

WOOD POLES
APPROXIMATELY 200 STRUCTURES
NO NEW ROADS FOR CONSTRUCTION PLANNED
ANY ROADS BUILT FOR CONSTRUCTION WILL BE RECLAI



POLE DETAIL

SCALE: NONE



POWERLINE CLEAR AREA

SCALE: NONE

Order 2 Soil Survey

of the

Powerline Corridor
Swens Pad Ventilation and Escape Shafts
Coal Pile Expansion

at the

Skyline Mine

Located Southwest of Scofield, Utah

Prepared for

Canyon Fuels Company

by

Long Resource Consultants, Inc.
Morgan, Utah

December 4, 2014

Table of Contents

List of Tables

List of Figures

Appendices

Section One

Purpose of Soil Survey

The purpose of this report is to summarize the results of an Order 2 soil inventory conducted for Canyon Fuels Company near the Skyline mine in Carbon County, Utah. This soil survey encompasses the following locations:

- Proposed expansion of an existing coal pile;
- Installation of a single pole 3-phase 12.5 kilovolt powerline to supply power to the mine as mining moves southwest; and
- Construction of mine ventilation and escape shafts.

The northeast end of the soil survey area is approximately 3.7 miles southwest of Scofield, Utah. This soil survey was prepared so that the Skyline mine could: 1) identify suitable sources of topsoil and subsoil; 2) determine potential depths and quantities of topsoil and subsoil; 3) identify potential impacts of construction activities on the soil resource; and 4) develop a reclamation plan for the proposed construction areas.

Project Area

The Powerline Corridor soil survey area is on the Wasatch Plateau between Scofield, Utah to the northeast and Fairview, Utah on the southwest, . The soil survey corridor extends from the existing Skyline mine surface facilities near the top of Eccles Canyon on the northeast end and traverses a ridge to the proposed Swens Pad in Upper Huntington Canyon on the southwest end, Figure 1. The soil survey area is located in portions of Sections 13, 23, 24, 26, and 27 in Township 13 South, Range 6 East, Salt Lake base meridian (Utah AGRC 2014b). The soil survey area is on the Scofield, Utah 7.5 minute USGS quadrangle (Utah AGRC 2014c). Elevation ranges from approximately 8,640 feet (2,634 meters) in the bottom of both Eccles Canyon and Upper Huntington Canyon to a benchmark of 9,655 feet (2,944 meters) on the ridge traversed by the proposed powerline corridor (Utah AGRC 2014c).

The Powerline Corridor soil survey area encompasses three proposed project areas:

- *Swens Pad* at the juncture of Swens Canyon and Upper Huntington Canyon;
- *Powerline Corridor* from the existing mine surface facilities in upper Eccles Canyon to the Swens Pad location in Upper Huntington Canyon; and

- *Coal Pile Expansion* adjacent to the existing coal pile and surface mine facilities in upper Eccles Canyon.

The soil survey of these combined project areas is covered by this soil survey report, which will be referred to as the Powerline Corridor soil survey area for the purposes of this report. Soils in the three proposed project areas are similar and adjacent.

Facilities

The Powerline Corridor soil survey encompasses three proposed facilities near the existing Skyline mine (Galecki 2014).

Coal Pile Expansion

The Skyline mine is proposing to enlarge the existing coal stockpile by moving up Eccles Canyon as well as up the adjacent north and south sideslopes. The area surveyed for the coal pile expansion covered approximately 11.8 acres and covers some areas outside the proposed expansion.

Powerline Corridor

The area surveyed for the powerline corridor was approximately 2.6 miles long and covers approximately 77.16 acres of previously undisturbed native soils and vegetation. There is approximately 0.3 miles and 4.67 acres of corridor on the north end that crosses through the existing mine surface facilities. The surveyed area is larger than the proposed disturbance. The proposed disturbance width along the powerline corridor is not anticipated to be greater than 15 feet.

The final 0.3 miles of corridor on the southwest end is where the powerline will be routed underground with no proposed surface disturbance. Soils were not evaluated in this area.

Swens Pad

A ventilation shaft (16 foot) and escape shaft (6 foot) are proposed for construction at the Swens Pad facility. The location is at the southwest end of the powerline corridor near the lower end of Swens Canyon where it enters Upper Huntington Canyon. The area surveyed at the Swens pad location is approximately 18.9 acres.

Vegetation

Vegetation communities are directly related to aspect. North slopes are dominated by Englemann spruce, subalpine fir, and Douglas fir. South slopes are dominated by quaking aspen, mountain big sagebrush, grasses, and high mountain shrubs.

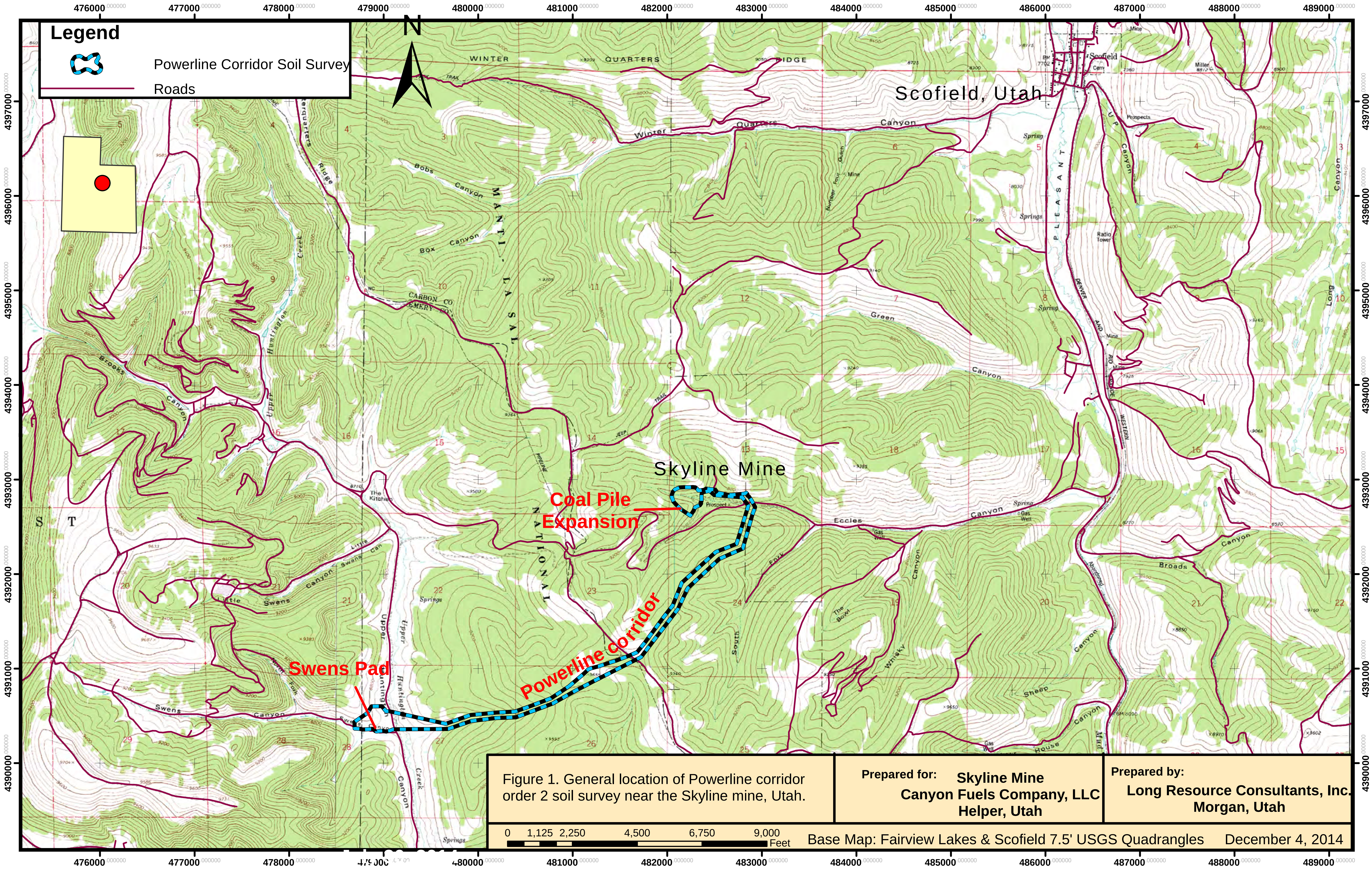


Figure 1. General location of Powerline corridor order 2 soil survey near the Skyline mine, Utah.

Climate

An official U.S. Weather Bureau station is located near the Skyline Mine, Table 1. The Skyline mine is at the northeast end of the Powerline Corridor soil survey. The weather station name is Scofield - Skyland Mine, Utah. The period of available records is July 1, 1984 through February 28, 2013 (WRCC 2014). The moisture regime is ustic and udic, characterized by deep winter snowfall and summer thunderstorms. Soil temperature regime is cryic, characterized by very cold winters and moderate summers (USDA Manti 2014 and USDA NRCS 2014a).

Table 1. Summary of weather data for the Scofield - Skyland Mine, Utah weather station.

	Ave Max Temp (F)	Ave Min Temp (F)	Ave Total Precip (in)	Ave. Total Snowfall (in)	Ave Total Snow Depth (in)
January	32.9	11.2	2.84	44.8	18
February	33.3	12.0	2.85	44.8	19
March	39.7	17.7	2.49	32.5	10
April	46.9	23.8	2.57	23.8	3
May	56.5	31.0	1.82	7.2	0
June	68.1	38.8	1.13	0.5	0
July	75.9	46.3	1.44	0.0	0
August	73.9	44.8	1.53	0.0	0
September	65.0	37.0	1.79	0.6	0
October	52.7	28.0	2.23	10.0	1
November	39.3	17.8	2.46	31.6	4
December	32.2	10.6	2.63	40.9	12
Annual	51.4	26.6	25.78	236.6	6

Source: Western Regional Climate Center, November 2014.
Period of Record: July 1, 1984 to February 28, 2013.

Geology

The Blackhawk Formation (Kb) is the dominate geologic formation in the Powerline Corridor soil survey area (Knowles 1996). It is a member of the Upper Cretaceous Mesaverde Group. The Blackhawk Formation (Kbh) consists of "sandstone, shaly siltstone, carbonaceous shale, and coal of continental and deltaic origin (Witkind 1991)."

Quaternary alluvium (Qal) is present along Upper Huntington Creek on the southwest end of the Powerline Corridor soil survey (Knowles 1996).

Quaternary landslides (Qls) and landslide zones were mapped near the western end of the Powerline Corridor soil survey on the east side of Upper Huntington Creek (Knowles 1996).

How this Soil Survey was Made

This soil survey was made in accordance with the guidelines for an order 2 soil survey as detailed in the *Soil Survey Manual* (USDA NRCS 1993) and *National Soil Survey Handbook* (USDA NRCS 2014b). Soils were classified using the *Keys to Soil Taxonomy, Twelfth Edition* (USDA NRCS 2014d). The dominant taxonomic Great Groups are Haplocryolls and Haplocryepts.

Evaluation of Soils

Soils were examined, described, and sampled in hand dug pits (5) and cutbanks (2). Soil profile descriptions and samples were collected on September 19 and 20, 2014. The soil survey map, Figure 2, details the locations of the soil profiles that were examined, sampled, and analyzed within the Powerline soil survey area.

Soil Profile Descriptions

Soil profile descriptions were completed for each soil sample and miscellaneous landform location. Soil colors (Munsell 2012) were evaluated in the office under natural lighting using the profile box samples collected at each location. Soil *Pedon Description Forms* (USDA NRCS 1997) were completed for each soil pit using the methods detailed in the *Field Book for Describing and Sampling Soils*, version 3.0 (Schoeneberger et. al., 2012). All soil descriptions were completed by Robert E. Long, Certified Professional Soil Scientist and entered into a Pedon PC database (Soil Survey Staff 2012). Soil profile descriptions are in Appendix A. Photographs of the soil profile locations are in Appendix B.

The geomorphic setting for each soil profile location was determined based on the Geomorphic Description System (USDA NRCS 2008)

Soil sample locations are coded by the year that the sample was collected (2014). For example, soil sample location 14SKY08 was the eighth soil description location (08) collected at the Skyline mine (SKY) in 2014 (14).

Soil samples of each horizon were collected in new gallon size plastic freezer bags and in micromonolith profile boxes. The sealed sample bags were shipped to Inter Mountain Laboratory in Sheridan, Wyoming for analysis. Box samples were used for further examination of soil profile characteristics and retained as a record of each soil profile. Photos of the soil profile boxes are in Appendix C.

Soil Profile Locations

The location of each soil sample location was determined with a hand-held GPS (Garmin GPSMAp 60st™) in the UTM NAD83 coordinate system. The X and Y coordinates for each soil profile location are listed as part of the profile description in Appendix A.

Digital Mapping

The soil survey map, Figure2, was produced using ARCMap software (version 10.2.1). Digital natural color aerial photography (NAIP 2011), USGS topographic maps, Public Land Survey Sections (PLSS), and a Utah transportation layer were downloaded from the Utah Automated Geographic Reference Center (Utah AGRC 2014a-d).

Analysis of Soil Samples

Soil samples (22) from 7 representative soil profiles collected from within or immediately adjacent to the Powerline soil survey area were sampled by soil horizon and submitted for chemical and physical analysis. Results of the laboratory analysis of soil samples are in Appendix D.

Soil samples were analyzed for parameters outlined by Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM 2005), Table 2.

Table 2. Soil analysis parameters for topsoil and overburden (Utah DOGM, 2005).

Parameter	Unit
Paste pH	s.u.
Saturation percent	%
Electrical Conductivity (ECe)	dS/m
Organic Matter Percent	%
Soluble Na, Mg, and Ca	meq/l
Sodium Adsorption Ratio	
Particle Size Analysis (report very fine sand, sand, silt, and clay)	%
$CaCO_3$ Percent	%
Total Organic Carbon	%

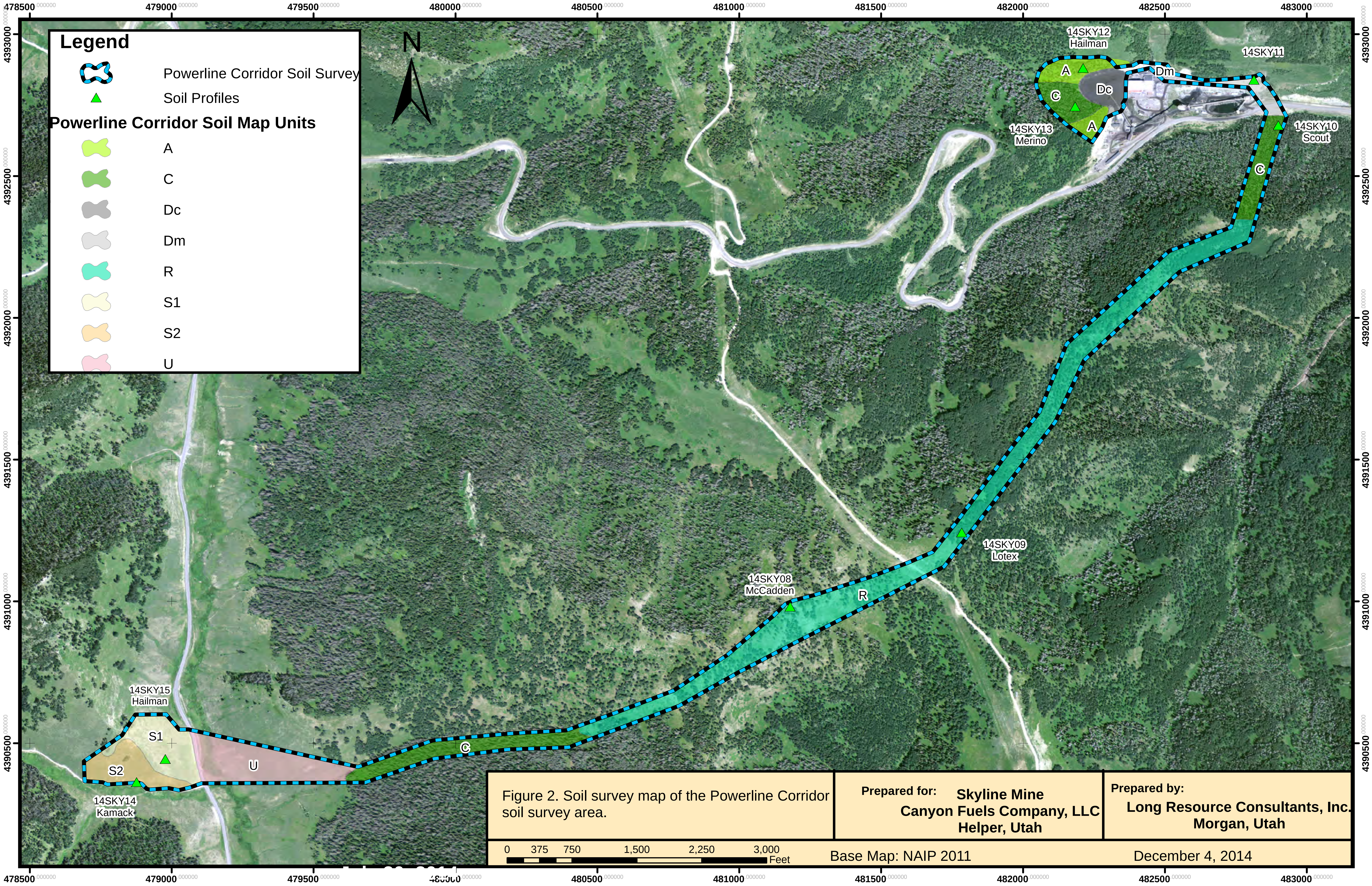


Figure 2. Soil survey map of the Powerline Corridor soil survey area.

Existing Soil Surveys

Two existing Order 3 soil surveys have been completed in the Powerline soil survey, Figure 3. The majority of Powerline Corridor soil survey is in the area previously mapped as part of the Manti-LaSal National Forest soil survey (UT645). A small portion on the northeast end was mapped by the Natural Resource Conservation Service (NRCS) as part of the Carbon Area, Utah Parts of Carbon and Emery Counties Soil Survey (UT616).

Manti LaSal National Forest

An order 3 soil survey has been conducted in the Manti LaSal National Forest (MLNF). Figure 3 shows the relationship of the MNLF soil map units to the Powerline soil survey. Table 3 lists the MNLF order 3 soil map units that occur within the Powerline soil survey corridor (USDA - Manti 2014). Table 4 lists the taxonomic classification of each soil family as listed in the data files received from the Manti LaSal National Forest (USDA - Manti 2014).

Soils mapped by the MLNF are characterized by dark surfaces (mollic and pachic epipedons) and accumulations of illuvial clay (argillic horizons) in some soil families. The amount of soils that are shallow to bedrock (lithic contact) is of limited extent in the MLNF soil map units. The dominant physiographic setting of the MLNF map units is mountain sideslopes. The dominant physiographic setting along the Powerline corridor is a mountain ridge with sideslopes at the north and south ends of the corridor. The soil temperature regime of all the MLNF soil map unit components is cryic.

Table 3. Manti LaSal National Forest order 3 soil survey map units within the Powerline soil survey corridor.

Map Unit[1]	Soil Map Unit[1]	Vegetation[1]	Acres[2]
32	Pando - Toze families, 2-15% slopes	Mtn sage, silver sage	26.0
42	Becks - Cryaquolls - Silas families, 0-5% slopes	Silver sage	5.5
81	Bundo - Lucky Star - Scout families, 30-60% slopes	Spruce, fir, PSME	13.3
109A	Wrenman - Elwood - Clayburn families, 20-60% slopes	Mtn big sage, grass	4.3
401	Elwood - Merino families, 5-40% slopes	Mtn big sage, grass	2.6
560	Lucky Star - Skylick families, 30-60% slopes	Aspen	51.5
713	Lucky Star - Adel families, 30-60% slopes	Aspen	9.1
820	Lucky Star - Bundo - Adel families, 30-60%	Spruce, fir, aspen	16.2

1. Manti LaSal National Forest soil survey map unit symbol (USDA - Manti 2014).
2. Area calculated as plane acres using ARCMap software (v10.2.1).

Table 4. Taxonomic classification of soil families mapped in the Manti LaSal National Forest order 3 soil survey within the Powerline corridor soil survey.

Soil Family	Taxonomic Classification[1]
Adel	Pachic Haplocryolls fine-loamy, mixed, superactive
Becks	Aquic Haplocryolls loamy-skeletal, mixed, superactive
Bundo	Ustic Palecryalfs loamy-skeletal, mixed, superactive
Clayburn	Pachic Argicryolls fine-loamy, mixed, superactive
Elwood	Typic Argicryolls loamy-skeletal, mixed, superactive
Lucky Star	Typic Palecryolls loamy-skeletal, mixed, superactive
Merino	Lithic Eutrocryepts loamy-skeletal, mixed, superactive
Pando	Alfic Argicryolls loamy-skeletal, mixed, superactive
Silas	Cumulic Haplocryolls fine-loamy, mixed, superactive
Skylick	Pachic Palecryolls fine-loamy, mixed, superactive
Scout	Ustic Eutrocryepts loamy-skeletal, mixed, superactive
Toze	Calcic Pachic Haplocryolls fine-loamy, mixed, superactive
Wrenman	Ustic Haplocryolls fine-loamy, mixed, superactive

1. The edition of *Keys to Soil Taxonomy* was not specified in the data received from the MLNF.

NRCS Soil Survey

Soils on the northeastern edge of the Powerline soil survey corridor were mapped by the Natural Resources Conservation Service (NRCS) as part of the Soil Survey of the Carbon Area, Utah Parts of Carbon, and Emery Counties (USDA NCS 2014a). Soils mapped by the NRCS are characterized by accumulation of illuvial clay (argillic horizons) and dark surfaces (mollic and pachic) in most profiles. Open grass and sagebrush areas on south facing slopes were mapped as frigid while the conifer and aspen areas were mapped as cryic.

Table 5 lists the Carbon Area soil map units within the Powerline soil survey corridor (USDA 2014a). Table 6 lists the taxonomic classification of the major soils that were mapped by the NRCS within the Powerline corridor soil survey.

Table 5. Carbon Area soil survey map units mapped within the Powerline soil survey corridor (USDA NRCS 2014a).

Map Unit[1]	Soil Map Unit[1]	Slope[1]	NRCS Ecological Class[1, 2]	Acres[3]
		%		
118	Trag - Croydon complex	30 to 60	Mtn Loam (Salina wildrye)	1.5
125	Uinta - Toze families complex	40 to 70	High Mtn Loam (Aspen) High Mtn Very Steep Stony Loam (Englemann spruce) High Mtn Very Steep Stony Loam (Englemann spruce)	3.7

1. Carbon Area, Utah soil survey, parts of Carbon and Emery Counties (USDA 2014a).
2. Ecological class listed on top is for first named major soil in map unit and ecological class listed on bottom is for major soil named second in map unit.
3. Area calculated as plane acres using ARCMap software (v10.2.1).

Table 6. Taxonomic classification of soils mapped within the Powerline corridor by the Soil Survey of Carbon Area, Utah Parts of Carbon and Emery Counties (USDA NRCS 2014a).

Soil Family	Taxonomic Classification[1]	Taxonomic Classification[2]
Croydon	Argic Cryoborolls fine-loamy, mixed, superactive	Pachic Argicryolls fine-loamy, mixed, superactive
Toze	Calcic Pachic Cryoborolls fine-loamy, mixed, superactive	Calcic Pachic Haplocryolls fine-loamy, mixed, superactive
Trag	Typic Argiborolls fine-loamy, mixed, superactive, frigid	Typic Argiustolls fine-loamy, mixed, superactive
Uinta	Typic Cryoboralfs fine-loamy, mixed, superactive	Eutric Glossocryalfs fine-loamy, mixed, superactive

1. Classification listed in database downloaded from Web Soil Survey (USDA 2014a).
2. Classification listed on the current official soil series description (USDA 2014b).

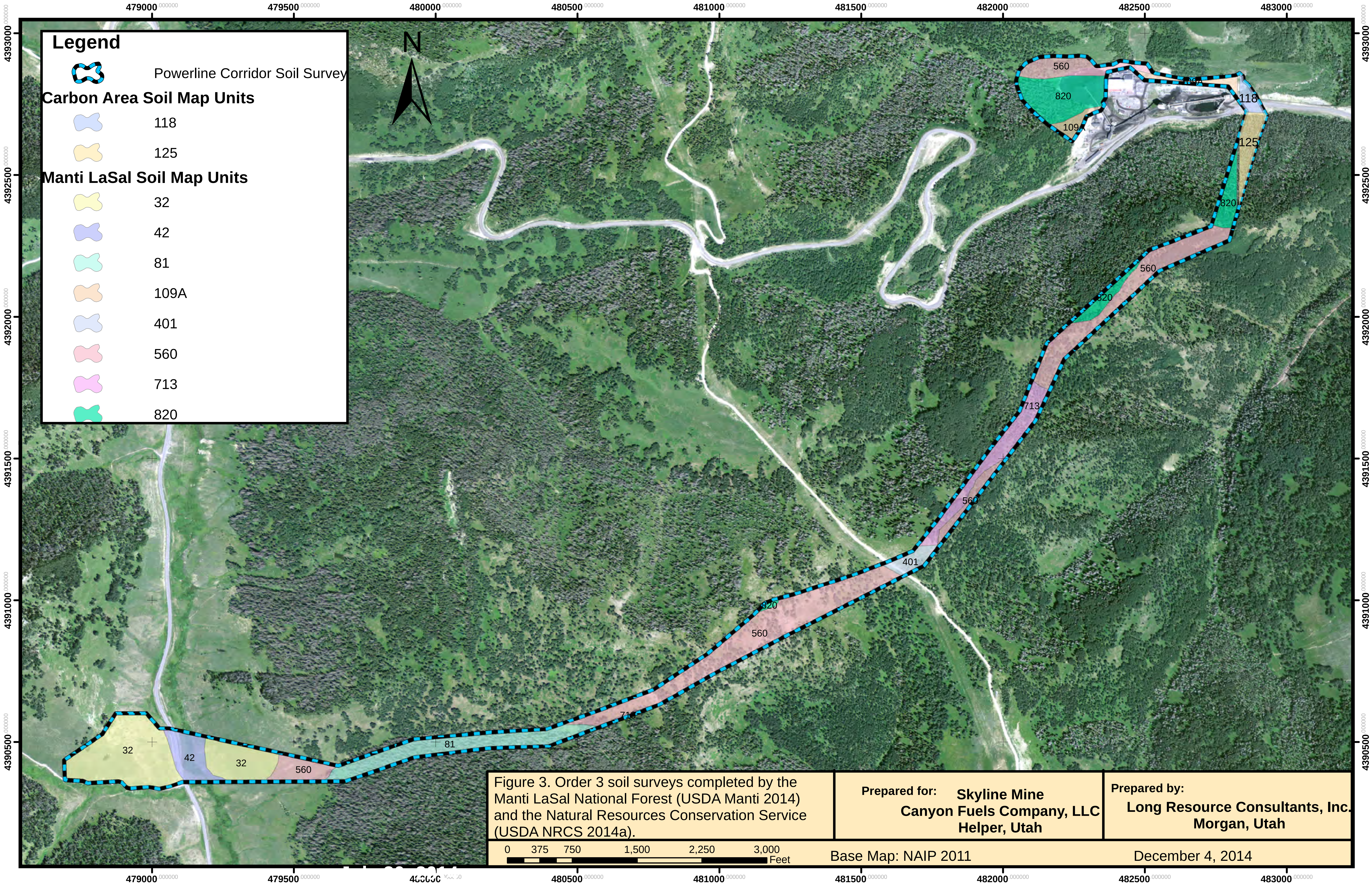


Figure 3. Order 3 soil surveys completed by the Manti LaSal National Forest (USDA Manti 2014) and the Natural Resources Conservation Service (USDA NRCS 2014a).

Section Two

Soil Characteristics

Soils in the Powerline Corridor soil survey area are characterized by depth to sandstone bedrock, coarse soil texture, dark soil surface color (mollic or pachic), and absence of a zone of illuvial clay accumulation (no argillic horizon). The location of each soil profile described in the Powerline Corridor soil survey is shown in Figure 2.

Cambic horizon

Soils in the Powerline Corridor soil survey area have strong cambic horizons. This indicates that some soil development has taken place. However, none of the soil profiles showed any indications of illuvial clay accumulation and there was not enough clay increase between horizons to meet the requirements for an argillic horizon based on the laboratory analysis.

Depth to Bedrock

Sandstone bedrock (lithic contact) influences the soil depth in the majority of the profiles in the survey area. The depth to fractured sandstone bedrock was less than 50 cm (20 inches) from the mineral soil surface in profiles 14SKY08, 14SKY09, and 14SKY13. Fractured sandstone was observed at 84 cm (33 inches) in profile 14SKY12. Field observations at 14SKY15 did not definitively identify a lithic contact, but did indicate that it may be relatively close to the hole depth of 110 cm (43 inches).

Shale bedrock was observed at 108 cm in profile 14SKY14.

Soil pH

The soil pH ranges from 5.6 to 6.7 in the soil profiles described and sampled. Soils with pH from 6.0 to 6.4 are considered to be *Fair* (DOGM 2005). Soils with pH from 5.5 up to 6.0 are considered to be *Poor* (DOGM 2005). Although the soil pH is either *Fair* or *Poor* based on the *Guidelines for Management of Topsoil and Overburden* (DOGM 2005), they are native soils that are supporting good grass, shrub, and tree communities.

Soil Texture

Soil textures in the Powerline Corridor soil survey area included loam, sandy loam, loamy sand, and sand. The percent clay ranged from 0 to 15 percent. The taxonomic particle size classes are coarse-loamy and loamy-skeletal (coarse-loamy range). Four of the seven soil profiles were skeletal with greater than 35 percent rock fragments in the control section.

Soil Families

Soils in the Powerline Corridor soil survey area were classified to the taxonomic family using the *Keys to Soil Taxonomy, Twelfth Edition* (USDA NRCS 2014d). Six distinct soil families were identified in the soil survey area. The priority for soil family name selection was based on the following criteria:

1. Soil family name was previously used by either the Manti LaSal National Forest or NRCS as part of the previous order 3 mapping completed in and adjacent to the Powerline Corridor soil survey area.
2. Soil family name was previously used by the NRCS on another soil survey in Utah.
3. Soil family name was previously mapped by the NRCS in a state adjacent to Utah.
4. Soil family name is from an established soil series (USDA 2014c).

The soil profiles described in the Powerline Corridor soil survey are listed in Table 7.

Table 7. Taxonomic classification of soil profiles described and sampled in the Powerline Corridor soil survey area.

Profile	Family	Taxonomic Classification
14SKY08	McCadden	Lithic Haplocryoll loamy-skeletal, mixed, superactive
14SKY09	Lotex	Lithic Haplocryoll loamy, mixed, superactive
14SKY10	Scout	Ustic Haplocryept loamy-skeletal, mixed, superactive
14SKY11	Rock Outcrop	
14SKY12	Hailman	Pachic Haplocryoll coarse-loamy, mixed, superactive
14SKY13	Merino	Lithic Haplocryept loamy-skeletal, mixed, superactive
14SKY14	Kamack	Typic Haplocryoll loamy-skeletal, mixed, superactive
14SKY15	Hailman	Pachic Haplocryoll coarse-loamy, mixed, superactive

Potential suitability of soils (Good, Fair, or Poor) in these soil family descriptions are based on the *Guidelines for Management of Topsoil and Overburden* (DOGM 2005).

Hailman Family

Pachic Haplocryolls coarse-loamy, mixed, superactive

Representative soil profile: 14SKY15

Hailman family soils occur on concave and linear gently sloping to very steep slopes. They have thick dark surfaces (pachic) and are coarse textured with less than 18 percent clay in the control section. Hailman family soils have a *Good* to *Fair* Available Water Capacity. Typically, these soils have sandstone bedrock within 150 cm (60 inches) of the soil surface.

The Hailman family soils are a *Poor* source of reclamation material due to the pH of 5.7 throughout the representative soil profile. While the soil pH rates the typifying profile for Hailman family soils as *Poor*, there is a well established mountain big sagebrush community growing at the location. Other Hailman family soil profiles(14SKY12) have *Good* to *Fair* soil pH.

Native vegetation is mountain big sagebrush, Quaking aspen, mountain brome, grasses, and forbs.

The Hailman soil series was established in Wasatch County, Utah.

Kamack Family

Typic Haplocryolls loamy-skeletal, mixed, superactive

Representative soil profile: 14SKY14

Kamack family soils occur on steep to very steep linear convex south facing mountain backslopes and footslopes. They have dark surfaces (mollic), are coarse textured with less than 18 percent clay and greater than 35 percent rock fragments in the control section. Kamack family soils have *Fair* Available Water Capacity. Typically, these soils have fractured shale within 150 cm (60 inches) of the soil surface.

Native vegetation is mountain big sagebrush, mountain brome, Oregon grape, buckwheat, and grasses.

The Kamack family soils are a *Fair* to *Poor* source of reclamation material to 51 cm (20 inches) based on pH in the representative soil profile. The subsoil below 51 cm (20 inches) is loamy sand and is *Fair* source of reclamation material.

The Kamack soil series was established in Summit County, Utah.

Lotex Family
Lithic Haplocryolls loamy, mixed, superactive

Representative soil profile: 14SKY09

Lotex family soils are shallow to sandstone bedrock (less than 20 inches) and occur on mountain ridges. They have dark surfaces (mollic) and are coarse textured with less than 18 percent clay in the control section. Kamack family soils have *Good* Available Water Capacity.

Native vegetation is dominated by Quaking aspen, mountain brome, and needlegrass.

Lotex family soils are a *Fair* source of reclamation material limited by pH and saturation percent. They are also limited by the shallow depth to sandstone bedrock.

The Lotex soil series was established in Daggett County, Utah.

McCadden Family
Lithic Haplocryolls loamy-skeletal, mixed, superactive

Representative soil profile: 14SKY08

McCadden family soils are shallow to sandstone bedrock (less than 20 inches) and occur on mountain ridges. They have dark surfaces (mollic) and are coarse textured with less than 18 percent clay and greater than 35 percent rock fragments in the control section. McCadden family soils have *Good* Available Water Capacity.

Native vegetation is dominated by grasses, sagebrush, and coneflowers. These soils also support stands of mixed conifer and Quaking aspen on the mountain ridge.

McCadden family soils are a *Fair* to *Poor* source of reclamation material limited by pH and saturation percent. They are also limited by the shallow depth to sandstone bedrock.

The McCadden soil series was established in Utah County, Utah.

Merino Family
Lithic Haplocryepts loamy-skeletal, mixed, superactive

Representative soil profile: 14SKY13

Merino family soils are shallow to sandstone bedrock (less than 20 inches) and occur on steep to very steep linear mountain slopes. They have light colored surfaces (ochric), are coarse textured with less than 18 percent clay and greater than 35 percent rock fragments in the control section. Merino family soils have *Fair* Available Water Capacity.

Native vegetation is dominated by lodgepole pine (approximately 95 percent dead in vicinity of representative profile), elderberry, needlegrass, and mountain brome.

Merino family soils are a *Fair* to *Poor* source of reclamation material limited by pH and loamy sand textures. They are also limited by the shallow depth to sandstone bedrock. The representative soil profile had a very thick surface of decomposing needles, twigs, and cones, underlain by highly decomposed organic layer.

The Merino soil series was established in Colorado and used as a soil family name in the Manti LaSal National Forest soil survey (map unit 401).

Scout Family

Ustic Haplocryepts loamy-skeletal, mixed, superactive

Representative soil profile: 14SKY10

Scout family soils formed in very deep (greater than 150 cm or 60 inches) colluvium from sandstone on steep to very steep north facing mountain slopes. They have light colored surfaces (ochric) and are coarse textured with less than 18 percent clay and greater than 35 percent rock fragments in the control section. Scout family soils have *Fair* to *Good* Available Water Capacity in the upper 80 cm (32 inches) and *Poor* below 80 cm due to the sand texture.

Native vegetation is dominated by dead or dying mixed conifer forests. Quaking aspen shoots, currant, mountain brome, and mountain snowberry were observed in the vicinity of the representative pedon. The slope where the representative profile was described had recently been logged.

Scout family soils are a *Fair* source of reclamation material to a depth of 56 cm (22 inches) based on the representative soil profile. The underlying subsoil consists of very cobbly and extremely cobbly loamy sand and sand.

The Scout soil series was established in Cache County, Utah and used as a soil family name in the Manti LaSal National Forest soil survey (map unit 81).

Section Three

Soils Legend

Soils in the Powerline Corridor survey area were described with five soil map units and three miscellaneous landform units, Table 8.

Table 8. Soil map unit composition.

Map Unit	Pct	Family	Taxonomic	Profile	Vegetation
A	Hailman family loam, 20 to 65 percent slopes				
	90	Hailman	Pachic Haplocryolls coarse-loamy, mix, super	14SKY12	Aspen grass
	10	Lotex	Lithic Haplocryolls loamy, mixed, superactive		Aspen grass
C	Scout - Merino families complex, 15 to 60 percent slopes				
	55	Scout	Ustic Haplocryepts loamy-skeletal, mix, super	14SKY10	Conifer
	35	Merino	Lithic Haplocryepts loamy-skeletal, mix, super	14SKY13	Conifer
	10	Hailman	Pachic Haplocryolls coarse-loamy, mix, super		Aspen grass
Dc		Coal	Coal Pile		
Dm		Mine	Mine Facilities	14SKY11	
R	Lotex - McCadden families complex, 5 to 25 percent slopes				
	45	Lotex	Lithic Haplocryolls loamy, mixed, superactive	14SKY09	Aspen grass
	40	McCadden	Lithic Haplocryolls loamy-skeletal, mix, super	14SKY08	MC/Aspen/Grass
	10	Hailman	Pachic Haplocryolls coarse-loamy, mix, super		
	5	Merino	Lithic Haplocryepts loamy-skeletal, mix, super		
S1	Hailman family sandy loam, 5 to 15 percent slopes				
	90	Hailman	Pachic Haplocryoll coarse-loamy, mix, super	14SKY15	Sage/grass
	10	Kamack	Typic Haplocryoll loamy-skeletal, mix, super		Sage/grass
S2	Kamack family sandy loam, 10 to 35 percent slopes				
	85	Kamack	Typic Haplocryolls loamy-skeletal, mix, super	14SKY14	Sage/grass
	10	Hailman	Pachic Haplocryolls coarse-loamy, mix, super		Sage/grass
	5	Lotex	Lithic Haplocryolls loamy, mixed, superactive		Sage/grass
U	Underground Powerline Area				

Map Unit Descriptions

Potential suitability of soils (Good, Fair, or Poor) in these map unit descriptions are based on the *Guidelines for Management of Topsoil and Overburden* (DOGM 2005).

A Hailman family loam, 20 to 65 percent slopes

The A (aspen) soil map unit is located on steep to very steep south facing mountain sideslopes in Eccles Canyon north and northwest of the existing surface mine facilities. This map unit is dominated by soils that are deep to fractured sandstone.

The map unit consists of 90 percent Hailman family soils. Soil profile 14SKY12 is representative of Hailman family soils in map unit A. Also included in this map unit are 10 percent Lotex family soils and other similar soils.

Native vegetation consists of quaking aspen, mountain big sagebrush, and grasses.

This soil map unit is limited by steep slopes. These soils are a *Good* to *Fair* source of topsoil and subsoil for reclamation depending on the soil pH.

C Scout - Merino families complex, 15 to 60 percent slopes

The C (conifer) soil map unit is located on steep to very steep north facing mountain sideslopes in Eccles Canyon and Upper Huntington Canyon. This map unit is dominated by soils that formed in colluvium from sandstone and soils that are shallow to sandstone.

The map unit consists of 55 percent Scout family soils that formed in colluvium and 35 percent Merino family soils which are shallow to sandstone. Soil profile 14SKY10 is representative of Scout family soils and 14SKY13 is representative of Merino family soils in map unit C. Also included are 10 percent Hailman family soils in swales and other similar soils.

Native vegetation is dominated by dying mixed conifer stands.

This soil map unit is limited by steep slopes and depth to sandstone bedrock. These soils are a *Fair* to *Poor* source of topsoil and subsoil for reclamation depending on the soil pH and depth to sandstone bedrock.

Dc Coal Pile

Soils in this area have been previously disturbed for an existing coal stockpile and coal handling facilities.

Dm Mine Facilities

Soils in this area have been previously disturbed for construction of surface mine facilities and parking areas. Description 14SKY11 is representative of the soil resource at a proposed power pole location in this map unit.

R Lotex - McCadden families complex, 5 to 25 percent slopes

The R (ridge) soil map unit is located on a mountain ridge that traverses the Wasatch Plateau between Eccles Canyon on the northeast and Upper Huntington Canyon on the southwest. This map unit is dominated by soils that are shallow (less than 50 cm or 20 inches) to fractured sandstone bedrock.

The map unit consists of 45 percent Lotex family soils on gently sloping sections of the ridge and 40 percent McCadden family soils on the ridge summit. Soil profile 14SKY09 is representative of Lotex family soils and 14SKY08 is representative of McCadden family soils in map unit R. Also included are 10 percent Hailman family soils on concave sideslopes, 5 percent Merino family soils on convex sideslopes and shoulders, and other similar soils.

Native vegetation is dominated by aspen on Lotex family soils and a mixture of mixed conifer, aspen, and mountain shrubs on the McCadden family soils.

This soil map unit is limited by the shallow depth to sandstone bedrock. Proposed disturbances in this map unit will be limited to driving on the native surface for installation of power poles.

S1 Hailman family sandy loam, 5 to 15 percent slopes

The S1 (sagebrush) soil map unit is located on gently to strongly sloping mountain footslopes at the juncture of Upper Huntington and Swens canyons. This map unit is dominated by soils that are deep to sandstone and shale.

This map unit consists of 90 percent Hailman family soils. Soil profile 14SKY15 is representative of Hailman family soils in map unit S1. Also included are 10 percent Kamack family soils and other similar soils.

Native vegetation is dominated by mountain big sagebrush, grasses, and forbs.

This soil map unit is a *Poor* source of topsoil and subsoil for reclamation based on the low soil pH. However, this area supports a healthy native vegetation community of mountain big sagebrush, grasses, and forbs.

S2 Kamack family sandy loam, 10 to 35 percent slopes

The S2 (sagebrush) soil map unit is located on moderately steep to steep mountain sideslopes near the bottom of Swens Canyon at the proposed ventilation shaft and escape shaft location. This map unit is dominated by soils that are deep to shale and sandstone.

This map unit consists of 85 percent Kamack family soils. Soil profile 14SKY14 is representative of Kamack family soils in map unit S2. Also included are 10 percent Hailman family soils in swales, 5 percent Lotex family soils on convex ridges, and other similar soils.

Native vegetation is dominated by mountain big sagebrush, grasses, and forbs.

This soil map unit is limited by steep slopes. It is a *Fair* to *Poor* source of topsoil and subsoil depending on soil pH.

U Underground Powerline Area

The proposed powerline installation plan is to route the powerline underground through this area. This area was not included as part of the Powerline Corridor order 2 soil survey. Soils information in this area is limited to the MLNF order 3 soil survey and visual observations of the area.

The MLNF soil survey mapped this area with two soil map units. The upland area was mapped as being similar to the S1 and S2 map unit delineations with MLNF map unit 32. A narrow strip along Upper Huntington Creek was mapped as MLNF map unit 42.

The wet soils in MLNF map unit 42 are susceptible to rutting when wet.

Section Four

Topsoil and Subsoil Salvage

Areas within the Powerline Corridor soil survey that will require salvage and stockpiling of topsoil and subsoil include the *Coal Pile Expansion* area west of the existing mine facilities and the *Swens Pad* ventilation shaft location in Upper Huntington Canyon. Topsoil salvage is not required for installation of power poles (R645-301-232.410).

Soil Limiting Features

Low Available Water Capacity

The coarse soil textures in the Powerline Corridor soil survey area results in *Fair* to *Poor* Available Water Capacity (AWC) in approximately one-half of the soil horizons. AWC values were estimated using the *Soil Water Characteristics* model (Saxton 2009). This model adjusts the AWC for texture, organic matter, rock fragments and salinity. The estimated AWC values are listed in Table D-2 in Appendix D.

Table 9 lists the estimated AWC suitability for each soil profile based on criteria set forth in the *Guidelines for Management of Topsoil and Overburden* (DOGM 2005). Table 10 lists the AWC suitability by soil map unit.

Table 9. Suitability of topsoil and subsoil suitability for soil profiles.

Soil Profile	Soil Family	Topsoil AWC Suitability[1]	Subsoil AWC Suitability[1]
14SKY08	McCadden	Good	---- [2]
14SKY09	Lotex	Good	---- [2]
14SKY10	Scout	Good	Fair/Poor
14SKY11	Rock Outcrop	None	---- [2]
14SKY12	Hailman	Good	Good
14SKY13	Merino	Fair	---- [2]
14SKY14	Kamack	Fair	Fair/Poor
14SKY15	Hailman	Good	Fair

1. Suitability based on criteria set forth in *Guidelines for Management of Topsoil and Overburden* (DOGM 2005).
2. Subsoil included in topsoil rating for these shallow soils.

Table 10. Suitability of topsoil and subsoil AWC by soil map units, based on the dominate soil type in each map unit.

Soil Profile	Topsoil AWC Suitability[1]	Subsoil AWC Suitability[1]
A	Good	Good
C	Good	Fair/Poor
Dc	NA	NA
Dm	NA	NA
R	Good	---- [2]
S1	Fair	Fair/Poor
S2	Good	Fair
U	NA	NA

1. Suitability based on criteria set forth in *Guidelines for Management of Topsoil and Overburden* (DOGM 2005).
2. Subsoil included in topsoil rating for these shallow soils.

NA Not Applicable

Shallow Soils

Shallow soils are a limiting soil feature in soil map units C and R which have major components that are shallow. The estimated average topsoil salvage depth for each of these map units is 14 inches or greater. Use of substitute soil is not anticipated to be necessary for either soil map unit.

Topsoil and Subsoil Salvage Depths

Topsoil and subsoil salvage should be expected to vary within the soil map units. Salvage operations should be monitored to avoid mixing of topsoil and subsoil. Table 11 lists the estimated average topsoil and subsoil salvage depths for each soil map unit. Actual salvage depths should be expected to vary in the field and should be monitored during construction.

Topsoil and subsoil stockpiles should be protected from wind and water erosion.

Table 11. Estimated average topsoil and subsoil salvage depths based on weighted averages.

Map Unit	Map Unit Name	Estimated Topsoil Salvage Depth[1]	Estimated Subsoil Salvage Depth[1]	Estimated Total Salvage Depth[1]
		inches	inches	inches
A	Hailman loam, 20-65% slopes	19	12	31
C	Scout - Merino families complex, 15-60% slopes	17	1	18
Dc	Coal stockpile	0	0	0
Dm	Mine facilities	0	0	0
R	Lotex - McCadden families complex, 5-25% slopes	14	1	15
S1	Hailman family sandy loam, 5-15% slopes	16	27	43
S2	Kamack family sandy loam, 10-35% slopes	10	31	41
U	Underground powerline area	NA	NA	NA

1. Estimated salvage depths are based on weighted averages that take into account the contribution of each soil map unit component based on its percent occurrence in the map unit.
NA Not Applicable

Replacement of Topsoil and Subsoil

Topsoil and subsoil should be replaced in the reverse order of how they were removed. Subsoil replaced first followed by replacement of the topsoil. Reduction of soil compaction in either or both the topsoil and subsoil may be required prior to seeding.

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Appendix A

Soil Profile Descriptions

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Profile Descriptions

- Representative soil profile descriptions were described and sampled on September 19 and 20, 2014.

- Soil textures (USDA) and the percents sand, silt, and clay listed with these soil profile descriptions are the laboratory analysis results. Complete laboratory analysis results are in Appendix D.

- Electrical conductivity (ECe), saturated paste pH, and percent calcium carbonate values listed with these soil profile descriptions are the laboratory analysis results. Complete laboratory analysis results are in Appendix D.

- Soil profile data (field and selected laboratory analysis parameters) was entered into a database using Pedon PC software (Soil Survey Staff 2014).

14SKY08

Pedon ID: 14SKY08
Description Date: 9/19/2014
Describer: Robert Long

Soil Name As Correlated: McCadden family
Current Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryolls
Current Taxon Kind: Family
County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 481178E, 4390982N -- Datum NAD83, Zone 12
Legal Description: Section 26, Township 13 South, Range 6 East of the 29 Meridian

Landscape: mountains
Landform: ridge
Geomorphic Component: Mountaintop
Profile Pos: Summit
Slope: 9 percent
Elevation: 2942 meters (9652.2 feet)
Aspect: 2°
Shape: up/down: Convex; **across:** Linear

Drainage: Well drained
Runoff: Low
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover;
Existing Vegetation: FESTU - fescue (*Festuca*); RUDBE - coneflower (*Rudbeckia*); ARCA13 - silver sagebrush (*Artemisia cana*)

Surface Fragments: 10 percent angular sandstone gravels; 5 percent angular sandstone channers.

Parent Materials: residuum weathered from calcareous sandstone
Bedrock: Calcareous sandstone
Particle Size Control Section: 25 to 36 centimeters (9.8 to 14.2 inches)
Diagnostic Features: Mollic epipedon: 0 to 36 centimeters (0 to 14.2 inches), Cambic horizon: 9 to 36 centimeters (3.5 to 14.2 inches) and Lithic contact: 36 centimeters (14.2 inches)
Restrictions: Lithic bedrock: 36 centimeters (14.2 inches)

A --- 0 to 9 centimeters (0 to 3.5 inches); dark brown (10YR 3/3) moist, gravelly loam; grayish brown (10YR 5/2) dry; 44 percent sand; 41 percent silt; 15 percent clay; weak medium subangular blocky parting to moderate medium granular structure; very friable, slightly hard, nonsticky, slightly plastic; common medium roots throughout, common fine roots throughout and many very fine roots throughout; 20 percent angular sandstone gravels; electrical conductivity of 0.21 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.6, pH meter; clear smooth boundary; $CaCO_3$ 0.7 Percent.

Bw --- 9 to 36 centimeters (3.5 to 14.2 inches); dark brown (10YR 3/3) moist, very cobbly loam; brown (10YR 5/3) dry; 34 percent sand; 51 percent silt; 15 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; 20 percent angular sandstone cobbles and 15 percent angular sandstone gravels; electrical conductivity of 0.17 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.1, pH meter; abrupt smooth boundary; $CaCO_3$ 0.6 Percent.

R --- 36 centimeters (14.2 inches); fractured sandstone.

14SKY09

Pedon ID: 14SKY09
Description Date: 9/20/2014
Describer: Robert Long

Soil Name As Correlated: Lotex family
Current Taxonomic Class: Loamy, mixed, superactive Lithic Haplocryolls
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 481782E, 4391244N -- Datum NAD83, Zone 12
Legal Description: Section 23, Township 13 South, Range 6 East of the 29 Meridian

Landscape: mountains
Landform: ridge
Geomorphic Component: Mountaintop
Profile Pos: Summit
Slope: 23 percent
Elevation: 2883 meters (9458.7 feet)
Aspect: 70°
Shape: up/down: Concave; **across:** Convex

Drainage: Well drained
Runoff: Medium
Erosion: Class 1 - Sheet erosion

Primary Earth Cover: Tree cover;
Existing Vegetation: POTR5 - quaking aspen (*Populus tremuloides*); BRMA4 - mountain brome (*Bromus marginatus*); STIPA - needlegrass (*Stipa*)

Surface Fragments: 5 percent subangular sandstone gravels.

Parent Materials: residuum weathered from sandstone
Bedrock: at 30 centimeters (11.8 inches)
Particle Size Control Section: 25 to 30 centimeters (9.8 to 11.8 inches)
Diagnostic Features: Mollic epipedon: 0 to 30 centimeters (0 to 11.8 inches), Cambic horizon: 13 to 30 centimeters (5.1 to 11.8 inches) and Lithic contact: 30 centimeters (11.8 inches)
Restrictions: Lithic bedrock: 30 centimeters (11.8 inches)

A --- 0 to 13 centimeters (0 to 5.1 inches); very dark grayish brown (10YR 3/2) moist, sandy loam; dark grayish brown (10YR 4/2) dry; 58 percent sand; 33 percent silt; 9 percent clay; weak medium subangular blocky parting to moderate medium granular structure; very friable, slightly hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone gravels; electrical conductivity of 0.25 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; neutral, pH 6.7, pH meter; clear smooth boundary; CaCO3 1.5 Percent.

Bw --- 13 to 30 centimeters (5.1 to 11.8 inches); very dark grayish brown (10YR 3/2) moist, sandy loam; grayish brown (10YR 5/2) dry; 56 percent sand; 33 percent silt; 11 percent clay; weak medium granular parting to strong medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 10 percent subangular sandstone gravels; electrical conductivity of 0.14 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 6, pH meter; abrupt smooth boundary; CaCO3 0.6 Percent.

R --- 30 centimeters (11.8 inches); sandstone.

14SKY10

Pedon ID: 14SKY10
Description Date: 9/19/2014
Describer: Robert Long

Soil Name As Correlated: Scout family
Current Taxonomic Class: Loamy-skeletal, mixed, superactive Ustic Haplocryepts
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 482898E, 4392680N -- Datum NAD83, Zone 12
Legal Description: Section 13, Township 13 South, Range 6 East of the 29 Meridian
Landscape: mountains
Landform: mountain slope
Geomorphic Component: Lower third of mountainflank
Profile Pos: Backslope
Slope: 20 percent
Elevation: 2628 meters (8622 feet)
Aspect: 10°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: Medium
Erosion: None

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Other shrub cover
Existing Vegetation: POTR5 - quaking aspen (*Populus tremuloides*); BRMA4 - mountain brome (*Bromus marginatus*); SYMPH - snowberry (*Symphoricarpos*); RIBES - currant (*Ribes*)

Surface Fragments: 3 percent angular sandstone gravels; 2 percent angular sandstone cobbles.

Parent Materials: colluvium derived from sandstone
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Mollic epipedon: 4 to 15 centimeters (1.6 to 5.9 inches) and Cambic horizon: 15 to 34 centimeters (5.9 to 13.4 inches)

Oi --- 0 to 4 centimeters (0 to 1.6 inches); needles and twigs.

A --- 4 to 15 centimeters (1.6 to 5.9 inches); dark brown (7.5YR 3/2) moist, gravelly sandy loam; brown (7.5YR 5/3) dry; 58 percent sand; 35 percent silt; 7 percent clay; weak medium platy parting to moderate medium granular structure; very friable, slightly hard, nonsticky, nonplastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; 20 percent subangular sandstone gravels; electrical conductivity of 0.27 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; neutral, pH 6.7, pH meter; clear smooth boundary; $CaCO_3$ 1 Percent.

Bw --- 15 to 34 centimeters (5.9 to 13.4 inches); brown (7.5YR 4/3) moist, gravelly sandy loam; light brown (7.5YR 6/3) dry; 54 percent sand; 39 percent silt; 7 percent clay; moderate medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone cobbles and 15 percent subangular sandstone gravels; electrical conductivity of 0.14 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.2, pH meter; clear smooth boundary; $CaCO_3$ 0.8 Percent.

C --- 34 to 56 centimeters (13.4 to 22 inches); brown (10YR 4/3) moist, very gravelly sandy loam; very pale brown (10YR 7/3) dry; 62 percent sand; 32 percent silt; 6 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; very friable, hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone stones, 5 percent subangular sandstone cobbles and 30 percent subangular sandstone gravels; electrical conductivity of 0.11 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.2, pH meter; abrupt wavy boundary; $CaCO_3$ 0.8 Percent.

2A --- 56 to 80 centimeters (22 to 31.5 inches); very dark gray (10YR 3/1) moist, very cobbly loamy sand; gray (10YR 5/1) dry; 82 percent sand; 14 percent silt; 4 percent clay; moderate medium subangular blocky parting to single grain and moderate fine subangular blocky structure; very friable, hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone stones, 20 percent subangular sandstone cobbles and 20 percent subangular sandstone gravels; electrical conductivity of 0.11 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.1, pH meter; clear wavy boundary; $CaCO_3$ 3.8 Percent.

2C1 --- 80 to 130 centimeters (31.5 to 51.2 inches); grayish brown (10YR 5/2) moist, very cobbly sand; light gray (10YR 7/2) dry; 90 percent sand; 10 percent silt; 0 percent clay; single grain; loose, loose, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; 10 percent subangular sandstone stones, 25 percent subangular sandstone cobbles and 20 percent subangular sandstone gravels; electrical conductivity of 0.08 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.4, pH meter; gradual smooth boundary; $CaCO_3$ 0.5 Percent.

2C2 --- 130 to 160 centimeters (51.2 to 63 inches); grayish brown (10YR 5/2) moist, extremely cobbly sand; light gray (10YR 7/2) dry; 92 percent sand; 8 percent silt; 0 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; 10 percent subangular sandstone stones, 35 percent subangular sandstone cobbles and 20 percent subangular sandstone gravels; electrical conductivity of 0.08 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.1, pH meter; $CaCO_3$ 0.1 Percent.

14SKY11

Pedon ID: 14SKY11
Description Date: 9/19/2014
Describer: Robert Long

Site Notes: Power pole location staked north of highway and conveyor in previously disturbed area. No safe access to area. Location consists of shallow soils, sandstone outcrop, and very steep slopes. Distant observations made from south side of highway.

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 482836E, 4392973N -- Datum NAD83, Zone 12
Legal Description: Section 13, Township 13 South, Range 6 East of the 29 Meridian

Landscape: mountains
Landform: mountain slope
Geomorphic Component: Free face
Profile Pos: Backslope
Slope: 42 percent
Elevation: 2668 meters (8753.3 feet)
Aspect: 185°
Shape: up/down: Concave; **across:** Convex

Runoff: Very high
Erosion: Class 4

Primary Earth Cover: Barren land; **Secondary Earth Cover:**
Parent Materials: sandstone
Restrictions: Lithic bedrock

14SKY12

Pedon ID: 14SKY12
Description Date: 9/19/2014
Describer: Robert Long

Pedon Notes: Soil is similar to Adel, but this profile is coarse-loamy and Adel is fine-loamy.

Soil Name As Correlated: Hailman family
Current Taxonomic Class: Coarse-loamy, mixed, superactive Pachic Haplocryolls
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 482211E, 4392882N -- Datum NAD83, Zone 12
Legal Description: Section 13, Township 13 South, Range 6 East of the 29 Meridian
Landscape: mountains
Landform: mountain slope
Geomorphic Component: Lower third of mountainflank
Profile Pos: Backslope
Slope: 60 percent
Elevation: 2688 meters (8818.9 feet)
Aspect: 162°
Shape: up/down: Linear; **across:** Linear

Drainage: Well drained
Runoff: Medium
Erosion: None - deposition

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: POTR5 - quaking aspen (*Populus tremuloides*); BRMA4 - mountain brome (*Bromus marginatus*); ELTR7 - slender wheatgrass (*Elymus trachycaulus*)

Surface Fragments: 2 percent sandstone boulders.

Parent Materials: residuum weathered from sandstone
Bedrock: Sandstone at 84 centimeters (33.1 inches)
Particle Size Control Section: 25 to 84 centimeters (9.8 to 33.1 inches)
Diagnostic Features: Mollic epipedon: 0 to 50 centimeters (0 to 19.7 inches), Cambic horizon: 20 to 84 centimeters (7.9 to 33.1 inches) and Lithic contact: 84 centimeters (33.1 inches)
Restrictions: Lithic bedrock: 84 centimeters (33.1 inches)

A --- 0 to 20 centimeters (0 to 7.9 inches); very dark grayish brown (10YR 3/2) moist, loam; grayish brown (10YR 5/2) dry; 46 percent sand; 39 percent silt; 15 percent clay; weak medium subangular blocky parting to moderate coarse granular structure; very friable, slightly hard, slightly sticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent angular sandstone gravels and 1 percent angular sandstone boulders; electrical conductivity of 0.31 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; neutral, pH 6.6, pH meter; clear smooth boundary; $CaCO_3$ 1.3 Percent.

Bw1 --- 20 to 50 centimeters (7.9 to 19.7 inches); very dark grayish brown (10YR 3/2) moist, loam; grayish brown (10YR 5/2) dry; 46 percent sand; 37 percent silt; 17 percent clay; moderate medium prismatic parting to strong medium subangular blocky structure; friable, hard, slightly sticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent angular sandstone gravels; electrical conductivity of 0.18 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; neutral, pH 6.6, pH meter; gradual smooth boundary; $CaCO_3$ 1 Percent.

Bw2 --- 50 to 84 centimeters (19.7 to 33.1 inches); dark grayish brown (10YR 4/2) moist, loam; light brownish gray (10YR 6/2) dry; 48 percent sand; 36 percent silt; 16 percent clay; strong medium prismatic parting to strong medium subangular blocky structure; friable, hard, slightly sticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 10 percent angular sandstone gravels; electrical conductivity of 0.15 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.4, pH meter; abrupt smooth boundary; $CaCO_3$ 1 Percent.

R --- 84 centimeters (33.1 inches); fractured sandstone.

14SKY13

Pedon ID: 14SKY13
Description Date: 9/19/2014
Describer: Robert Long

Soil Name As Correlated: Merino
Current Taxonomic Class: Loamy-skeletal, mixed, superactive Lithic Haplocryepts
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 482182E, 4392746N -- Datum NAD83, Zone 12
Legal Description: Section 13, Township 13 South, Range 6 East of the 29 Meridian
Landscape: mountains
Landform: mountain slope
Geomorphic Component: Center third of mountainflank
Profile Pos: Backslope
Slope: 30 percent
Elevation: 2700 meters (8858.3 feet)
Aspect: 15^{o}
Shape: up/down: Linear; **across:** Linear

Drainage: Well drained
Runoff: Very low
Erosion: None - deposition

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: PICO - lodgepole pine (*Pinus contorta*); SAMBU - elderberry (*Sambucus*); STIPA - needlegrass (*Stipa*); BRMA4 - mountain brome (*Bromus marginatus*)

Surface Fragments: None observed.

Parent Materials: residuum weathered from sandstone
Bedrock: Sandstone at 55 centimeters (21.7 inches)
Particle Size Control Section: 18 to 55 centimeters (7.1 to 21.7 inches)
Diagnostic Features: Cambic horizon: 36 to 55 centimeters (14.2 to 21.7 inches) and Lithic contact: 55 centimeters (21.7 inches)
Restrictions: Lithic bedrock: 55 centimeters (21.7 inches)

Oi --- 0 to 5 centimeters (0 to 2 inches); needles, twigs, leaves, & cones.

Oe --- 5 to 18 centimeters (2 to 7.1 inches); decomposing pine needles.

A --- 18 to 36 centimeters (7.1 to 14.2 inches); brown (7.5YR 5/4) moist, loamy sand; light brown (7.5YR 6/3) dry; 74 percent sand; 23 percent silt; 3 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 10 percent angular sandstone gravels; electrical conductivity of 0.15 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.7, pH meter; clear smooth boundary; $CaCO_3$ 0.2 Percent.

Bw --- 36 to 55 centimeters (14.2 to 21.7 inches); brown (7.5YR 4/4) moist, gravelly loamy sand; light brown (7.5YR 6/3) dry; 75 percent sand; 22 percent silt; 3 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 15 percent angular sandstone gravels; electrical conductivity of 0.12 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 6, pH meter; abrupt smooth boundary; $CaCO_3$ 0.2 Percent.

R --- 55 centimeters (21.7 inches); fractured sandstone.

14SKY14

Pedon ID: 14SKY14
Description Date: 9/20/2014
Describer: Robert Long

Pedon Notes: Text: This site is transitional between frigid and cryic. Profile classified as cryic to fit with USFS soil mapping. Frigid alternative would be Pathead family mapped by NRCS east of mine at similar elevation and aspect.

Soil Name As Correlated: Kamack family
Current Taxonomic Class: Loamy-skeletal, mixed, superactive Typic Haplocryolls
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 478875E, 4390364N -- Datum NAD83, Zone 12
Legal Description: Section 27, Township 13 South, Range 6 East of the 29 Meridian

Landscape: mountains
Landform: mountain slope
Geomorphic Component: Lower third of mountainflank
Profile Pos: Backslope
Slope: 42 percent
Elevation: 2648 meters (8687.7 feet)
Aspect: 190°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: High
Erosion: Class 1 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*); BRMA4 - mountain brome (*Bromus marginatus*); MARE11 - Oregon grape (*Mahonia repens*); ERIOG - buckwheat (*Eriogonum*); FESTU - fescue (*Festuca*)

Surface Fragments: 10 percent subangular sandstone gravels; 3 percent subangular sandstone cobbles; 1 percent subangular sandstone stones; 1 percent subangular sandstone boulders.

Parent Materials: colluvium derived from sandstone over residuum weathered from siltstone
Bedrock: Calcareous shale at 108 centimeters (42.5 inches)
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Mollic epipedon: 0 to 23 centimeters (0 to 9.1 inches), Cambic horizon: 23 to 51 centimeters (9.1 to 20.1 inches) and Paralithic contact: 108 to 150 centimeters (42.5 to 59.1 inches)
Restrictions: Paralithic bedrock: 108 to 150 centimeters (42.5 to 59.1 inches)

A --- 0 to 23 centimeters (0 to 9.1 inches); dark brown (7.5YR 3/2) moist, gravelly sandy loam; brown (7.5YR 5/3) dry; 64 percent sand; 28 percent silt; 8 percent clay; weak medium subangular blocky parting to moderate medium granular structure; very friable, slightly hard, nonsticky, nonplastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; 1 percent subangular sandstone stones, 4 percent subangular sandstone cobbles and 10 percent subangular sandstone gravels; electrical conductivity of 0.17 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; slightly acid, pH 6.1, pH meter; clear smooth boundary; $CaCO_3$ 0.7 Percent.

Bw --- 23 to 51 centimeters (9.1 to 20.1 inches); pale brown (10YR 6/3) moist, extremely cobbly sandy loam; very pale brown (10YR 7/3) dry; 66 percent sand; 28 percent silt; 6 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone flags, 10 percent subangular sandstone stones, 20 percent subangular sandstone cobbles and 15 percent subangular sandstone gravels; electrical conductivity of 0.22 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.8, pH meter; clear smooth boundary; $CaCO_3$ 0.4 Percent.

C --- 51 to 108 centimeters (20.1 to 42.5 inches); yellowish brown (10YR 5/4) moist, very stony loamy sand; pale brown (10YR 6/3) dry; 80 percent sand; 17 percent silt; 3 percent clay; single grain; loose, loose, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; 25 percent subangular sandstone stones, 15 percent subangular sandstone cobbles and 10 percent subangular sandstone gravels; electrical conductivity of 0.1 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 6, pH meter; abrupt smooth boundary; $CaCO_3$ 0.6 Percent.

2Cr --- 108 to 150 centimeters (42.5 to 59.1 inches); few very fine roots around fragments; fractured shale.

14SKY15

Pedon ID: 14SKY15
Description Date: 9/20/2014
Describer: Robert Long

Pedon Notes: Text: Area is transitional between frigid and cryic. Correlated profile classification as cryic with USFS mapping of Toze family in area.

Soil Name As Correlated: Hailman family
Current Taxonomic Class: Coarse-loamy, mixed, superactive Pachic Haplocryolls
Current Taxon Kind: Family

County or Parish: UT007 - Carbon
State or Territory: UT - Utah
UTM: 478976E, 4390445N -- Datum NAD83, Zone 12
Legal Description: Section 27, Township 13 South, Range 6 East

Landscape: mountains
Landform: mountain slope
Geomorphic Component: Lower third of mountainflank
Profile Pos: Footslope
Slope: 12 percent
Elevation: 2652 meters (8700.8 feet)
Aspect: 105°
Shape: up/down: Concave; **across:** Concave

Drainage: Well drained
Runoff: Low
Erosion: Class 1 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ARTRV - mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*); STIPA - needlegrass (*Stipa*); BRMA4 - mountain brome (*Bromus marginatus*); FESTU - fescue (*Festuca*)

Surface Fragments: 5 percent subangular sandstone gravels.

Parent Materials: colluvium derived from sandstone over residuum weathered from sandstone
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Mollic epipedon: 0 to 44 centimeters (0 to 17.3 inches) and Argillic horizon: 18 to 74 centimeters (7.1 to 29.1 inches)

A --- 0 to 18 centimeters (0 to 7.1 inches); dark brown (7.5YR 3/2) moist, sandy loam; brown (7.5YR 5/3) dry; 60 percent sand; 34 percent silt; 6 percent clay; weak medium subangular blocky parting to moderate coarse granular structure; very friable, slightly hard, nonsticky, nonplastic; common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone gravels; electrical conductivity of 0.11 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.7, pH meter; clear smooth boundary; CaCO3 0.3 Percent.

Bw1 --- 18 to 44 centimeters (7.1 to 17.3 inches); dark brown (7.5YR 3/3) moist, sandy loam; brown (7.5YR 5/3) dry; 58 percent sand; 35 percent silt; 7 percent clay; weak medium prismatic parting to moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 5 percent subangular sandstone gravels; electrical conductivity of 0.09 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.7, pH meter; clear smooth boundary; CaCO3 0.4 Percent.

Bw2 --- 44 to 74 centimeters (17.3 to 29.1 inches); brown (7.5YR 4/2) moist, gravelly sandy loam; light brown (7.5YR 6/3) dry; 62 percent sand; 33 percent silt; 5 percent clay; moderate medium prismatic parting to moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common coarse roots throughout, common medium roots throughout, common fine roots throughout and common very fine roots throughout; 20 percent subangular sandstone cobbles and 10 percent subangular sandstone gravels; electrical conductivity of 0.07 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.7, pH meter; abrupt smooth boundary; CaCO3 0.1 Percent.

2C --- 74 to 110 centimeters (29.1 to 43.3 inches); brown (7.5YR 5/4) moist, very gravelly sandy loam; pink (7.5YR 7/3) dry; 70 percent sand; 29 percent silt; 1 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; 20 percent subangular sandstone cobbles and 20 percent subangular sandstone gravels; electrical conductivity of 0.06 mmhos/cm by EC meter, saturated paste; noneffervescent by HCl, 1 normal; moderately acid, pH 5.7, pH meter; weathered sandstone; CaCO3 0.3 Percent.

Appendix B

Soil Profile Location Photographs

Photo B - 1. Soil profile location 14SKY08, McCadden family soil; loamy-skeletal, mixed, superactive Lithic Haplocryolls. Looking northeast across opening surrounded by quaking aspen and Englemann spruce. Vegetation near profile location includes fescue and coneflower. Extensive rodent activity has mixed the surface horizon. Extensive amount of dead conifers in adjacent stands.

Photo B - 2. Soil profile location 14SKY08, McCadden family soil; loamy-skeletal, mixed, superactive Lithic Haplocryolls. Looking west southwest upslope across ridge. Soil is similar to Lotex (14SKY09), but it has more rock fragments.

Photo B - 3. Soil profile location 14SKY09, Lotex family; loamy, mixed superactive Lithic Haplocryolls. Looking upslope along ridge. Soil is similar to McCadden (14SKY08), but it has less rock fragments. Soil number in photo is incorrect.

Photo B - 4. Soil profile location 14SKY10, Storm family; loamy-skeletal, mixed, superactive Typic Haplocryepts. Looking west up slope across from Skyline mine surface facilities. Area has been recently logged. Significant amount of dead conifers in adjacent stand in background. Profile is on footslope.

Photo B - 5. Soil profile 14SKY10, Scout family; loamy-skeletal, mixed, superactive Ustic Haplocryepts. Buried surface at 56 cm (22 inches). Scout family soils were mapped by the Manti LaSal National Forest in similar settings including the southwest end of the powerline corridor and south of Swens Pad.

Photo B - 6. Location 14SKY11 is near sandstone outcrop near center of photo (11:00 from small conveyor building). Area has been previously disturbed. Site could not be accessed. Close-up of location can be seen in Photo B-7.

Photo B - 7. Close-up of location 14SKY11 is near exposed sandstone outcrop near center of photo as seen in Photo B-6.

Photo B - 8. Soil profile location 14SKY12, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls. Looking northeast across very steep 60 percent south southeast facing slope. Soil has a thick dark surface (pachic) and a strong cambic horizon. Control section (25-100 cm or 10 to 40 inches) has less than 18 percent clay.

Photo B - 9. Soil profile location 14SKY13, Merino family; loamy-skeletal, mixed, superactive Lithic Haplocryepts. Location is in stand of dead lodgepole pine, subalpine fir, and Englemann spruce on north facing slope. Fallen dead trees can be seen in photo. Soil was described in hole left by fallen tree.

Photo B - 10. Soil profile 14SKY13, Merino family; loamy-skeletal, mixed, superactive Lithic Haplocryepts. Profile had a very thick surface of decomposing needles, twigs, and cones. Merino family soils were mapped by the Manti LaSal National Forest in the area, but primarily on ridges dominated by grasses and shrubs.

Photo B - 11. Soil profile 14SKY14, Kamack family; loamy-skeletal, mixed, superactive Typic Haplocryolls. Rock fragments are subangular sandstone. The percent slay ranges from 3 to 8 percent in the soil profile. Fractured shale is at 108 cm (42.5 inches) in this profile (dark gray at bottom of hole in photo). Profile described in roadcut along Swens Canyon road on south side of proposed "Swens Pad."

Photo B - 12. Soil profile location 14SKY15, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls. Looking north across proposed "Swens Pad" location. Soil is similar to the Toze family soil mapped at this location, but 14SKY15 has an weighted average 4 percent clay in the control section (25 to 100 cm or 10 to 40 inches).

Photo B - 13. Soil profile location 14SKY15, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls. Looking west upslope from across profile (lower left in photo) in soil map unit S1 into the steeper S2 map unit at the proposed "Swens Pad" location.

Photo B - 14. Soil profile location 14SKY15, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls. Looking southeast from center of proposed Swens Pad" location across Upper Huntington Canyon. Proposed powerline route will cross Upper Huntington Creek and highway (light gray on right center of photo) through an underground bore.

Appendix C

Soil Profile Box Photographs

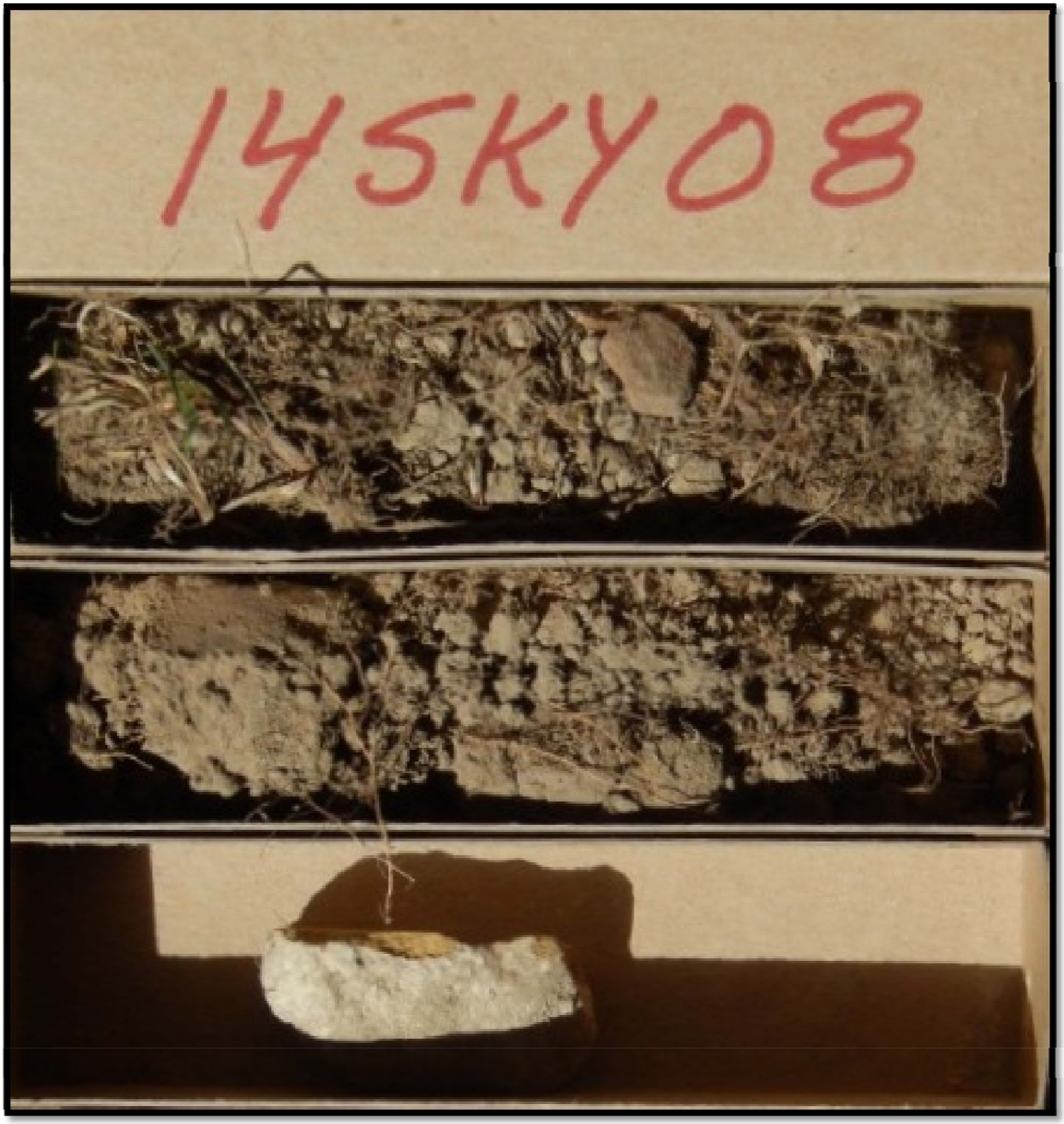

Photo C - 1. Soil profile 14SKY08, McCadden family soil; loamy-skeletal, mixed, superactive Lithic Haplocryolls.

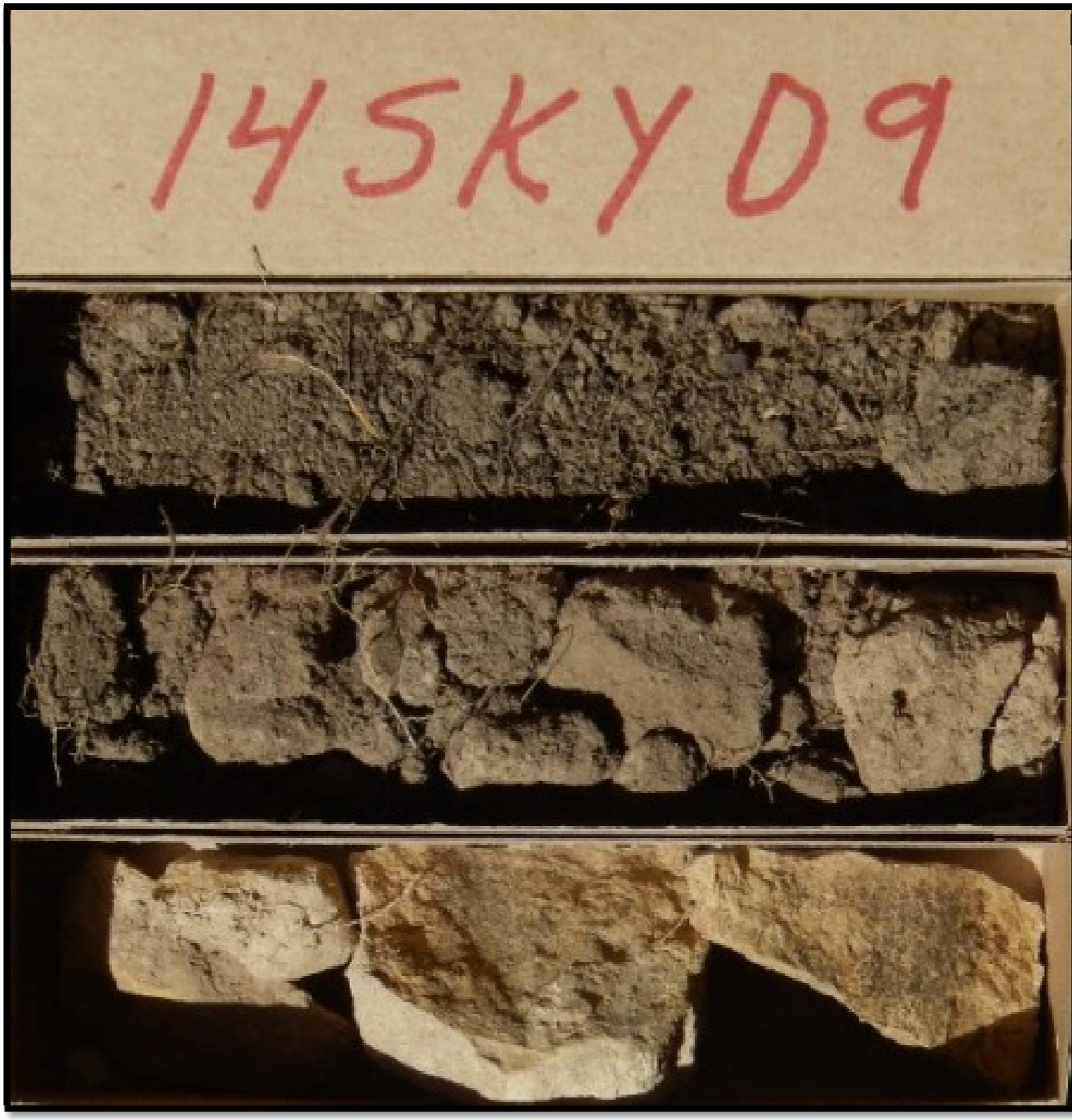

Photo C - 2. Soil profile 14SKY09, Lotex family; loamy, mixed superactive Lithic Haplocryolls.

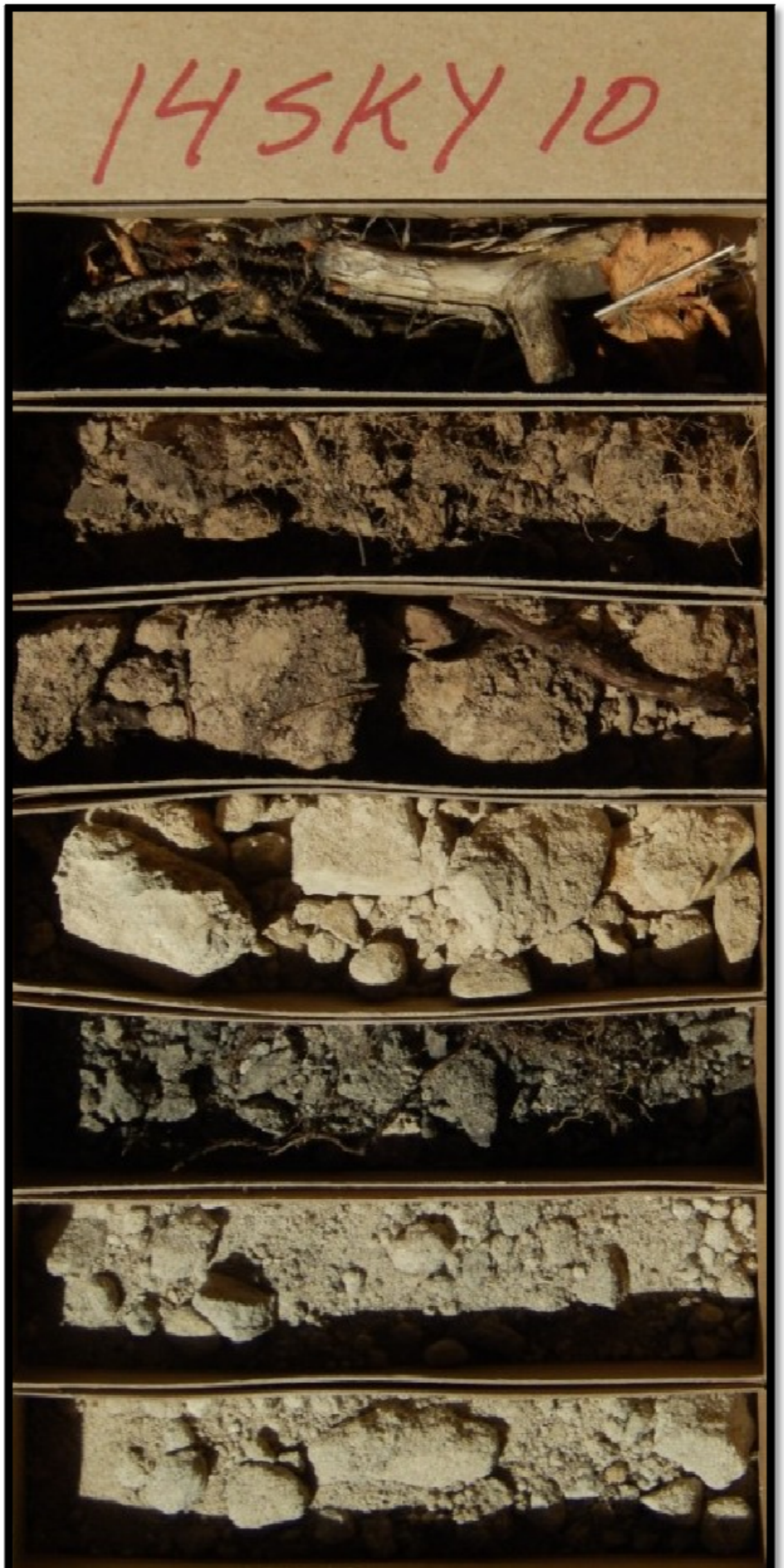

Photo C - 3. Soil profile 14SKY10, Storm family; loamy-skeletal, mixed, superactive Typic Haplocryepts.

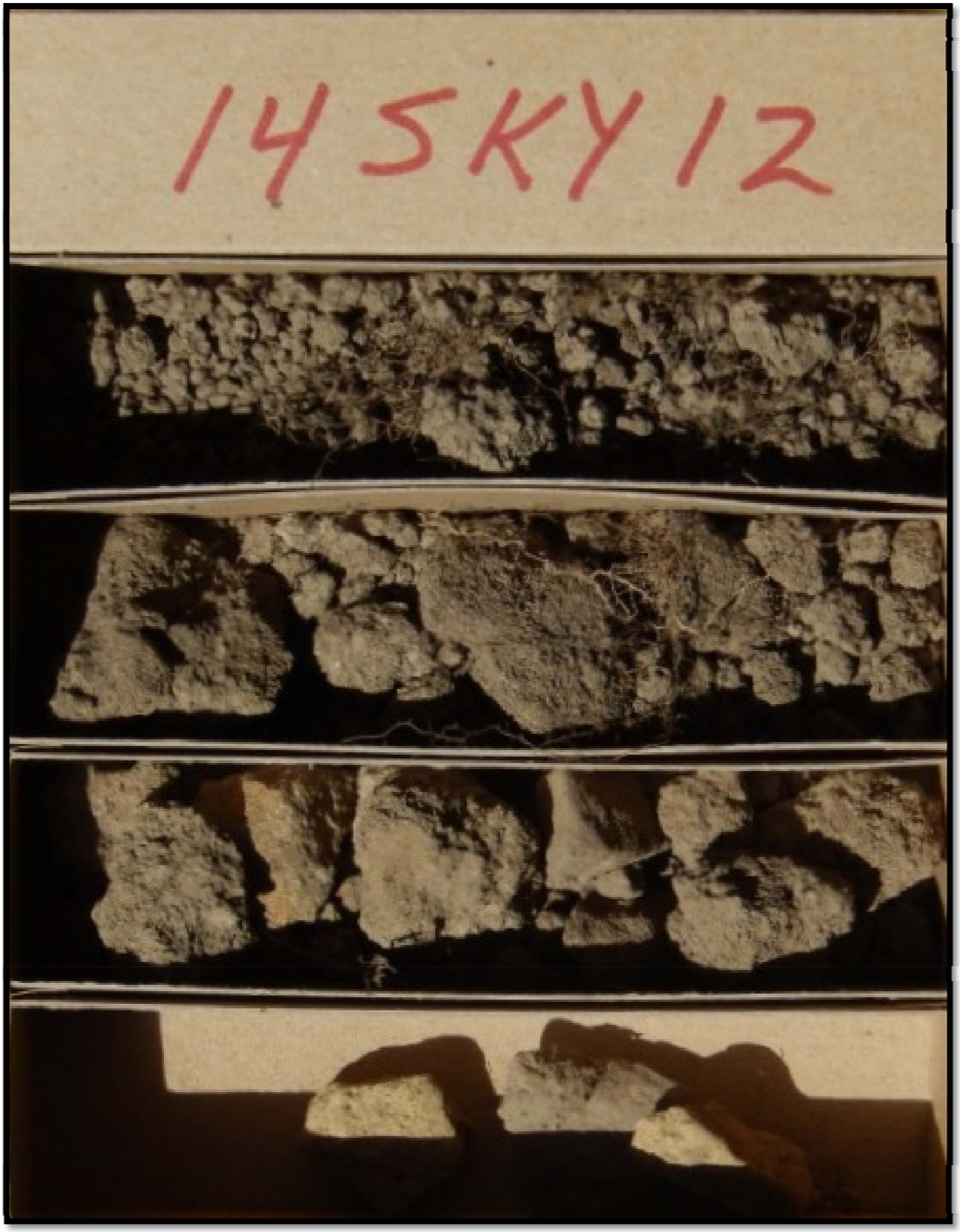

Photo C - 4. Soil profile 14SKY12, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls.

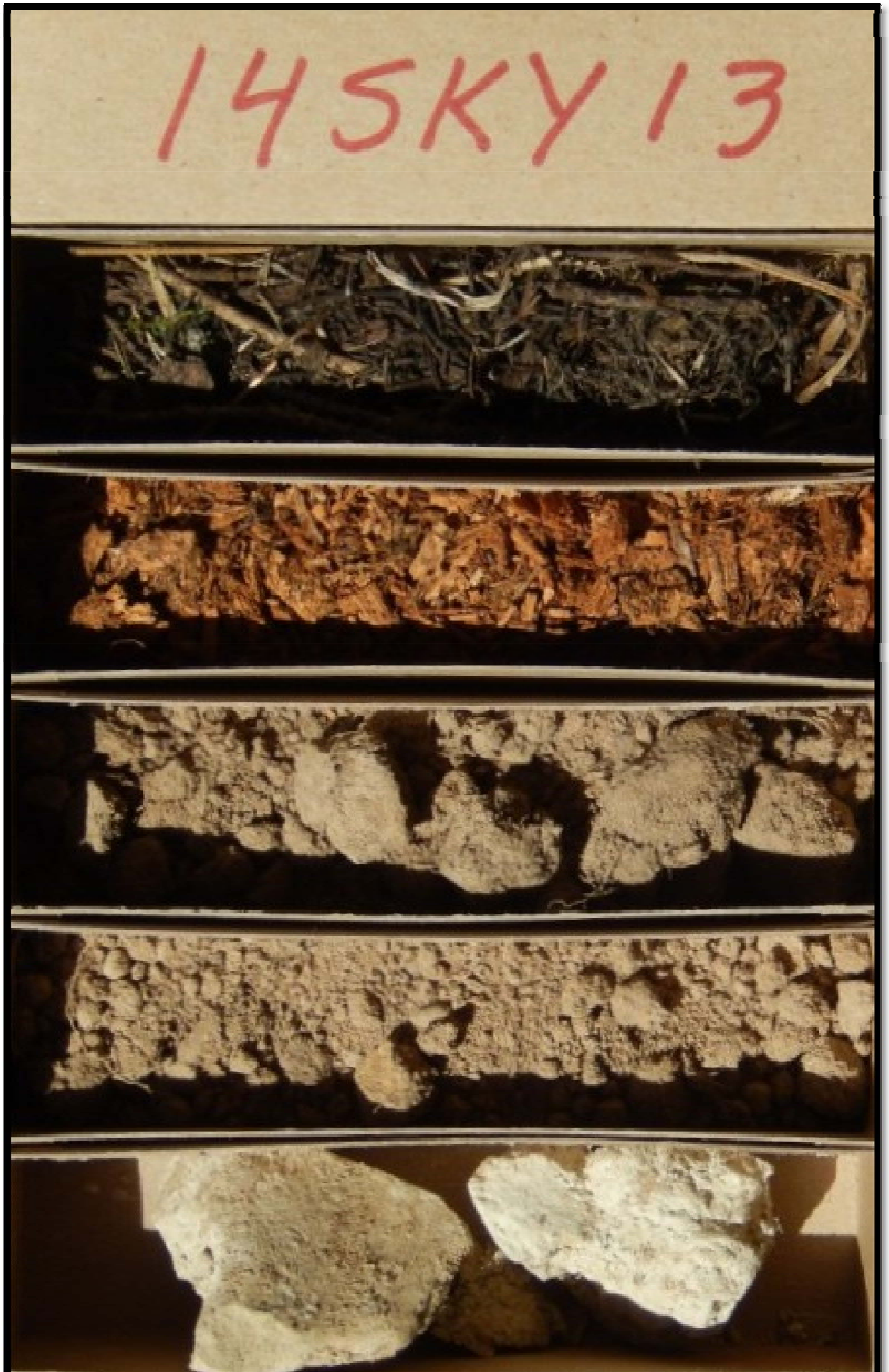

Photo C - 5. Soil profile 14SKY13, Merino family; loamy-skeletal, mixed, superactive Lithic Haplocryepts.

Photo C - 6. Soil profile 14SKY14, Kamack family; loamy-skeletal, mixed, superactive Typic Haplocryolls.

Photo C - 7. Soil profile 14SKY15, Hailman family; coarse-loamy, mixed, superactive Pachic Haplocryolls.

Appendix D

Laboratory Analysis

Table D-1. Summary of laboratory analysis of soil samples collected at the Skyline mine in September 2014.

SampleID	Begin Depth	End Depth	pH	Saturation	Electrical Conductivity	Organic Matter LOI	CO3	PE Calcium	PE Magnesium	PE Sodium	SAR	Sand	Silt	Clay	Texture	Very Fine Sand	Total Carbon	TOC
			s.u.	%	dS/m	%	%	meq/L	meq/L	meq/L		%	%	%		%	%	%
14SKY07	0	11	6.4	63.4	0.37	7.9	1.4	2.02	0.57	0.16	0.14	62.0	32.0	6.0	Sandy Loam	8.0	3.7	3.5
14SKY07	11	28	7.0	44.1	0.24	3.2	0.6	1.52	0.24	0.20	0.21	62.0	30.0	8.0	Sandy Loam	19.6	1.3	1.2
14SKY07	28	48	6.9	47.7	0.23	4.0	0.9	1.45	0.31	0.20	0.21	62.0	31.0	7.0	Sandy Loam	14.2	1.5	1.4
14SKY08	0	9	5.6	64.2	0.21	6.3	0.7	1.13	0.39	0.17	0.20	44.0	41.0	15.0	Loam	6.4	3.3	3.2
14SKY08	9	36	6.1	49.9	0.17	3.7	0.6	1.18	0.30	0.25	0.29	34.0	51.0	15.0	Silty Loam	18.1	1.7	1.7
14SKY09	0	13	6.7	70.3	0.25	8.2	1.5	1.36	0.38	0.18	0.19	58.0	33.0	9.0	Sandy Loam	12.2	3.8	3.6
14SKY09	13	30	6.0	55.1	0.14	4.2	0.6	0.77	0.23	0.15	0.21	56.0	33.0	11.0	Sandy Loam	16.4	1.7	1.6
14SKY10	4	15	6.7	48.0	0.27	4.7	1.0	1.94	0.65	0.17	0.15	58.0	35.0	7.0	Sandy Loam	20.4	2.3	2.2
14SKY10	15	34	6.2	45.2	0.14	6.0	0.8	0.98	0.41	0.19	0.23	54.0	39.0	7.0	Sandy Loam	19.8	3.1	3.0
14SKY10	34	56	6.2	29.1	0.11	4.5	0.8	0.66	0.25	0.22	0.32	62.0	32.0	6.0	Sandy Loam	25.5	2.4	2.3
14SKY10	56	80	6.1	74.7	0.11	**35.0**	3.8	0.74	0.23	0.38	0.55	82.0	14.0	4.0	Loamy Sand	12.7	22.4	22.0
14SKY10	80	130	6.4	34.5	0.08	1.6	0.5	0.54	0.15	0.16	0.27	90.0	10.0	<0.1	Sand	7.6	1.2	1.1
14SKY10	130	160	6.1	33.9	0.08	1.0	0.1	0.51	0.14	0.18	0.31	92.0	8.0	<0.1	Sand	9.2	0.5	0.5
14SKY12	0	20	6.6	57.0	0.31	8.0	1.3	1.73	0.45	0.18	0.17	46.0	39.0	15.0	Loam	17.5	4.0	3.8
14SKY12	20	50	6.6	42.7	0.18	4.6	1.0	1.00	0.37	0.23	0.28	46.0	37.0	17.0	Loam	18.5	2.5	2.3
14SKY12	50	84	6.4	42.3	0.15	2.9	1.0	0.81	0.25	0.19	0.25	48.0	36.0	16.0	Loam	18.7	1.2	1.1
14SKY13	18	36	5.7	37.0	0.15	1.9	0.2	1.30	0.31	0.18	0.20	74.0	23.0	3.0	Loamy Sand	13.5	0.9	0.8
14SKY13	36	55	6.0	28.8	0.12	1.1	0.2	0.96	0.25	0.25	0.32	75.0	22.0	3.0	Loamy Sand	12.5	0.3	0.3
14SKY14	0	23	6.1	48.1	0.17	2.9	0.7	0.75	0.27	0.22	0.30	64.0	28.0	8.0	Sandy Loam	21.3	1.4	1.4
14SKY14	23	51	5.8	32.1	0.22	1.6	0.4	0.93	0.37	0.24	0.29	66.0	28.0	6.0	Sandy Loam	18.1	0.8	0.7
14SKY14	51	108	6.0	30.7	0.10	0.8	0.6	0.50	0.25	0.19	0.30	80.0	17.0	3.0	Loamy Sand	16.5	0.4	0.3
14SKY15	0	18	5.7	43.8	0.11	3.6	0.3	0.60	0.23	0.17	0.26	60.0	34.0	6.0	Sandy Loam	24.0	1.3	1.2
14SKY15	18	44	5.7	38.5	0.09	2.0	0.4	0.42	0.18	0.18	0.32	58.0	35.0	7.0	Sandy Loam	22.5	0.9	0.8
14SKY15	44	74	5.7	36.8	0.07	1.6	0.1	0.32	0.14	0.16	0.33	62.0	33.0	5.0	Sandy Loam	21.5	0.9	0.8
14SKY15	74	110	5.7	28.7	0.06	0.9	0.3	0.20	0.10	0.18	0.45	70.0	29.0	1.0	Sandy Loam	20.5	0.2	0.2

DOGM Suitability	Good	Fair	Poor	Unacceptable

Table D-2. Estimated available water capacity for Powerline Corridor soil profiles.

SampleID	Begin Depth	End Depth	Electrical Conductivity	Organic Matter LOI	Sand	Clay	Texture	Estimated Available Water Capacity[1]	Estimated Available Water Capacity[1]
			dS/m	%	%	%		inch/foot	in/in
14SKY01	0	15	0.29	9.1	53.0	8.0	Sandy Loam	1.68	0.14
14SKY01	15	38	0.20	6.4	47.0	9.0	Loam	1.70	0.14
14SKY01	38	58	0.15	4.4	47.0	9.0	Loam	0.91	0.08
14SKY02	0	29	0.20	10.1	59.0	8.0	Sandy Loam	0.90	0.08
14SKY05	0	14	0.21	7.1	58.0	11.0	Sandy Loam	1.53	0.13
14SKY05	14	36	0.19	5.3	58.0	12.0	Sandy Loam	1.39	0.12
14SKY05	36	58	0.18	5.0	58.0	12.0	Sandy Loam	1.37	0.11
14SKY07	0	11	0.37	7.9	62.0	6.0	Sandy Loam	1.35	0.11
14SKY07	11	28	0.24	3.2	62.0	8.0	Sandy Loam	1.06	0.09
14SKY07	28	48	0.23	4.0	62.0	7.0	Sandy Loam	0.76	0.06
14SKY08	0	9	0.21	6.3	44.0	15.0	Loam	1.56	0.13
14SKY08	9	36	0.17	3.7	34.0	15.0	Silty Loam	1.32	0.11
14SKY09	0	13	0.25	8.2	58.0	9.0	Sandy Loam	1.72	0.14
14SKY09	13	30	0.14	4.2	56.0	11.0	Sandy Loam	1.38	0.12
14SKY10	4	15	0.27	4.7	58.0	7.0	Sandy Loam	1.24	0.10
14SKY10	15	34	0.14	6.0	54.0	7.0	Sandy Loam	1.43	0.12
14SKY10	34	56	0.11	4.5	62.0	6.0	Sandy Loam	0.87	0.07
14SKY10	56	80	0.11	**35.0**	82.0	4.0	Loamy Sand	0.64	0.05
14SKY10	80	130	0.08	1.6	90.0	<0.1	Sand	0.28	0.02
14SKY10	130	160	0.08	1.0	92.0	<0.1	Sand	0.24	
14SKY12	0	20	0.31	8.0	46.0	15.0	Loam	1.93	0.16
14SKY12	20	50	0.18	4.6	46.0	17.0	Loam	1.65	0.14
14SKY12	50	84	0.15	2.9	48.0	16.0	Loam	1.53	0.13
14SKY13	18	36	0.15	1.9	74.0	3.0	Loamy Sand	0.87	0.07
14SKY13	36	55	0.12	1.1	75.0	3.0	Loamy Sand	0.77	0.06
14SKY14	0	23	0.17	2.9	64.0	8.0	Sandy Loam	1.06	0.09
14SKY14	23	51	0.22	1.6	66.0	6.0	Sandy Loam	0.56	0.05
14SKY14	51	108	0.10	0.8	80.0	3.0	Loamy Sand	0.38	0.03
14SKY15	0	18	0.11	3.6	60.0	6.0	Sandy Loam	1.36	0.11
14SKY15	18	44	0.09	2.0	58.0	7.0	Sandy Loam	1.30	0.11
14SKY15	44	74	0.07	1.6	62.0	5.0	Sandy Loam	0.88	0.07
14SKY15	74	110	0.06	0.9	70.0	1.0	Sandy Loam	0.70	0.06

1. Available water capacity estimated by using Soil Water Characteristics model (Saxton 2009).

DOGM Suitability	Good	Fair	Poor	Unacceptable

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 10/29/2014

CLIENT: Canyon Fuel Company
Project: Skyline Mine Topsoil
Lab Order: S1410053

CASE NARRATIVE

Report ID: S1410053001

Samples 14SKY01, 14SKY02, 14SKY05, 14SKY07, 14SKY08, 14SKY09, 14SKY10, 14SKY12, 14SKY13, 14SKY14, and 14SKY15 were received on October 1, 2014.

Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, December 1994
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs

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Soil Analysis Report

Canyon Fuel Company

HC 35 Box 380
Helper, UT 84526

Report ID: S1410053001

Project: Skyline Mine Topsoil

Date Received: 10/1/2014

Date Reported: 10/29/2014

Work Order: S1410053

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter LOI %	CO3 %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1410053-001	14SKY01	0-15	6.6	66.6	0.29	9.1	1.1	1.49	0.43	0.19	0.19
S1410053-002	14SKY01	15-38	6.3	61.2	0.20	6.4	1.0	1.41	0.36	0.16	0.17
S1410053-003	14SKY01	38-58	6.3	55.4	0.15	4.4	0.9	1.00	0.35	0.16	0.20
S1410053-004	14SKY02	0-29	6.2	72.0	0.20	10.1	1.2	1.07	0.39	0.17	0.20
S1410053-005	14SKY05	0-14	6.4	53.8	0.21	7.1	0.9	1.27	0.40	0.21	0.23
S1410053-006	14SKY05	14-36	6.4	56.2	0.19	5.3	1.1	1.46	0.40	0.22	0.23
S1410053-007	14SKY05	36-58	6.4	53.1	0.18	5.0	0.7	1.18	0.33	0.20	0.23
S1410053-008	14SKY07	0-11	6.4	63.4	0.37	7.9	1.4	2.02	0.57	0.16	0.14
S1410053-009	14SKY07	11-28	7.0	44.1	0.24	3.2	0.6	1.52	0.24	0.20	0.21
S1410053-010	14SKY07	28-48	6.9	47.7	0.23	4.0	0.9	1.45	0.31	0.20	0.21
S1410053-011	14SKY08	0-9	5.6	64.2	0.21	6.3	0.7	1.13	0.39	0.17	0.20
S1410053-012	14SKY08	9-36	6.1	49.9	0.17	3.7	0.6	1.18	0.30	0.25	0.29
S1410053-013	14SKY09	0-13	6.7	70.3	0.25	8.2	1.5	1.36	0.38	0.18	0.19
S1410053-014	14SKY09	13-30	6.0	55.1	0.14	4.2	0.6	0.77	0.23	0.15	0.21
S1410053-015	14SKY10	4-15	6.7	48.0	0.27	4.7	1.0	1.94	0.65	0.17	0.15
S1410053-016	14SKY10	15-34	6.2	45.2	0.14	6.0	0.8	0.98	0.41	0.19	0.23
S1410053-017	14SKY10	34-56	6.2	29.1	0.11	4.5	0.8	0.66	0.25	0.22	0.32
S1410053-018	14SKY10	56-80	6.1	74.7	0.11	35.0	3.8	0.74	0.23	0.38	0.55
S1410053-019	14SKY10	80-130	6.4	34.5	0.08	1.6	0.5	0.54	0.15	0.16	0.27
S1410053-020	14SKY10	130-160	6.1	33.9	0.08	1.0	0.1	0.51	0.14	0.18	0.31

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

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Report ID: S1410053001

Project: Skyline Mine Topsoil
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Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter LOI %	CO3 %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1410053-021	14SKY12	0-20	6.6	57.0	0.31	8.0	1.3	1.73	0.45	0.18	0.17
S1410053-022	14SKY12	20-50	6.6	42.7	0.18	4.6	1.0	1.00	0.37	0.23	0.28
S1410053-023	14SKY12	50-84	6.4	42.3	0.15	2.9	1.0	0.81	0.25	0.19	0.25
S1410053-024	14SKY13	18-36	5.7	37.0	0.15	1.9	0.2	1.30	0.31	0.18	0.20
S1410053-025	14SKY13	36-55	6.0	28.8	0.12	1.1	0.2	0.96	0.25	0.25	0.32
S1410053-026	14SKY14	0-23	6.1	48.1	0.17	2.9	0.7	0.75	0.27	0.22	0.30
S1410053-027	14SKY14	23-51	5.8	32.1	0.22	1.6	0.4	0.93	0.37	0.24	0.29
S1410053-028	14SKY14	51-108	6.0	30.7	0.10	0.8	0.6	0.50	0.25	0.19	0.30
S1410053-029	14SKY15	0-18	5.7	43.8	0.11	3.6	0.3	0.60	0.23	0.17	0.26
S1410053-030	14SKY15	18-44	5.7	38.5	0.09	2.0	0.4	0.42	0.18	0.18	0.32
S1410053-031	14SKY15	44-74	5.7	36.8	0.07	1.6	0.1	0.32	0.14	0.16	0.33
S1410053-032	14SKY15	74-110	5.7	28.7	0.06	0.9	0.3	0.20	0.10	0.18	0.45

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

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Soil Analysis Report

Canyon Fuel Company

HC 35 Box 380
Helper, UT 84526

Report ID: S1410053001

Project: Skyline Mine Topsoil

Date Received: 10/1/2014

Date Reported: 10/29/2014

Work Order: S1410053

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Total Carbon %	TOC %
S1410053-001	14SKY01	0-15	53.0	39.0	8.0	Sandy Loam	22.7	4.7	4.5
S1410053-002	14SKY01	15-38	47.0	44.0	9.0	Loam	14.2	3.3	3.2
S1410053-003	14SKY01	38-58	47.0	44.0	9.0	Loam	19.2	2.3	2.2
S1410053-004	14SKY02	0-29	59.0	33.0	8.0	Sandy Loam	3.3	5.1	5.0
S1410053-005	14SKY05	0-14	58.0	31.0	11.0	Sandy Loam	6.8	2.8	2.7
S1410053-006	14SKY05	14-36	58.0	30.0	12.0	Sandy Loam	15.0	2.0	1.9
S1410053-007	14SKY05	36-58	58.0	30.0	12.0	Sandy Loam	11.5	1.8	1.7
S1410053-008	14SKY07	0-11	62.0	32.0	6.0	Sandy Loam	8.0	3.7	3.5
S1410053-009	14SKY07	11-28	62.0	30.0	8.0	Sandy Loam	19.6	1.3	1.2
S1410053-010	14SKY07	28-48	62.0	31.0	7.0	Sandy Loam	14.2	1.5	1.4
S1410053-011	14SKY08	0-9	44.0	41.0	15.0	Loam	6.4	3.3	3.2
S1410053-012	14SKY08	9-36	34.0	51.0	15.0	Silty Loam	18.1	1.7	1.7
S1410053-013	14SKY09	0-13	58.0	33.0	9.0	Sandy Loam	12.2	3.8	3.6
S1410053-014	14SKY09	13-30	56.0	33.0	11.0	Sandy Loam	16.4	1.7	1.6
S1410053-015	14SKY10	4-15	58.0	35.0	7.0	Sandy Loam	20.4	2.3	2.2
S1410053-016	14SKY10	15-34	54.0	39.0	7.0	Sandy Loam	19.8	3.1	3.0
S1410053-017	14SKY10	34-56	62.0	32.0	6.0	Sandy Loam	25.5	2.4	2.3
S1410053-018	14SKY10	56-80	82.0	14.0	4.0	Loamy Sand	12.7	22.4	22.0
S1410053-019	14SKY10	80-130	90.0	10.0	<0.1	Sand	7.6	1.2	1.1
S1410053-020	14SKY10	130-160	92.0	8.0	<0.1	Sand	9.2	0.5	0.5

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Canyon Fuel Company

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Helper, UT 84526

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Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Total Carbon %	TOC %
S1410053-021	14SKY12	0-20	46.0	39.0	15.0	Loam	17.5	4.0	3.8
S1410053-022	14SKY12	20-50	46.0	37.0	17.0	Loam	18.5	2.5	2.3
S1410053-023	14SKY12	50-84	48.0	36.0	16.0	Loam	18.7	1.2	1.1
S1410053-024	14SKY13	18-36	74.0	23.0	3.0	Loamy Sand	13.5	0.9	0.8
S1410053-025	14SKY13	36-55	75.0	22.0	3.0	Loamy Sand	12.5	0.3	0.3
S1410053-026	14SKY14	0-23	64.0	28.0	8.0	Sandy Loam	21.3	1.4	1.4
S1410053-027	14SKY14	23-51	66.0	28.0	6.0	Sandy Loam	18.1	0.8	0.7
S1410053-028	14SKY14	51-108	80.0	17.0	3.0	Loamy Sand	16.5	0.4	0.3
S1410053-029	14SKY15	0-18	60.0	34.0	6.0	Sandy Loam	24.0	1.3	1.2
S1410053-030	14SKY15	18-44	58.0	35.0	7.0	Sandy Loam	22.5	0.9	0.8
S1410053-031	14SKY15	44-74	62.0	33.0	5.0	Sandy Loam	21.5	0.9	0.8
S1410053-032	14SKY15	74-110	70.0	29.0	1.0	Sandy Loam	20.5	0.2	0.2

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs, Inc
1673 Terra Ave, Sheridan, Wyoming, 82801
(307) 672-8945

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Canyon Fuel Company, LLC.
HC 35 Box 380
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Project ID: Skyline Mine Topsoil
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Lab ID	Sample ID	Organic Matter %	Sand %	Silt %	Clay %	Very Fine Sand %	Texture	K-factor (t.ac.h/100acft.tf.in)	Structure s	Permeability p	M
S1410053-001	14SKY01(0-15cm)	9.1	53.0	39.0	8.0	22.7	Sandy Loam	0.09	2	2	5676.4
S1410053-002	14SKY01(15-38cm)	6.4	47.0	44.0	9.0	14.2	Loam	0.21	2	3	5296.2
S1410053-003	14SKY01(38-58cm)	4.4	47.0	44.0	9.0	19.2	Loam	0.31	2	3	5751.2
S1410053-004	14SKY02(0-29cm)	10.1	59.0	33.0	8.0	3.3	Sandy Loam	0.02	2	2	3339.6
S1410053-005	14SKY05(0-14cm)	7.1	58.0	31.0	11.0	6.8	Sandy Loam	0.08	2	2	3364.2
S1410053-006	14SKY05(14-36cm)	5.3	58.0	30.0	12.0	15.0	Sandy Loam	0.15	2	2	3960.0
S1410053-007	14SKY05(36-58cm)	5.0	58.0	30.0	12.0	11.5	Sandy Loam	0.14	2	2	3652.0
S1410053-008	14SKY07(0-11cm)	7.9	62.0	32.0	6.0	8.0	Sandy Loam	0.08	2	2	3760.0
S1410053-009	14SKY07(11-28cm)	3.2	62.0	30.0	8.0	19.6	Sandy Loam	0.25	2	2	4563.2
S1410053-010	14SKY07(28-48cm)	4.0	62.0	31.0	7.0	14.2	Sandy Loam	0.20	2	2	4203.6
S1410053-011	14SKY08(0-9cm)	6.3	44.0	41.0	15.0	6.4	Loam	0.15	2	3	4029.0
S1410053-012	14SKY08(9-36cm)	3.7	34.0	51.0	15.0	18.1	Silty Loam	0.35	2	3	5873.5
S1410053-013	14SKY09(0-13cm)	8.2	58.0	33.0	9.0	12.2	Sandy Loam	0.08	2	2	4113.2
S1410053-014	14SKY09(13-30cm)	4.2	56.0	33.0	11.0	16.4	Sandy Loam	0.21	2	2	4396.6
S1410053-015	14SKY10(4-15cm)	4.7	58.0	35.0	7.0	20.4	Sandy Loam	0.24	2	2	5152.2
S1410053-016	14SKY10(15-34cm)	6.0	54.0	39.0	7.0	19.8	Sandy Loam	0.20	2	2	5468.4
S1410053-017	14SKY10(34-56cm)	4.5	62.0	32.0	6.0	25.5	Sandy Loam	0.26	2	2	5405.0
S1410053-018	14SKY10(56-80cm)	35.0	82.0	14.0	4.0	12.7	Loamy Sand	-0.40	2	2	2563.2
S1410053-019	14SKY10(80-130cm)	1.6	90.0	10.0	0.1	7.6	Sand	0.03	1	1	1758.2
S1410053-020	14SKY10(130-160cm)	1.0	92.0	8.0	0.1	9.2	Sand	0.03	1	1	1718.3
S1410053-021	14SKY12(0-20cm)	8.0	46.0	39.0	15.0	17.5	Loam	0.13	2	3	4802.5
S1410053-022	14SKY12(20-50cm)	4.6	46.0	37.0	17.0	18.5	Loam	0.23	2	3	4606.5
S1410053-023	14SKY12(50-84cm)	2.9	48.0	36.0	16.0	18.7	Loam	0.29	2	3	4594.8
S1410053-024	14SKY13(18-36cm)	1.9	74.0	23.0	3.0	13.5	Loamy Sand	0.21	2	2	3540.5
S1410053-025	14SKY13(36-55cm)	1.1	75.0	22.0	3.0	12.5	Loamy Sand	0.21	2	2	3346.5
S1410053-026	14SKY14(0-23cm)	2.9	64.0	28.0	8.0	21.3	Sandy Loam	0.26	2	2	4535.6
S1410053-027	14SKY14(23-51cm)	1.6	66.0	28.0	6.0	18.1	Sandy Loam	0.28	2	2	4333.4

These Results apply only to the samples tested.

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Karen Secor, Soil Lab Supervisor

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S1410053-028	14SKY14(51-108cm)	0.8	80.0	17.0	3.0	16.5	Loamy Sand	0.21	2	2	3249.5
S1410053-029	14SKY15(0-18cm)	3.6	60.0	34.0	6.0	24.0	Sandy Loam	0.30	2	2	5452.0
S1410053-030	14SKY15(18-44cm)	2.0	58.0	35.0	7.0	22.5	Sandy Loam	0.35	2	2	5347.5
S1410053-031	14SKY15(44-74cm)	1.6	62.0	33.0	5.0	21.5	Sandy Loam	0.35	2	2	5177.5
S1410053-032	14SKY15(74-110cm)	0.9	70.0	29.0	1.0	20.5	Sandy Loam	0.35	2	2	4900.5

These Results apply only to the samples tested.

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Karen Secor, Soil Lab Supervisor

Skyline Mine
Swen Canyon Ventilation Shaft Pad
Design Report

Canyon Fuel Company
Skyline Mine
Scofield, Utah

Revised
January 2016

EarthFax EarthFax Engineering Group, LLC.

Engineers / Scientists
www.earthfax.com

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CHAPTER 1

INTRODUCTION

Canyon Fuel Company is planning the construction of two shafts to be used for ventilation and emergency access at the east end of Swen Canyon (the Site) for the Skyline Mine (Skyline). The Site is located on Skyline Drive approximately 11 miles south of Scofield, Utah. To prevent adverse hydrologic impacts to the surrounding area, Canyon Fuel Company (Canyon Fuel) will construct runoff and sediment control facilities in the area, including berms or silt fences, ditches, a pond, a sediment basin, and an Alternative Sediment Control Area (ASCA). In addition, a geotechnical analysis was performed for the Site to confirm that the Site expansion will be stable. Drilling the two shafts will create wetted cuttings; the pond will be constructed large enough to contain these cuttings. Both the operational and reclaimed site layouts were considered within the hydrological design and geotechnical analysis.

The purpose of this document is to present information for the design and layout of the site including runoff and sediment controls and geotechnical analysis. A berm or silt fence and ditch system will be installed around and within the perimeter of the site to contain sediment and runoff discharges from the disturbed areas and direct runoff into the pond or ASCA. Additionally, a berm or silt fence system will be installed to divert upstream runoff and sediment around the site. A separate storm water runoff and sediment system will be constructed around the topsoil stockpile area to control and direct runoff into a sediment basin. The site has been designed to conform to the applicable criteria outlined in the Utah Administrative Code Titles R645-300 and 301. However, Skyline requested that the pond and sediment basin be designed as non-discharging retention systems. Therefore, the pond and sediment basin will contain runoff from the 100-year, 24-hour storm event and one year of accumulated sediment.

This document has been prepared for Canyon Fuel by EarthFax Engineering Group, LLC, and contains the following information:

- Location and background information;
- Site layout;
- hydrologic analyses to determine runoff and sediment discharge for the regulator design storm event;
- Sediment control design criteria;
- Berms, silt fence, ditches, swale, pond, and sediment basin construction drawings; and
- Geotechnical analysis with results and recommendations.

Engineering calculations and other supporting information are included as attachments to this document.

CHAPTER 2
LOCATION AND BACKGROUND INFORMATION

The general layout of the proposed operational site is shown on Sheet 1. Note that the design includes both a “pond” (designed to control shaft cuttings) and a “sediment basin” (designed to control runoff and sediment from the topsoil stockpile area). The “pad” will be treated as an Alternative Sediment Control Area (ASCA). The total disturbed area is approximately 6.8 acres. Note the disturbed area boundary (DAB) on the drawings is 9.7 acres to allow for construction access and to allow for adjustments in the cut slope angles and embankment thickness.

The pad has been designed to slope towards the access road to allow haul trucks and other vehicle to have a clear view of on-coming traffic and to minimize the pad view from the north side of the valley Swen Canyon terminates in. Due to this design the pad cannot reasonably be diverted into the pond. Additionally, creation of a sedimentation pond along the south side of the pad would increase the disturbed area and degrade the scenic integrity of the area further. Maintaining the scenic integrity of the valley was the major concern of the U.S. Forest Service, which manages the land. For these reasons the pad will be treated as an ASCA.

The total maximum volume of cuttings contributing to the pond will be approximately 13,000 CY. The total runoff area contributing to the pond including the pond itself is 2.0 acres. The pond has been designed to contain storm water runoff from the 100-year, 24-hour storm event, one year of accumulated sediment, and cuttings from the creation of the shafts. The sediment basin and storm water conveyance system around the topsoil stockpile have been deigned to contain runoff from the 100-year, 24-hour storm event and one year of accumulated sediment. Construction of the Site will begin as soon as the Utah Division of Oil, Gas, and Mining issues a permit.

The pond and sediment basin have been designed to meet or exceed the requirements of R645-301-742 and 743 in accordance with the following criteria:

- The pond and sediment basin will contain the runoff from a 100-year, 24-hour storm event in addition to sediment yielded from its catchment area.
- All embankments surrounding the pond and sediment basin have been evaluated for slope stability. They have been designed with a minimum factor of safety of 1.3 against rotational shear failure when the pond and sediment basin are filled to capacity.
- The pond and sediment basin will be constructed from native or imported materials. The embankment will not be constructed from coal mine waste rock.
- The spillway will safely convey runoff from a 25-year, 6-hour storm event.

The berms or silt fencing and ditches which convey runoff to the pond and sediment basin have been designed to meet or exceed the requirements of R645-301-742 and 743 as indicated below:

- The conveyance system will safely convey the runoff from a 100-year, 24-hour storm event.
- All of the side slopes of the berms or silt fences and ditches have been designed to prevent channel degradation and erosion.
- The berms and ditches will be constructed from native or imported materials and not from coal mine waste rock.
- Where necessary, culvert outfalls will be riprap armored to prevent erosion.
- The sediment basin spillway will safely convey runoff from a 25-year, 6-hour storm event.

The berms or silt fencing and swale which convey runoff to the ASCA have been designed to meet or exceed the requirements of R645-301-742 and 743 as indicated below:

- The conveyance system will safely convey the runoff from a 10-year, 24-hour storm event.
- All of the side slopes of the berms or silt fences and swale have been designed to prevent channel degradation and erosion.

- The berms and swale will be constructed from native or imported materials and not from coal mine waste rock.
- Where necessary, culvert outfalls will be riprap armored to prevent erosion.

The access road ditches and culverts convey runoff away from the Site and toward an existing drainage along Skyline Drive and have been designed to meet or exceed the requirements of R645-301-742 and 743 as indicated below:

- The conveyance system will safely convey the runoff from a 10-year, 6-hour storm event.
- All of the side slopes of the ditches have been designed to prevent channel degradation and erosion.
- The ditches will be constructed from native or imported materials and not from coal mine waste rock.
- Where necessary, culvert outfalls will be riprap armored to prevent erosion.

The geotechnical analysis was performed to assure that the designed conforms to the requirements as specified in R645-301-533 and 536. Thus, the Site has been designed to comply with the following criteria:

- The minimum pad and roadway side slope stability safety factor of 1.5 was applied
- The minimum embankment slope stability safety factor of 1.3 at steady state was applied

CHAPTER 3
OPERATIONAL AND RECLAMATION DESIGN

3.1 Introduction

The Site operational and reclamation plan have been designed to comply with all regulations as specified R645-301. Thus, the Site has been designed to comply with the following criteria:

- Topsoil will be removed and stockpiled prior to other site disturbance to prevent erosion.
- Access road and pad are designed to be stable.
- The reclaimed surface will be stabilized and re-vegetated.

The accompanying design sheets provide the layout, road profiles, cross sections, and design details for both the operational and reclamation plans.

3.2 Topsoil

According to the Soil Survey (Long Resource Consultants, 2014), the disturbed site consists of 2 varying topsoil depths. These depths range from 10-16 inches where slopes range from 20% to 50% and 27-31 inches where slopes range from 10% to 20%. Sheet 6 shows the soil depths and the associated topsoil volume. The topsoil removal within the site will yield approximately 15,100 cubic yards. The topsoil will be stockpiled south of the pad. Geo-fabric or similar material will be placed along the existing soil surface prior to placing topsoil. Additionally, signs will be placed to clearly indicate were the topsoil is located. The topsoil will be placed at a maximum depth of no greater than 20 feet. Following placement in the stockpile, the topsoil will be re-vegetated to prevent erosion. A berm or silt fence system will direct storm water runoff from the topsoil stockpile into a sediment basin to detain storm runoff and sediment.

Prior to site development, topsoil will be removed. An engineer or trained professional will guide soil removal to assure that the maximum volume is removed for stockpiling and to prevent bedrock from being placed with soil. The reclaimed surface will consist of an average of 18-inches of topsoil. A backhoe or trackhoe will be used to create a pock-marked surface. The surface will then be re-vegetated.

3.3 Roads

The road layout is shown on Sheet 1. The road profile and cross sections can be seen on Sheet 2. The road will have a minimum width of 17 feet, allowing for one directional traffic with large trucks. All curves will have an outside radius of 90 feet or greater to allow trucks to negotiate curves. The road surface will be constructed from road base or similar material. All drainage along the roads will be designed to safely convey storm water runoff from the 10-year, 6-hour event off site. Maximum slopes on the road will not exceed 7.25%.

CHAPTER 4
SEDIMENT CONTROL DESIGN

4.1 Hydrology Introduction

Storm water discharge for the area was calculated using HydroCAD version 10.00. The curve number (CN) values used were recommended by HydroCAD according to the NRCS soil report in Attachment A. During the design phase only the soil depth information, provided by Long Resources, was available for the Site. No soils information was available from the NRCS website for the Site. Therefore, a soil survey area 3 miles northeast of the Site, near Skyline's main facility, was used. This area had similar vegetation, elevation and slopes. All of the soils in this survey were hydrological group C. Therefore, group C soils were used to create the hydrological model. As information from Long Resources became available the soils assumptions were proved to be conservative. However, the affected areas that drain into the pond, pad, and sediment basin were small enough that there would be little affect to the design. The developed site consists of a gravel and soil pad, bed rock cuts, a gravel access road, and the pond area. The corresponding CN values are 91, 98, 89, and 98, respectively. The undeveloped areas consist of brush lands in good condition and have a corresponding CN value of 65. The reclaimed surface will be the same or very similar to the existing surface and be re-vegetated to match existing conditions. Additionally, the pock-mark surface created in reclamation retains water within divots preventing runoff. Therefore, no reclamation hydrology model was created.

Design storm magnitudes were taken from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Point Precipitation Frequency Estimates web page (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html). Site watershed areas and average slopes were calculated from a 2-foot contour interval topographic map provided by Skyline using AutoCAD 2014 software. All storm runoff calculations are included in Attachment A.

4.2 Drainage Area Characteristics

The drainage area contributing to the Site watershed is delineated in Sheet 4 for operational watersheds. The area draining to the pond will include all of the cut area west of the pond, the pond itself, and a small undeveloped area that cannot be reasonably diverted. The drainage area contributing to the sediment basin includes only the topsoil stockpile and the sediment basin. The ASCA will include the pad, the cut area to the west of the pad, and a small undeveloped area that cannot be reasonably diverted. The drainage areas contributing the road drainage ditches consist of the road surface, cut areas above the road, fill areas above the roads, and undeveloped areas that cannot be reasonably diverted.

4.3 Runoff Volume Calculations

The100-year, 24-hour storm event was used in areas contributing pond and sediment basin. The 10-year, 24-hour storm event was used in areas contributing to the ASCA. The 10-year, 6-hour storm event was used in areas contributing to the access road diversion system. The pond and sediment basin spillways were designed to safely convey runoff from a 25-year, 6-hour event. The runoff volumes are presented in Table 1 and the HydroCAD worksheets in Attachment A. Results of runoff calculations are provided in Attachment A.

4.4 Sediment Volume Calculations

With limited soils information for the Site an average annual anticipated sediment yield from disturbed areas at the Site was calculated using an assumed conservative value of 0.1 acre-feet per acre per year. For ease of calculations a conservative sediment yield from the small undisturbed area was assumed to be 0.1 acre-feet per year, as well.

The average annual sediment yield in acre-feet per acre for each watershed was multiplied by that watershed's area to find the annual volume of sediment participated from the area. Finally, the volumes for each watershed were summed to determine the total annual sediment yield of the area draining into the pond, sediment basin, and ASCA. In this manner, the calculated average annual sediment yield for the area draining to pond, sediment basin, and ASCA are approximately 320 cubic yards, 83 cubic yards, and 323 cubic yards, respectively.

4.5 Pond and Sediment Basin Capacities

The pond has been designed to be non-discharging. Therefore, the pond has been evaluated and will safely retain runoff from a 100-year, 24-hour storm event from contributing watersheds (649 cubic yards) and one year of predicted sediment yield (320 cubic yards) for a total of 969 cubic yards. Additionally, the pond will retain all of the 13,000 cubic yards of wetted cutting from developing the mine shafts. As the water from the cuttings evaporates or infiltrates the volume will likely decrease to 6,500 cubic yards. The cuttings volume represents a maximum volume of potential materials removed. With 6,500 cubic yards of available sediment storage after the cuttings have dried the 60% sediment cleanout elevation will be 8,698.2 (4,100 cubic yards). A spillway has been designed as an emergency overflow for the pond as part of prudent engineering. However, as mentioned above, the pond is not anticipated to ever discharge. The stage-capacity table for the pond is shown in Table 2 and a graph is shown in Figure 2.

The sediment basin has been designed to be non-discharging. Therefore, the sediment basin has been evaluated and will safely retain runoff from a 100-year, 24-hour storm event from contributing watersheds (176 cubic yards) and one year of predicted sediment yield (195 cubic yards) for a total of 371 cubic yards. The sediment will be removed when 60% of the one year capacity, 115 cubic yards or approximately 8,692.05 feet elevation, is reached. A spillway has been designed as an emergency overflow for the sediment basin as part of prudent engineering. However, as mentioned above, the sediment basin is not anticipated to ever discharge. The stage-capacity table for the sediment basin is shown in Table 3 and a graph is shown in Figure 3.

4.6 Runoff Conveyance System Details

Peak flows for the berms, culverts, and ditches were calculated using HydroCAD version 10.00 and FlowMaster version 6.0. The results of these calculations are presented in Attachment A. For design details, see Sheets 4 and 5. The conveyance system for the pond and sediment basin was designed to safely convey the runoff volume resulting from a 100-year, 24-hour event. The conveyance system for the access road was designed to safely convey the runoff volume resulting from a 10-year, 6-hour event. The berm or silt fence system for the undisturbed areas upstream of the Site was designed to safely convey the runoff volume resulting from a 100-year, 24-hour event. The conveyance system for the ASCA was designed to safely convey runoff volume resulting from the 10-year, 24-hour event. Velocities above 5.00 fps require rock lining according to the attached U.S. Department of Transportation Tables in Attachment A. For conveyance system capacities for the velocities, depths, and freeboard see Table 4 and Attachment A.

The ASCA will drain south where a 4 to 10 foot cut will form a natural berm. A berm or silt fence along the east side of the pad will direct runoff south through a swale across the access road and into the cut berm. The sediment that accumulates along this berm will be cleaned out periodically to allow for runoff storage.

CHAPTER 5
GEOTECHNICAL ANALYSIS

5.1 Geotechnical Introduction

The purpose of this section is to summarize the methods and findings of geotechnical analyses performed for the site. As shown in Sheet 1 of the design drawings, the proposed operational site will be constructed through a combination of excavation and utilizing the native or imported material to construct working surfaces.

The Long Resources investigation included the collection of soil samples for characterizing the soil profile and soil types representative of the Site. Soil samples were analyzed for grain size distribution, texture, K-factor, structure and permeability. For the Site, two soil samples are representative of the Site, including 14SKY14 and 14SKY15. Laboratory results are provided in Attachment B. Soil data specific to the geotechnical analyses are listed in Table 6. From the soil data collected, soil types were correlated to typical soil strength values for analysis and modeling. These values (including unit weight, permeability, cohesive strength, angle of internal friction) are listed in Table 6. Two values were used for the cohesive strength of the Sandy Loam, 200 psf for the topsoil stockpile and 1050 psf for the compacted embankments. It is strongly recommended the soil conditions be verified during construction. If conditions differ or vary from what is presented in this report, a qualified geotechnical engineer should be contacted to reevaluate or give further guidance.

The Long Resources field investigation generally encountered Sandy Loam topsoil on top of fractured sandstone with a shale bedrock. An email dated September 22, 2014 from Robert Long of Long Resources describes the soils conditions encountered during the investigation. An excerpt as detailed below:

> Estimated average topsoil salvage depths will vary across the landscape and should be monitored during construction.

> Depth to rock fragments (greater than 50 percent cobbles and stones) is the primary limiting feature at Swens pad. The sandstone rock fragments are sub-angular and could be fractured sandstone bedrock. It was not possible to dig through the rocky subsoil by hand due to the amount and size of the rock fragments.
>
> Small localized areas of sandstone outcrop were observed on these steep side slopes. Shale was observed at 42 inches on the steep side slope. This preliminary estimate for the steep slopes is based on field notes for soil profile 14SKY14.

From the description above, it is likely to anticipate a thin surface of weathered sandstone/shale overlying competent shale bedrock. The actual rock structure of the shale bedrock is unknown and should be evaluated during construction. If conditions differ or vary from what is presented in this report, a qualified geotechnical engineer should be contacted to reevaluate or give further guidance.

5.2 Evaluation Methods

Slope stability analyses were performed using the slope stability software *Slide 5.0 ("Slide")* by Rocscience. This program uses an iterative procedure to evaluate the factor of safety against rotational shear failure for tens of thousands of potential failure surfaces that may develop within a given slope. Each trial failure surface is discretized into small slices and the driving and resisting forces/moments are calculated for each according to Bishop's Simplified Method of Slices and Janbu Simplified Method of Slices. These forces are then summed over the entire failure surface to obtain a factor of safety defined as the sum of the resisting forces divided by the sum of the driving forces. Therefore, a factor of safety less that 1.0 indicates the potential for slope failure.

The analysis discussed herein relied on soils data collected during the Long Resource field investigation, as this investigation encompassed the same general area as the proposed pad. Stability analyses were performed for three locations throughout the Site: topsoil and access road, topsoil stockpile and sediment basin, and pond. The engineering properties summarized in Section 5.1 were assumed for this evaluation. Details on each of the slope-stability scenarios analyzed and soil properties used for these analyses are included in the following subsections.

5.2.1 Topsoil and Access Road

Four scenarios were analyzed for this section. Perpendicular to STA 7+75 along the access road alignment, the analyzed section reaches from the top of the topsoil stockpile to the east side slope of the access road. The first scenario looks at the stability of the topsoil stockpile with the cut above the access road at 1.5H:1V (horizontal to vertical). The second scenario looks at the stability of the topsoil stockpile with the cut above the access road at 0.5H:1V. The third scenario looks at the access road side slope stability with the cut above the road at 1.5H:1V. The fourth scenario looks at the access road side slope stability with the cut above the road at 0.5H:1V. It is our understanding that the topsoil stockpile will be constructed to a maximum height of 20 feet with a maximum side slope of 2H:1V and the excavations made to competent shale bedrock.

5.2.2 Topsoil Stockpile and Sediment Basin

Four scenarios were analyzed for this section. Perpendicular to STA 10+50 along the access road alignment, the analyzed section reaches from the top of the topsoil stockpile, through the sediment basin spillway, to the east side slope of the access road. The first scenario looks at the stability of the topsoil stockpile, sediment basin with steady state seepage conditions. The second scenario looks at the stability of the sediment basin out slope with steady state seepage conditions. The third scenario looks at the stability of the access road side slope with steady state seepage conditions. The fourth scenario looks at the stability of the topsoil stockpile with rapid drawdown seepage conditions. The fifth scenario looks at the sediment basin in slope with rapid drawdown conditions.

Because the toe of a portion of the topsoil stockpile side slope and access road will coincide with the location of the sediment basin, analyses were performed for slope stability with and without ponded water at the toe of the stockpile.

The stability of the stockpile slope with water in the sediment basin was analyzed under the ponded condition. This condition assumes the sediment basin at the toe of the slope is completely full of water and the conservative variability of soils encompassing the stockpile. The effects of ponded water were determined using *Slide's* slope stability analysis and assumed hydraulic conditions.

The stability of the sediment basin embankment outer slope was analyzed under the steady-state seepage condition. This condition assumes the sediment basin is completely full of water with a phreatic surface fully developed within the embankment. The location of the phreatic surface was determined using *Slide's* finite-element seepage subprogram and assumed hydraulic conditions.

It is our understanding that the topsoil stockpile, as mentioned above, will be constructed to a maximum height of 20 feet with a maximum side slope of 2H:1V.

5.2.3 Pond Embankment

Six scenarios were analyzed for this section. Perpendicular to the spillway along the pond access road, this section reaches from the west pond access road cut to the spillway bottom. It is our understanding that the pond embankment is to be constructed with the following geometry:

- **Inner Slope**. Maximum 17 feet tall at a 3H:1V slope
- **Crest**. Minimum 17 feet wide
- **Outer Slope**. Maximum 52.31 feet tall at a 2H:1V slope

The stability of the pond embankment outer slope was analyzed under the steady-state seepage condition. This condition assumes the pond is completely full of water with a phreatic surface fully developed within the embankment. The location of the phreatic surface was determined using *Slide's* finite-element seepage subprogram and assumed hydraulic conditions.

The stability of the pond embankment inner slope was analyzed under a "rapid drawdown" condition. That is, it was assumed the pond is quickly drained such that the buttressing effect of the pond water is lost but pore pressures remain trapped within the embankment that had developed during the steady-state seepage condition, thus weakening the slope. This is the most critical condition for the inner slopes of the pond embankment.

Stability analyses for the pond embankment assumed that all native soils below the phreatic surface were fully saturated and weakened. For this analysis, the pond embankment was modeled at the correlated maximum dry density of the surface soil and should be constructed as such in the field. These are conservative assumptions since in reality the pond will only be filled intermittently and with a finite quantity of water incapable of saturating all underlying soils.

5.4 Results

The soil properties used as input for *Slide* analyses are summarized in Table 6. As discussed above, these data are taken from the Long Resource field investigation, laboratory testing results, and correlated typical values. In the interest of conservatism, soil properties and analyses were selected to provide worst-case estimates of geotechnical conditions at the operational shaft pad site. Reclamation of the site will return the operational phase to its former existing topography and slope stability would expect to hold the same factor of safety as modeled in the operational phase, if constructed with the same recommendations.

The calculated minimum factors of safety for the various scenarios described above are summarized in Table 5. As shown in this table, the minimum factor of safety for against slope failure of the topsoil stockpile is expected to be 1.9. The minimum factor of safety for the sediment basin and pond without ponded water is 2.3. The sediment basin and pond embankment factor of safety, under rapid drawdown, is 5.4. The minimum factor of safety for the road side slope is 3.3.

The minimum acceptable factor of safety promulgated by the DOGM for the pond embankment is 1.3 under steady-state seepage conditions (R645-301-533.110). This factor of safety applies to NRCS (1985) Class A embankments and those not meeting the criteria of MSHA 30 CFR Sec. 77.216(a). The proposed embankment classifies as a Class A embankment given its rural location, low ponded depth (6 feet) and low retention volume (less than 10 acre-feet). The calculated factor of safety of 1.3 is therefore considered acceptable and the embankment is expected to remain stable under the geometry and loading conditions presented herein.

5.5 Recommendations

The results of this investigation apply to the slope geometries and soil conditions discussed above. If actual conditions differ from those assumed in this report, topsoil stockpile, pond embankment, access road and sediment basin embankment slope stability should be re-evaluated as necessary.

The following are recommended specific to the design and construction of the Shale bedrock excavation:

- From the field investigation description above, it is likely to anticipate a thin surface of weathered sandstone/shale overlying competent shale bedrock. This thin layer should be removed to expose the competent shale bedrock. The actual rock structure of the shale bedrock is unknown and should be evaluated during construction. If conditions differ or vary from what is presented in this report, a qualified geotechnical engineer should be contacted to reevaluate or give further guidance.
- It is recommended that the final exposed cut slope be designed to mitigate rockfall and erosion concerns, especially for the cut slope adjacent to the shaft pad. This would include, but not limited to, removing all loose rocks throughout the face and rocks along the top of the cut face to prevent rockfall hazards. Surface drainage should be continually monitored for effects of erosion on the bedrock.
- Shear strengths for design and analysis are generally based on preconstruction rock

mass conditions. Rock slopes are commonly excavated by drill and blast techniques. If improperly used, these excavation techniques can significantly alter the material properties of the rock mass comprising the slope. These altercations are more commonly evident as loosened rock which results in a reduction of strength. Excavation techniques should be properly evaluated and implemented for the conditions encountered.

- Stability and surface conditions should be continually monitored during and after construction of the pad.

The following are recommended specific to the design and construction of the topsoil stockpile:

- New lifts should be placed only over existing lifts that has had time to drain and has properly compacted to provide a stable base for a new lift. Areas which remain wet and soft should be allowed more time to dry and/or be scarified, if necessary.
- The dump surface should always be graded to facilitate drainage away from recently placed fill toward surface drainage courses. It may be advantageous to bulldoze shallow ditches at each lift elevation to improve surface drainage.
- Care should be taken not to fill over any frozen material which has not been properly drained and compacted.
- It may often be necessary to place soil material, allow time for drying, and then to compact the lift.
- In the unlikely event that severe material handling, placement and compaction problems are encountered, consider temporarily flattening of dump face slope angles or utilizing artificial waste rock stabilization measure. Other measures may be considered on a case-by-case basis.

The following are recommended specific to the design and construction of the access roads, pond, and sediment basin embankments:

- Embankments should be constructed using an A-4 or A-6 soil as defined by the AASHTO soil classification system (ASTM D3282) and recommended by the American Public Works Association for impermeable embankments. These soils have a plasticity index of at least 10 and a coefficient of permeability less than $7x10^{-6}$.
- If site soils do not meet the criteria discussed above, it is recommended that imported soils meeting the criteria be used to construct the embankments. Alternatively, site soils may be amended with materials in order to meet the criteria above.
- The embankment should be placed on a well-prepared and compacted subgrade free from any organic soils, vegetation, debris, frozen soils, soft soils, or other deleterious materials.
- The embankments should be well keyed into the underlying subgrade and adjacent

slopes.

- Embankment soils should be compacted with an appropriate compactor to at least 95% of the Standard Proctor maximum dry density (ASTM D698) at ±2% of the soil's optimum moisture content. Compacted lifts should not exceed 8 inches.
- The inside slope of constructed embankments should be armored with at least 1-foot of protective rock.
- It is recommended that topsoil be placed on the outer slope of constructed embankments and vegetation established in order to reduce the potential for erosion.
- Embankments should be regularly inspected for signs of damage, erosion, and piping and repairs made as necessary.

5.6 Limitations

The conclusions and recommendations presented in this report are based upon both the results of field and laboratory tests and correlated typical soil strength values for analysis and modeling. These define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout the site which could not be defined during this investigation and analyses. It is recommended that a soils engineer observe, at a minimum, the start of excavation to verify the existing in-situ conditions. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action be taken.

CHAPTER 6

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TABLE 1

Watershed Runoff Volumes

Watershed	Design Storm	Runoff Volume (CY)
DW-1	100-year, 24-hour	150
DW-2	100-year, 24-hour	452
DW-3	10-year, 24-hour	258
DW-4	100-year, 24-hour	58
DW-5	100-year, 24-hour	89
DW-6	100-year, 24-hour	29
DW-7	10-year, 6-hour	47
DW-8	10-year, 6-hour	47
DW-9	10-year, 6-hour	27
UW-1	100-year, 24-hour	306
UW-2	100-year, 24-hour	47
UW-3	10-year, 24-hour	2
UW-4	100-year, 24-hour	15
UW-5	10-year, 6-hour	2

TABLE 2

Pond Staged Capacities

Elevation	Surface Area (sq ft)	Incremental (cy)	Cumulative Volume (cy)
8,683.25	0		
8,683.3	4,800	4	4
8,684.0	5,700	140	140
8,686.0	9,200	550	690
8,688.0	12,800	820	1,510
8,690.0	16,700	1,090	2,600
8,692.0	20,900	1,390	3,990
8,694.0	25,800	1,730	5,720
8,694.8	31,000	800	6,520
8,696.0	31,300	1,310	7,830
8,698.0	37,000	2,530	10,360
8,698.2	37,600	280	10,640
8,700.0	42,900	2,680	13,320
8,700.4	43,800	640	13,960
8,701.4	46,900	1,690	15,650
Total			**15,480**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 3

Sediment Basin Staged Capacities

Elevation	Surface Area (sq ft)	Incremental (cy)	Cumulative Volume (cy)
8,687.5	0	0	0
8,688.0	100	1	1
8,690.0	700	30	30
8,692.0	1,700	80	110
8,692.05	2,400	5	115
8,693.05	2,500	80	195
8,694.0	3,200	95	290
8,694.6	3,700	80	370
8,695.0	4,000	60	430
Total			**430**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 4

Diversion Structure Depths, Velocities, and Rock Lining Size

Diversion Structure	Maximum Velocity (fps)	Rock Size (Dia. in)	Maximum Depth (ft)	Freeboard (ft)
DB-1	3.93	Not Required	0.26	0.74
DB-2	4.35	2*	0.31	0.69
DD-1	3.68	Not Required	0.55	0.45
DD-2	3.68	Not Required	0.46	0.54
DD-3	2.52	Not Required	0.45	0.55
UB-1	4.77	2**	0.60	0.40
UB-2	1.97	Not Required	0.13	0.87
Swale	1.82	Road Material	0.22	0.28
Pond Spillway	3.72	Not Required	0.13	0.87
Sed. Basin Spillway	4.44	Not Required	0.19	0.81

Depths and velocities based on FlowMaster and assumed elevations from AutoCAD topography of site.
Rock sizing based on U.S. Department of Transportation Table.
*Slopes greater than 1:6
**Slopes greater than 1:5

TABLE 5

Summary of *Slide* Analysis

Location/ Condition	Minimum Factor of Safety	Minimum Acceptable Factor of Safety
Topsoil and Access Road (STA 7+75) Access Road 1.5H:1V Topsoil Stockpile Stability	1.94	-
Topsoil and Access Road (STA 7+75) Access Road 0.5H:1V Topsoil Stockpile Stability	1.94	-
Topsoil and Access Road (STA 7+75) Access Road 1.5H:1V Road Side Slope Stability	4.99	1.5
Topsoil and Access Road (STA 7+75) Access Road 0.5H:1V Road Side Slope Stability	3.26	1.5
Topsoil Stockpile and Sediment Basin Topsoil Stockpile Side Slope, Steady State	2.43	-
Topsoil Stockpile and Sediment Basin Sediment Basin Out Slope, Steady State	14.28	1.3
Topsoil Stockpile and Sediment Basin Access Road Side Slope, Steady State	5.82	1.5
Topsoil Stockpile and Sediment Basin Topsoil Stockpile Side Slope, Rapid Drawdown	2.18	-
Topsoil Stockpile and Sediment Basin Sediment Basin In Slope, Rapid Drawdown	15.97	1.3
Pond Pond Access Road 0.5H:1V Pond Out Slope, Steady State	2.35	1.3
Pond Pond Access Road 0.5H:1V Pond In Slope, Rapid Drawdown	5.40	1.3
Pond Pond Access Road 1.5H:1V Pond Out Slope, Steady State	2.32	1.3
Pond Pond Access Road 1.5H:1V Pond In Slope, Rapid Drawdown	5.52	1.3

TABLE 6

Summary of Soil Properties

Sample ID Depth (in)	Grain Size Analysis				Typical Soil Values			
	Sand	Silt	Clay	Very Fine Sand	Unit Weight (lb/ft^3)	Permeability (ft/s)	Cohesive Strength (psf)	Angle of Internal Friction (degrees)
14SK14 0-9 [(a)]	64	28	8	21.3	115	8.2e-6	200 1050 compacted	33
14SK14 9-20 [(b)]	66	28	6	18.1	115	8.2e-6	200 1050 compacted	33
14SK14 20-43 [(c)]	80	17	3	16.5	115	8.2e-6	200 1050 compacted	33
14SK15 0-7 [(d)]	60	34	6	24	115	8.2e-6	200 1050 compacted	33
14SK15 7-17 [(e)]	58	35	7	22.5	115	8.2e-6	200 1050 compacted	33
14SK15 17-29 [(f)]	62	33	5	21.5	115	8.2e-6	200 1050 compacted	33
14SK15 29-43 [(g)]	70	29	1	20.5	115	8.2e-6	200 1050 compacted	33
Shale Bedrock [(h)]	-	-	-	-	170	3.3e-7	58500	25

*Samples 14SK14 and 14SK15 were analyzed as a homogenous soil for slope stability models.

(a) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(b) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(c) Loamy Sand. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(d) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(e) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(e) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(e) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(e) Sandy Loam. Soil sample was analyzed for particle size. Other soil properties were based on typical values for the anticipated conditions at the project site.

(e) Shale Bedrock. Soil properties were based on typical values for the anticipated conditions at the project site.

FIGURES

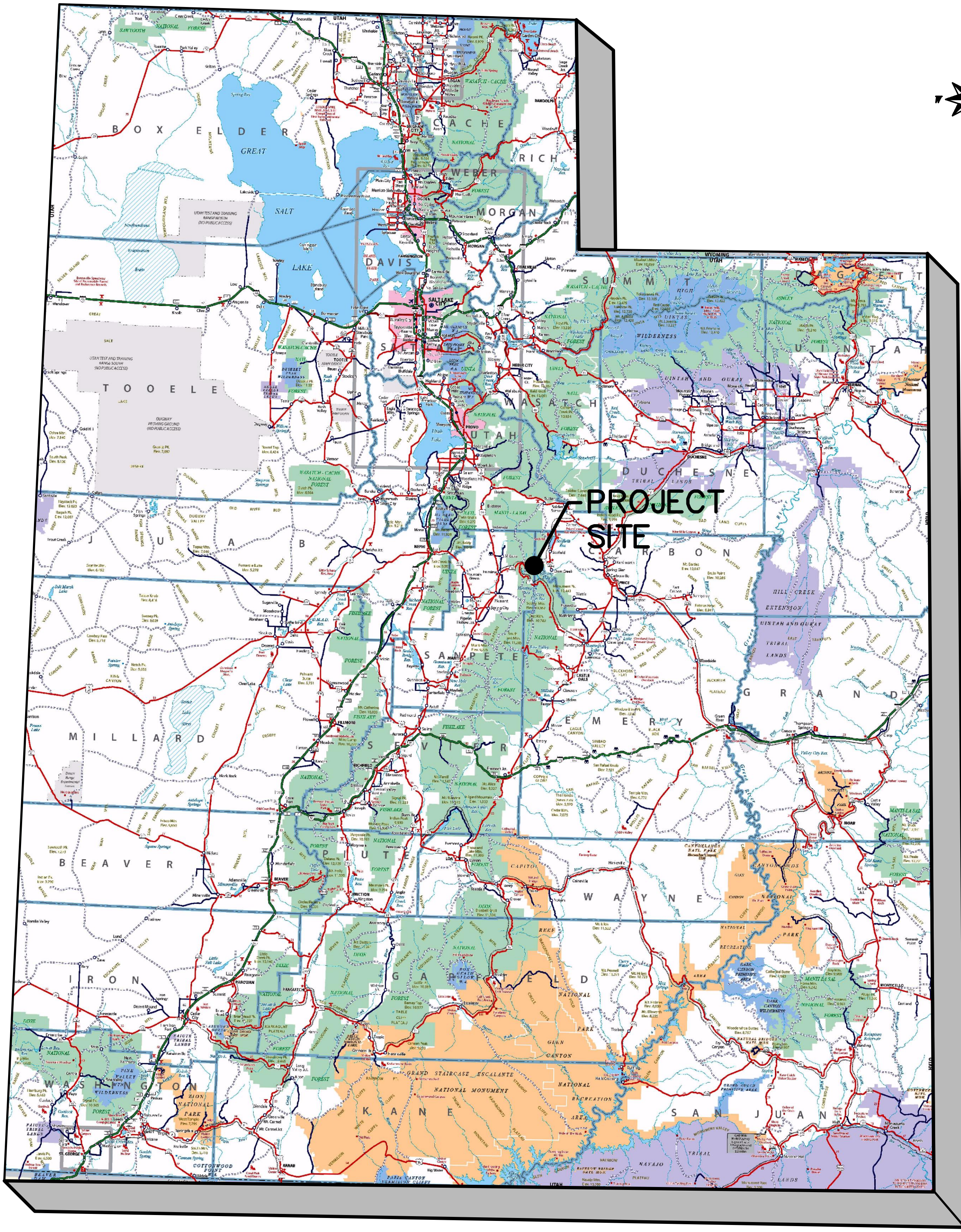

FIGURE 1. SITE LOCATION

EarthFax

G:\UC1547\01 - Swens Canyon pad design\DWG\FIGURE-1.dwg, 12/2/2014 2:56:49 PM

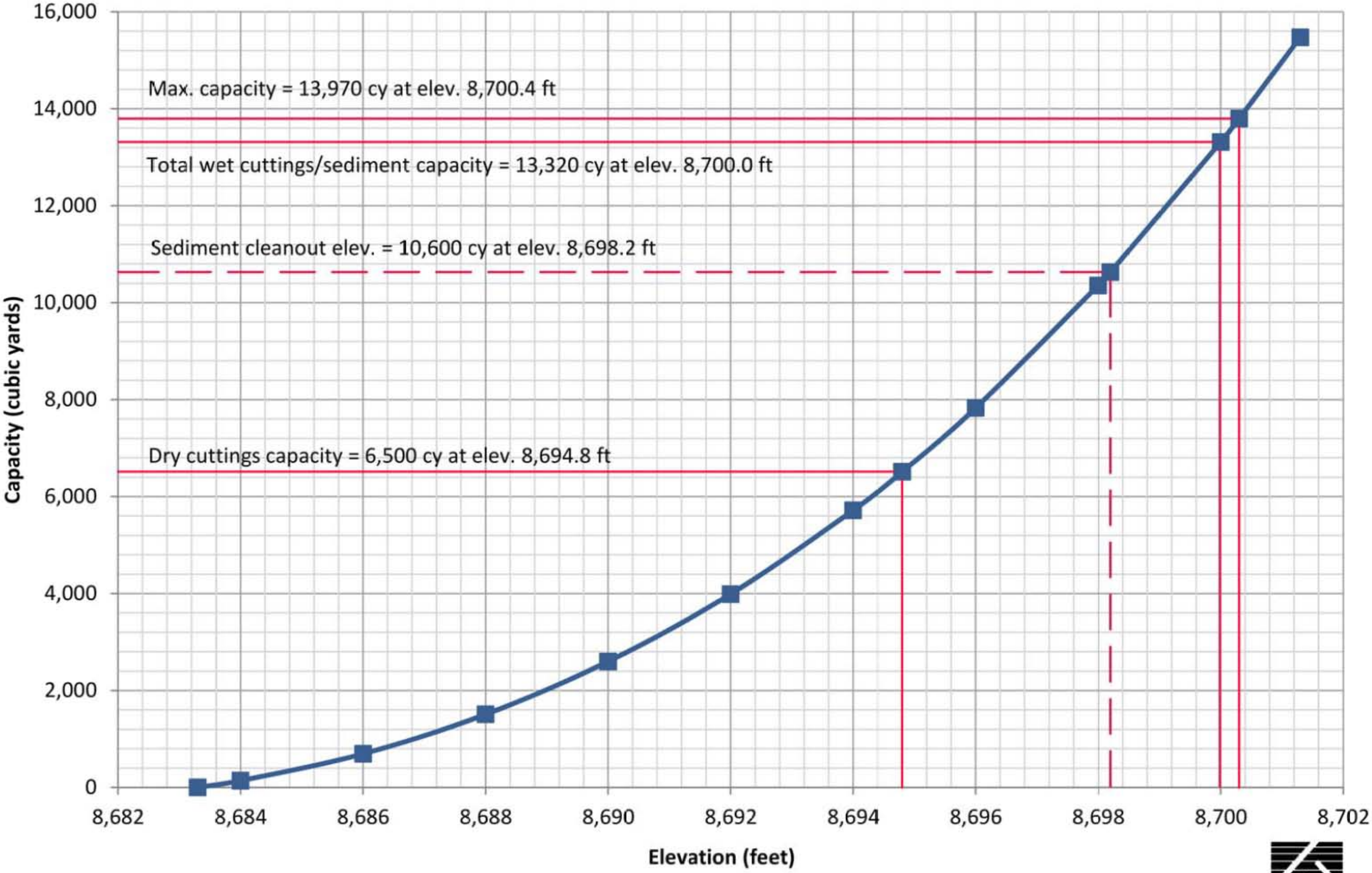

FIGURE 2. POND STAGE–CAPACITY CURVE

EarthFax

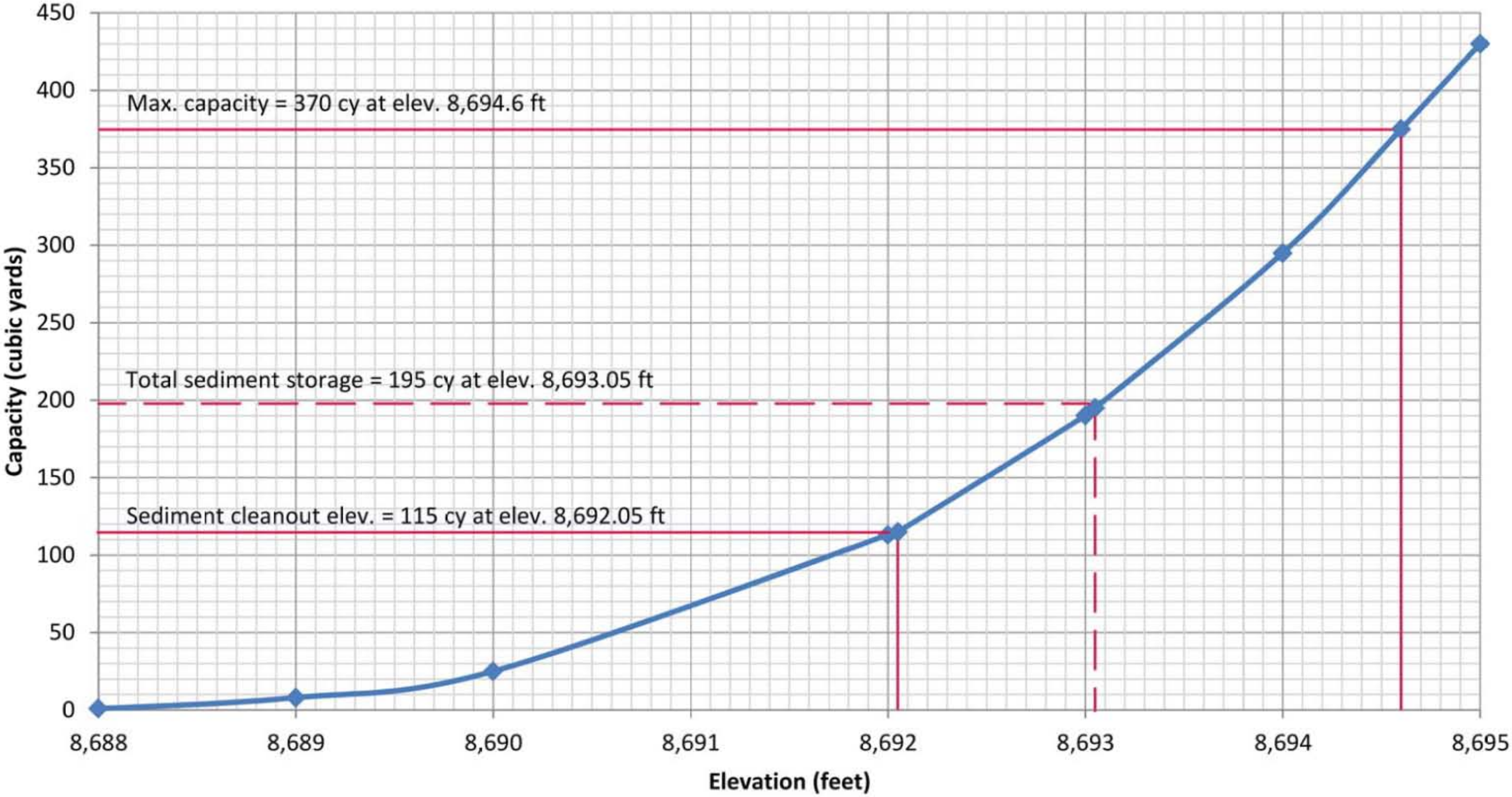

FIGURE 3. SEDIMENT BASIN STAGE–CAPACITY CURVE

EarthFax

ATTACHMENT A

Hydrology Calculations

NOAA Atlas 14, Volume 1, Version 5
Location name: Fairview, Utah, US*
Latitude: 39.6573°, Longitude: -111.2329°
Elevation: 9228 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.161 (0.139 0.192)	0.207 (0.179 0.246)	0.285 (0.242 0.337)	0.350 (0.295 0.416)	0.449 (0.370 0.535)	0.535 (0.434 0.640)	0.633 (0.504 0.761)	0.746 (0.577 0.904)	0.926 (0.686 1.14)	1.09 (0.777 1.37)
10-min	0.245 (0.211 0.292)	0.316 (0.272 0.376)	0.434 (0.369 0.514)	0.532 (0.450 0.633)	0.683 (0.564 0.815)	0.814 (0.661 0.975)	0.964 (0.767 1.16)	1.14 (0.879 1.38)	1.41 (1.04 1.74)	1.66 (1.18 2.09)
15-min	0.304 (0.262 0.362)	0.391 (0.338 0.466)	0.538 (0.458 0.637)	0.660 (0.558 0.785)	0.846 (0.699 1.01)	1.01 (0.819 1.21)	1.20 (0.951 1.44)	1.41 (1.09 1.71)	1.75 (1.29 2.16)	2.06 (1.47 2.59)
30-min	0.409 (0.353 0.487)	0.527 (0.455 0.627)	0.724 (0.617 0.858)	0.889 (0.751 1.06)	1.14 (0.942 1.36)	1.36 (1.10 1.63)	1.61 (1.28 1.93)	1.90 (1.47 2.30)	2.35 (1.74 2.91)	2.77 (1.97 3.49)
60-min	0.507 (0.437 0.603)	0.653 (0.563 0.776)	0.896 (0.763 1.06)	1.10 (0.930 1.31)	1.41 (1.17 1.68)	1.68 (1.37 2.01)	1.99 (1.58 2.39)	2.35 (1.82 2.85)	2.91 (2.16 3.60)	3.43 (2.44 4.32)
2-hr	0.631 (0.547 0.744)	0.799 (0.691 0.940)	1.05 (0.905 1.24)	1.28 (1.09 1.51)	1.63 (1.36 1.93)	1.93 (1.58 2.31)	2.29 (1.83 2.75)	2.69 (2.10 3.25)	3.33 (2.48 4.09)	3.91 (2.82 4.91)
3-hr	0.706 (0.621 0.822)	0.883 (0.778 1.03)	1.13 (0.989 1.32)	1.35 (1.17 1.57)	1.69 (1.45 1.98)	1.99 (1.67 2.34)	2.34 (1.93 2.77)	2.74 (2.21 3.28)	3.39 (2.63 4.13)	3.98 (2.99 4.94)
6-hr	0.913 (0.815 1.03)	1.13 (1.01 1.28)	1.38 (1.23 1.57)	1.60 (1.42 1.82)	1.91 (1.67 2.18)	2.19 (1.90 2.52)	2.53 (2.16 2.93)	2.91 (2.44 3.40)	3.53 (2.90 4.20)	4.10 (3.29 4.95)
12-hr	1.18 (1.07 1.31)	1.46 (1.32 1.62)	1.76 (1.58 1.96)	2.02 (1.81 2.25)	2.38 (2.11 2.66)	2.66 (2.34 3.00)	2.96 (2.58 3.36)	3.35 (2.88 3.83)	4.00 (3.38 4.63)	4.59 (3.82 5.38)
24-hr	1.25 (1.11 1.40)	1.54 (1.38 1.74)	1.87 (1.67 2.11)	2.13 (1.90 2.40)	2.49 (2.20 2.80)	2.76 (2.43 3.11)	3.03 (2.65 3.42)	3.38 (2.90 3.87)	4.04 (3.41 4.67)	4.64 (3.85 5.44)
2-day	1.54 (1.36 1.76)	1.91 (1.69 2.17)	2.32 (2.05 2.65)	2.66 (2.33 3.03)	3.11 (2.72 3.55)	3.46 (3.00 3.95)	3.81 (3.28 4.37)	4.17 (3.56 4.80)	4.64 (3.92 5.38)	5.01 (4.19 5.83)
3-day	1.77 (1.56 2.03)	2.19 (1.93 2.52)	2.67 (2.35 3.08)	3.06 (2.68 3.53)	3.59 (3.12 4.13)	4.00 (3.46 4.61)	4.42 (3.79 5.10)	4.84 (4.11 5.60)	5.41 (4.53 6.29)	5.84 (4.84 6.83)
4-day	1.99 (1.75 2.31)	2.47 (2.17 2.87)	3.02 (2.64 3.51)	3.47 (3.02 4.02)	4.07 (3.53 4.72)	4.54 (3.92 5.27)	5.02 (4.29 5.83)	5.51 (4.66 6.40)	6.17 (5.15 7.21)	6.67 (5.50 7.84)
7-day	2.51 (2.20 2.93)	3.12 (2.73 3.63)	3.83 (3.34 4.46)	4.40 (3.83 5.12)	5.18 (4.47 6.04)	5.79 (4.96 6.76)	6.41 (5.45 7.50)	7.04 (5.94 8.26)	7.88 (6.56 9.33)	8.54 (7.04 10.2)
10-day	2.91 (2.54 3.40)	3.62 (3.16 4.23)	4.44 (3.86 5.18)	5.08 (4.40 5.94)	5.95 (5.12 6.96)	6.60 (5.65 7.74)	7.27 (6.17 8.54)	7.94 (6.70 9.35)	8.83 (7.36 10.4)	9.51 (7.86 11.3)
20-day	4.00 (3.51 4.64)	4.99 (4.38 5.78)	6.14 (5.37 7.13)	7.04 (6.14 8.19)	8.25 (7.14 9.59)	9.17 (7.89 10.7)	10.1 (8.62 11.8)	11.0 (9.34 12.9)	12.3 (10.2 14.4)	13.2 (10.9 15.6)
30-day	4.94 (4.33 5.68)	6.15 (5.40 7.07)	7.51 (6.58 8.64)	8.56 (7.49 9.84)	9.93 (8.63 11.4)	11.0 (9.48 12.6)	12.0 (10.3 13.8)	13.0 (11.1 15.0)	14.3 (12.1 16.6)	15.3 (12.8 17.9)
45-day	6.21 (5.45 7.17)	7.72 (6.79 8.93)	9.43 (8.26 10.9)	10.7 (9.38 12.4)	12.5 (10.8 14.4)	13.8 (11.9 15.9)	15.0 (12.9 17.4)	16.3 (13.9 19.0)	18.0 (15.2 21.0)	19.3 (16.1 22.6)
60-day	7.42 (6.53 8.47)	9.25 (8.16 10.6)	11.3 (9.93 12.9)	12.9 (11.3 14.7)	14.9 (13.0 17.0)	16.4 (14.2 18.8)	17.9 (15.5 20.5)	19.4 (16.6 22.3)	21.3 (18.0 24.6)	22.7 (19.1 26.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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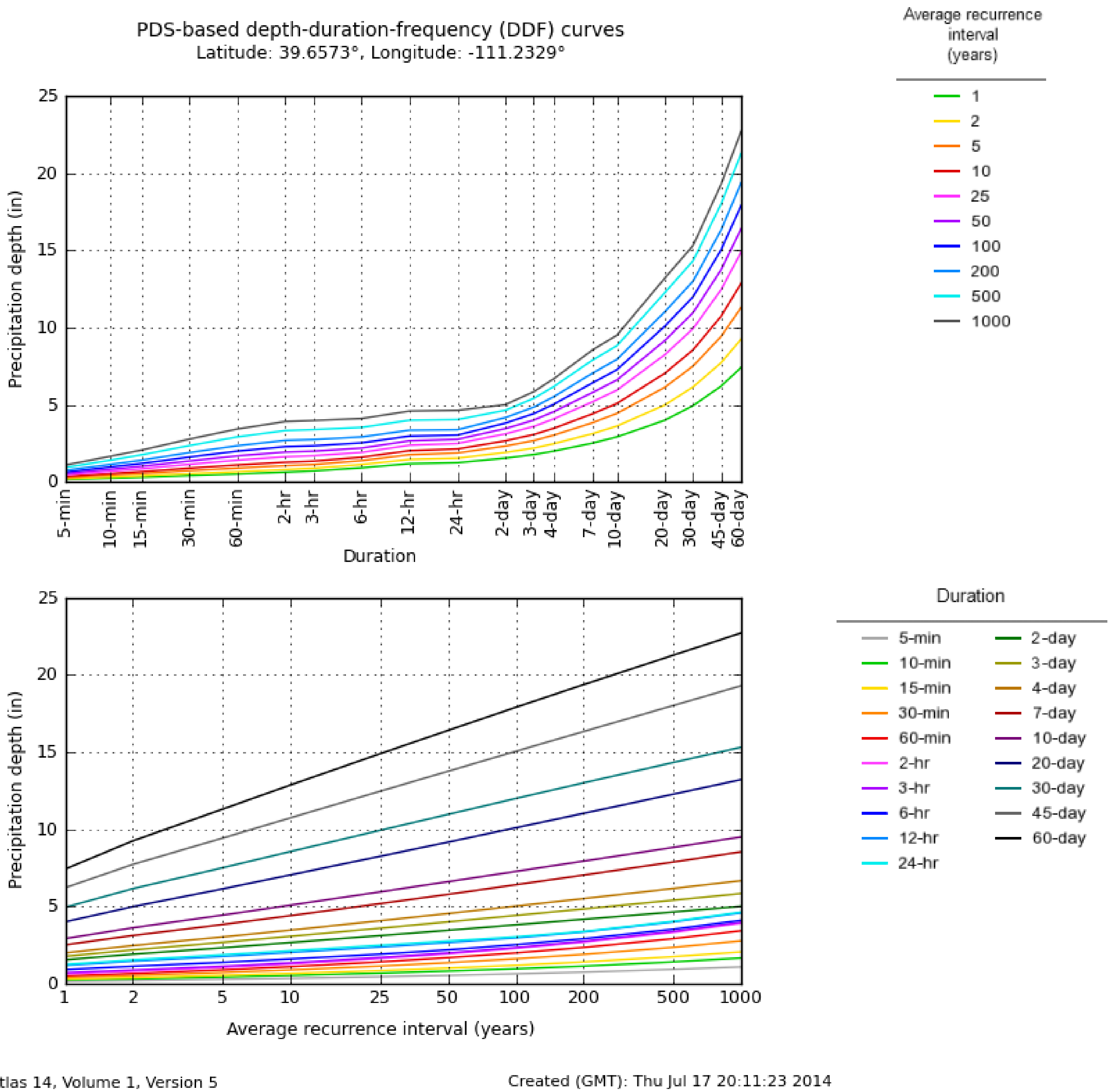
PF graphical



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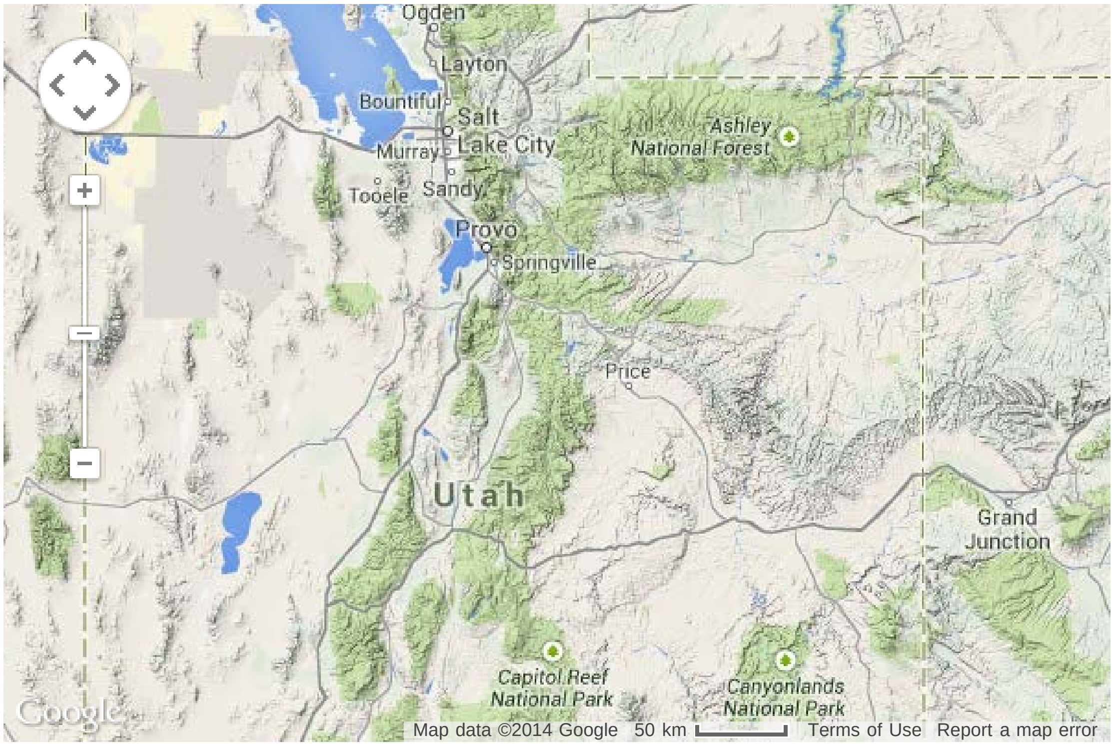
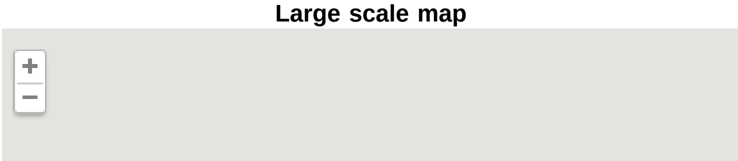
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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United States Department of Agriculture

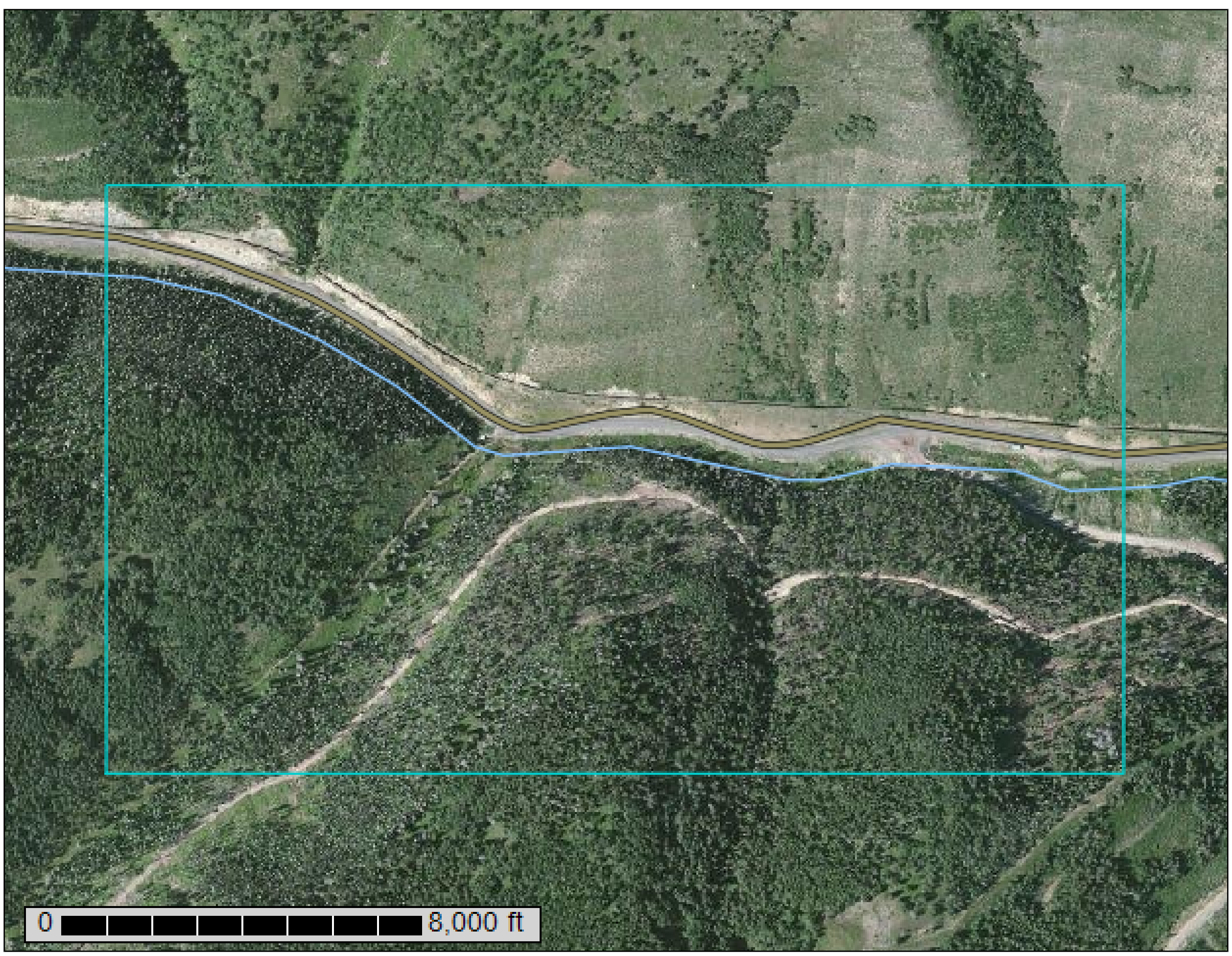
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Carbon Area, Utah, Parts of Carbon and Emery Counties



October 30, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

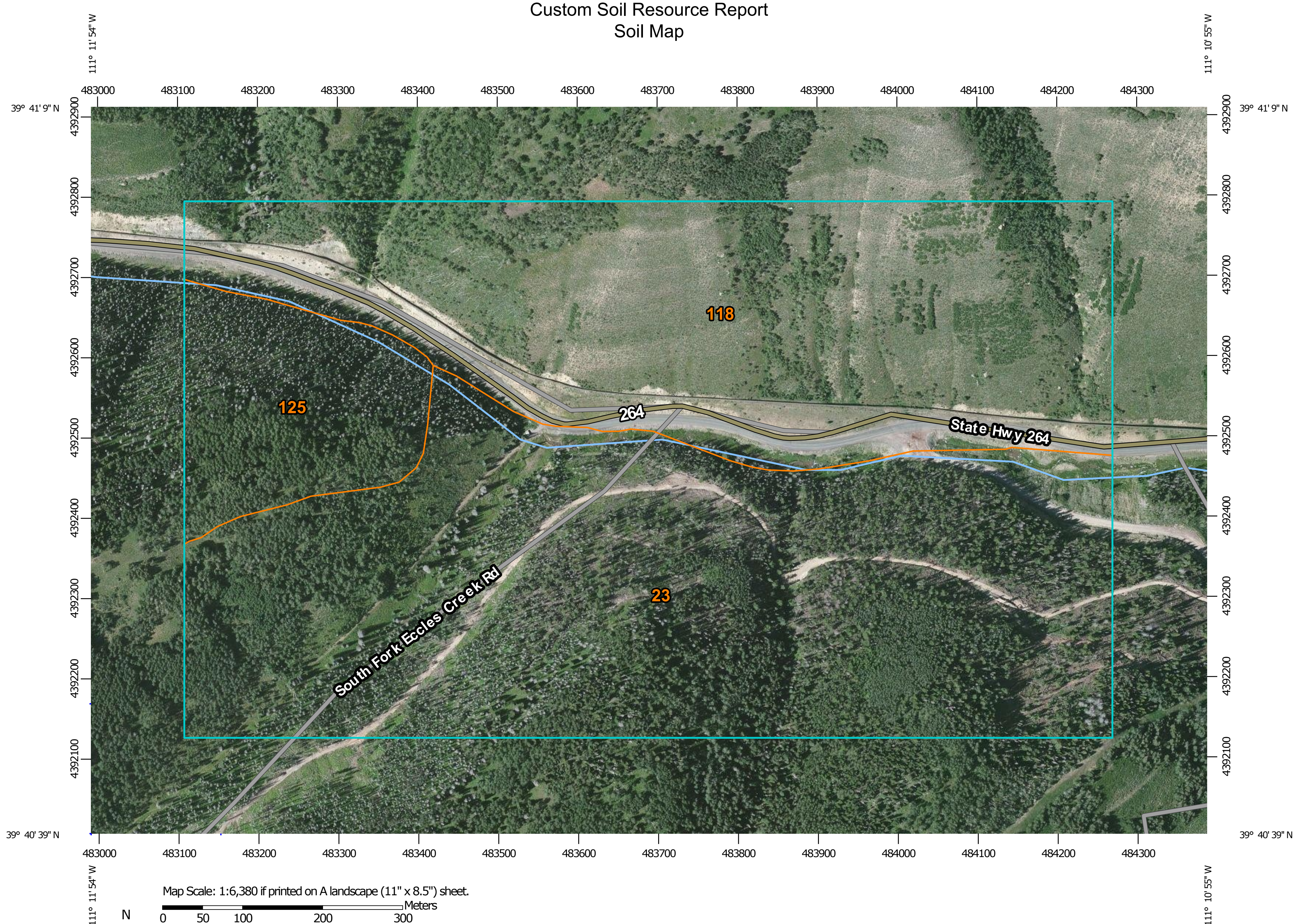
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:6,380 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 300, 600, 1200, 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 7, Jul 31, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 12, 2011—Aug 13, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Carbon Area, Utah, Parts of Carbon and Emery Counties (UT616)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
23	Curecanti family-Pathead complex	100.9	52.4%
118	Trag-Croydon complex	73.8	38.3%
125	Uinta-Toze families complex	17.9	9.3%
Totals for Area of Interest		**192.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Carbon Area, Utah, Parts of Carbon and Emery Counties

23—Curecanti family-Pathead complex

Map Unit Setting

National map unit symbol: jx4t
Elevation: 6,980 to 8,970 feet
Mean annual precipitation: 16 to 20 inches
Mean annual air temperature: 38 to 45 degrees F
Frost-free period: 60 to 100 days
Farmland classification: Not prime farmland

Map Unit Composition

Curecanti family and similar soils: 30 percent
Pathead and similar soils: 25 percent
Pathead and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Curecanti Family

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from sandstone and shale

Typical profile

A11 - 0 to 7 inches: loam
A12 - 7 to 15 inches: very stony loam
A2 - 15 to 20 inches: very stony loam
B21t, B22t - 20 to 60 inches: very stony loam

Properties and qualities

Slope: 50 to 70 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Mountain very steep loam (oak) (R048AY465UT)

Description of Pathead

Setting

Landform: Mountainsides, canyons
Landform position (three-dimensional): Mountainflank

Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Colluvium over residuum weathered from sandstone and shale

Typical profile

A1 - 0 to 4 inches: extremely bouldery fine sandy loam
C1, C2 - 4 to 38 inches: very stony fine sandy loam
R - 38 to 42 inches: unweathered bedrock

Properties and qualities

Slope: 40 to 70 percent
Percent of area covered with surface fragments: 33.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Mountain windswept ridge (R048AY478UT)

Description of Pathead

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium over residuum weathered from sandstone and shale

Typical profile

A1 - 0 to 3 inches: extremely stony loam
C1, C2 - 3 to 26 inches: very cobbly loam
R - 26 to 30 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 70 percent
Percent of area covered with surface fragments: 33.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Mountain very steep loam (salina wildrye) (R048AY466UT)

Minor Components

Perma family

Percent of map unit: 10 percent

Midfork family

Percent of map unit: 7 percent

Senchert family

Percent of map unit: 3 percent

118—Trag-Croydon complex

Map Unit Setting

National map unit symbol: jx44
Elevation: 7,580 to 9,470 feet
Mean annual precipitation: 16 to 25 inches
Mean annual air temperature: 34 to 40 degrees F
Frost-free period: 40 to 80 days
Farmland classification: Not prime farmland

Map Unit Composition

Trag and similar soils: 50 percent
Croydon and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trag

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium and/or colluvium derived from sandstone and shale

Typical profile

A1 - 0 to 10 inches: stony loam
B1,B21t,B22t - 10 to 36 inches: clay loam
C - 36 to 60 inches: clay loam

Properties and qualities

Slope: 30 to 60 percent

Percent of area covered with surface fragments: 13.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Mountain loam (salina wildrye) (R048AY409UT)

Description of Croydon

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and/or slope alluvium over residuum weathered from sandstone and shale

Typical profile

A11, A12 - 0 to 16 inches: loam
A2 - 16 to 23 inches: loam
B21t, B22t - 23 to 48 inches: clay loam
R - 48 to 52 inches: weathered bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: High mountain loam (aspen) (R047XA508UT)

Minor Components

Trag, extremely bouldery surface

Percent of map unit: 10 percent

Falcon

Percent of map unit: 5 percent

Rock outcrop

Percent of map unit: 5 percent
Landform: Hillslopes, mountain slopes
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex

125—Uinta-Toze families complex

Map Unit Setting

National map unit symbol: jx4d
Elevation: 7,780 to 9,570 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 34 to 38 degrees F
Frost-free period: 40 to 60 days
Farmland classification: Not prime farmland

Map Unit Composition

Uinta family and similar soils: 35 percent
Toze family and similar soils: 30 percent
Minor components: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Uinta Family

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from sandstone and siltstone

Typical profile

A11 - 0 to 3 inches: loam
A12 - 3 to 11 inches: stony sandy loam
B21t - 11 to 24 inches: stony clay loam
B22t - 24 to 42 inches: stony clay loam
R - 42 to 46 inches: unweathered bedrock

Properties and qualities

Slope: 40 to 70 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: High mountain very steep stony loam (engelmann spruce) (R048AY532UT)

Description of Toze Family

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from sandstone, shale and siltstone

Typical profile

A11 - 0 to 3 inches: fine sandy loam
A12, A13 - 3 to 32 inches: gravelly silt loam
C1k, C2 - 32 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: B
Ecological site: High mountain very steep stony loam (engelmann spruce) (R048AY532UT)

Minor Components

Comodore

Percent of map unit: 15 percent

Uinta family, no albic sub-surface

Percent of map unit: 15 percent

Midfork family

Percent of map unit: 5 percent

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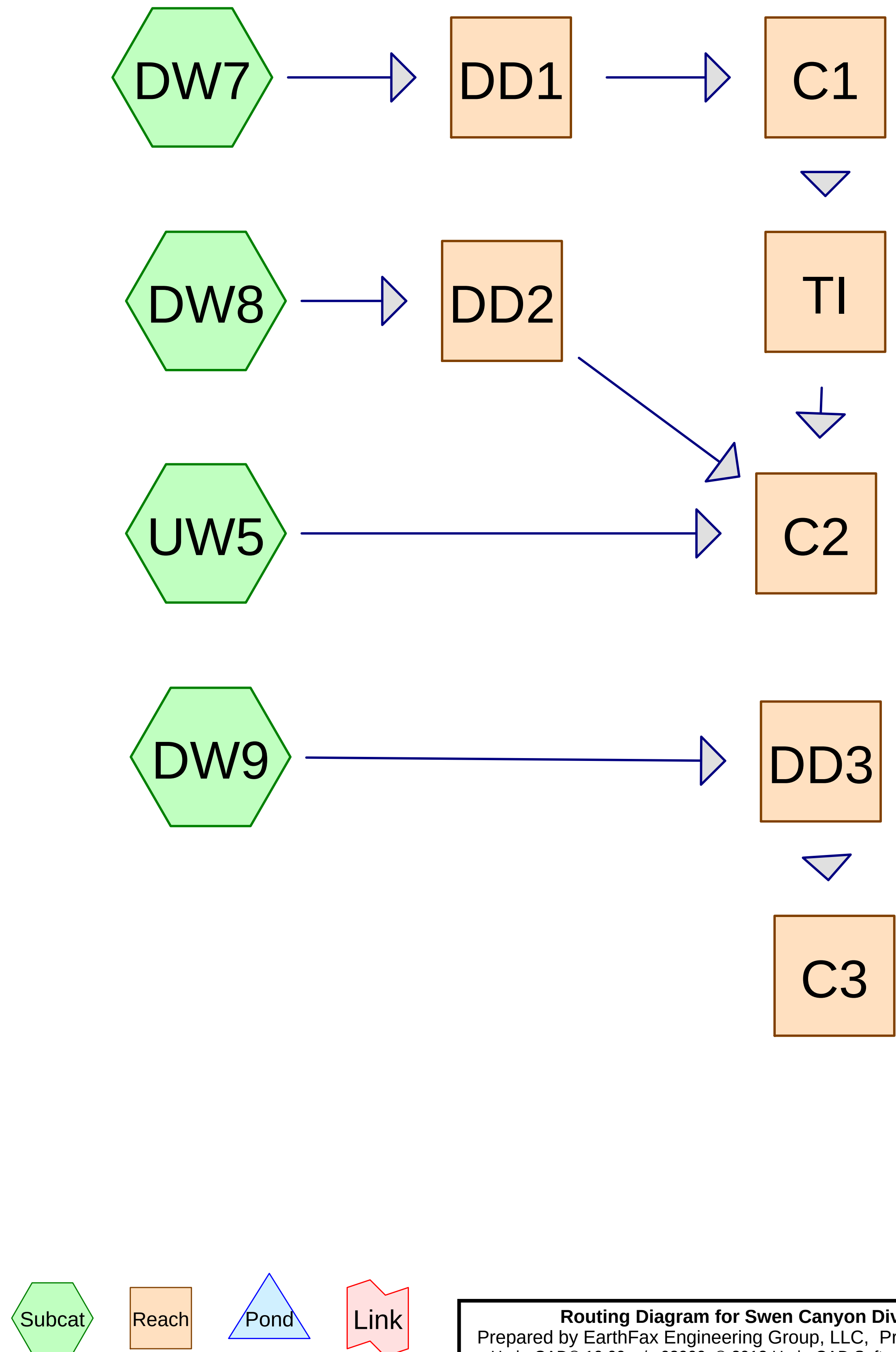


Routing Diagram for Swen Canyon Diversions
Prepared by EarthFax Engineering Group, LLC, Printed 11/14/2014

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.250	65	Brush, Good, HSG C (DW9, UW5)
0.350	77	Brush, Poor, HSG C (DW9)
1.250	89	Gravel roads, HSG C (DW7, DW8, DW9)

Summary for Subcatchment DW7:

Runoff = 1.01 cfs @ 2.94 hrs, Volume= 0.029 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.60"

Area (ac)	CN	Description
0.500	89	Gravel roads, HSG C
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	100	0.0200	0.64		**Lag/CN Method,**

Summary for Subcatchment DW8:

Runoff = 1.01 cfs @ 2.94 hrs, Volume= 0.029 af, Depth= 0.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.60"

Area (ac)	CN	Description
0.500	89	Gravel roads, HSG C
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	100	0.0200	0.64		**Lag/CN Method,**

Summary for Subcatchment DW9:

Runoff = 0.41 cfs @ 2.97 hrs, Volume= 0.017 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.60"

Area (ac)	CN	Description
1.000	65	Brush, Good, HSG C
0.350	77	Brush, Poor, HSG C
0.250	89	Gravel roads, HSG C
1.600	71	Weighted Average
1.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	200	0.1800	1.24		**Lag/CN Method,**

Summary for Subcatchment UW5:

Runoff = 0.01 cfs @ 3.01 hrs, Volume= 0.001 af, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.60"

Area (ac)	CN	Description
0.250	65	Brush, Good, HSG C
0.250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	100	0.3000	1.19		**Lag/CN Method,**

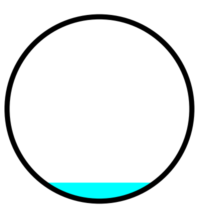
Summary for Reach C1:

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 0.71"
Inflow = 0.94 cfs @ 2.95 hrs, Volume= 0.029 af
Outflow = 0.92 cfs @ 2.96 hrs, Volume= 0.029 af, Atten= 2%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.18 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.34 fps, Avg. Travel Time= 0.5 min

Peak Storage= 11 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 44.98 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 120.0' Slope= 0.1833 '/'
Inlet Invert= 8,670.00', Outlet Invert= 8,648.00'



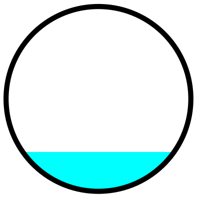
Summary for Reach C2:

Inflow Area = 1.250 ac, 0.00% Impervious, Inflow Depth = 0.57"
Inflow = 1.84 cfs @ 2.96 hrs, Volume= 0.060 af
Outflow = 1.82 cfs @ 2.96 hrs, Volume= 0.060 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.71 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.79 fps, Avg. Travel Time= 0.4 min

Peak Storage= 16 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 18.69 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0317 '/'
Inlet Invert= 8,647.90', Outlet Invert= 8,646.00'



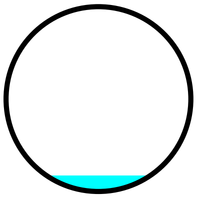
Summary for Reach C3:

Inflow Area =	1.600 ac,	0.00% Impervious, Inflow Depth = 0.13"	
Inflow =	0.31 cfs @	3.07 hrs, Volume=	0.017 af
Outflow =	0.30 cfs @	3.07 hrs, Volume=	0.017 af, Atten= 3%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.25 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.26 fps, Avg. Travel Time= 0.4 min

Peak Storage= 4 cf @ 3.07 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 21.01 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 50.0' Slope= 0.0400 '/'
Inlet Invert= 8,636.00', Outlet Invert= 8,634.00'



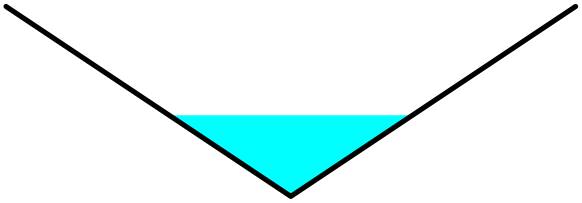
Summary for Reach DD1:

Inflow Area =	0.500 ac,	0.00% Impervious, Inflow Depth = 0.71"	
Inflow =	1.01 cfs @	2.94 hrs, Volume=	0.029 af
Outflow =	0.94 cfs @	2.95 hrs, Volume=	0.029 af, Atten= 7%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.59 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 1.8 min

Peak Storage= 47 cf @ 2.94 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 9.50 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 171.0' Slope= 0.0936 '/'
Inlet Invert= 8,686.00', Outlet Invert= 8,670.00'



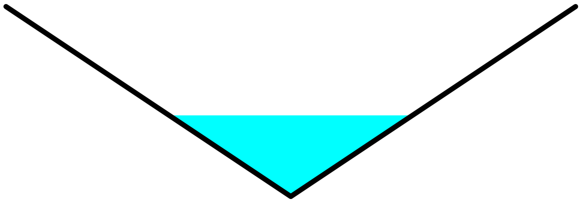
Summary for Reach DD2:

Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 0.71"
Inflow = 1.01 cfs @ 2.94 hrs, Volume= 0.029 af
Outflow = 0.94 cfs @ 2.95 hrs, Volume= 0.029 af, Atten= 7%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.59 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 1.8 min

Peak Storage= 47 cf @ 2.94 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 9.50 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 171.0' Slope= 0.0936 '/'
Inlet Invert= 8,686.00', Outlet Invert= 8,670.00'



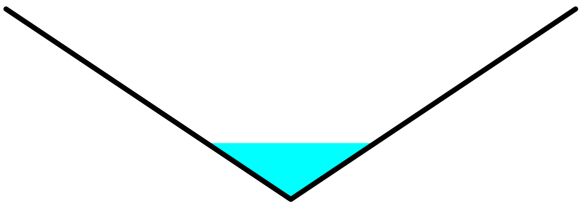
Summary for Reach DD3:

Inflow Area = 1.600 ac, 0.00% Impervious, Inflow Depth = 0.13"
Inflow = 0.41 cfs @ 2.97 hrs, Volume= 0.017 af
Outflow = 0.31 cfs @ 3.07 hrs, Volume= 0.017 af, Atten= 24%, Lag= 5.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.44 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 6.1 min

Peak Storage= 60 cf @ 3.02 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 8.33 cfs

0.00' x 1.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 460.0' Slope= 0.0217 '/'
Inlet Invert= 8,648.00', Outlet Invert= 8,638.00'



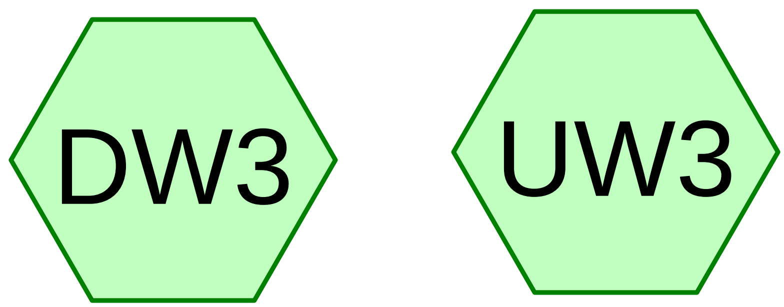
Summary for Reach TI:

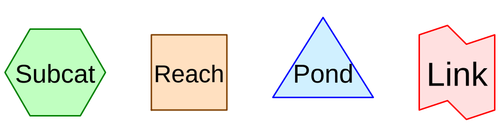
Inflow Area = 0.500 ac, 0.00% Impervious, Inflow Depth = 0.71"
Inflow = 0.92 cfs @ 2.96 hrs, Volume= 0.029 af
Outflow = 0.91 cfs @ 2.96 hrs, Volume= 0.029 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 0.4 min

Peak Storage= 9 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 3.00' Flow Area= 34.5 sf, Capacity= 191.32 cfs

5.50' x 3.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 17.50'
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 8,648.00', Outlet Invert= 8,647.90'





Routing Diagram for Swen Canyon ASCA
Prepared by EarthFax Engineering Group, LLC, Printed 12/10/2014

Summary for Subcatchment DW3:

Runoff = 3.53 cfs @ 11.95 hrs, Volume= 0.160 af, Depth> 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.13"

Area (ac)	CN	Description
1.500	91	Gravel roads, HSG D
1.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	250	0.0300	1.02		**Lag/CN Method,**

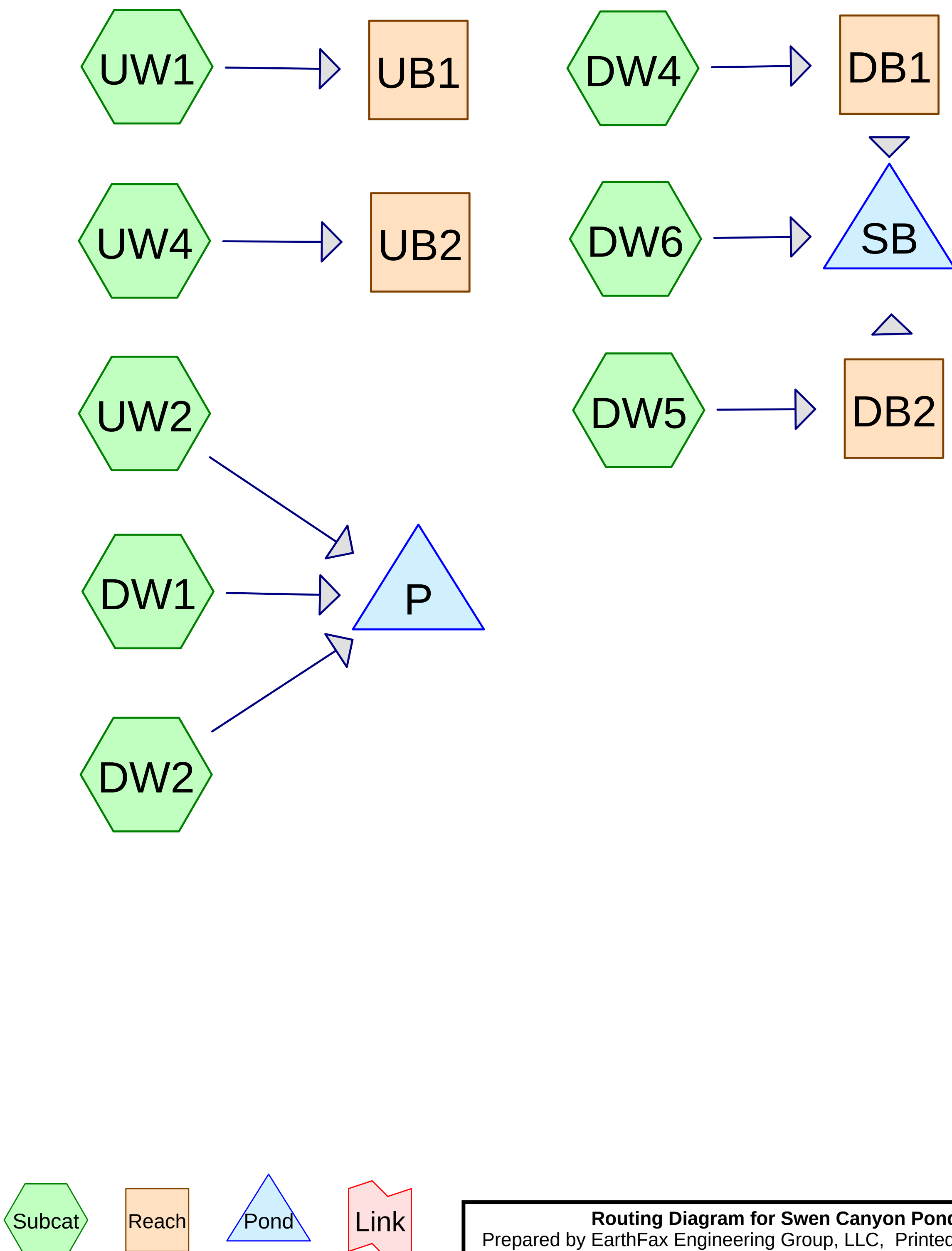
Summary for Subcatchment UW3:

Runoff = 0.02 cfs @ 11.95 hrs, Volume= 0.001 af, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.13"

Area (ac)	CN	Description
0.100	65	Brush, Good, HSG C
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	70	0.2000	0.90		**Lag/CN Method,**



Routing Diagram for Swen Canyon Pond
Prepared by EarthFax Engineering Group, LLC, Printed 12/10/2014
HydroCAD® 10.00 s/n 03900 © 2013 HydroCAD Software Solutions LLC

Summary for Subcatchment DW1:

Runoff = 1.93 cfs @ 11.89 hrs, Volume= 0.093 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.400	98	Unconnected pavement, HSG C
0.400		100.00% Impervious Area
0.400		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.6700	5.32		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 5.78 cfs @ 11.89 hrs, Volume= 0.280 af, Depth> 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
1.200	98	Unconnected pavement, HSG C
1.200		100.00% Impervious Area
1.200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.3300	2.91		**Lag/CN Method,**

Summary for Subcatchment DW4:

Runoff = 0.89 cfs @ 11.90 hrs, Volume= 0.036 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.400	77	Brush, Poor, HSG C
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	70	0.5000	1.99		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 1.33 cfs @ 11.90 hrs, Volume= 0.055 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.600	77	Brush, Poor, HSG C
0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	90	0.5000	2.09		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 0.44 cfs @ 11.90 hrs, Volume= 0.018 af, Depth> 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.200	77	Brush, Poor, HSG C
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	90	0.5000	2.09		**Lag/CN Method,**

Summary for Subcatchment UW1:

Runoff = 4.13 cfs @ 11.96 hrs, Volume= 0.190 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
2.600	73	Brush, Good, HSG D
2.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	550	0.3000	2.07		**Lag/CN Method,**

Summary for Subcatchment UW2:

Runoff = 0.68 cfs @ 11.93 hrs, Volume= 0.029 af, Depth> 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.400	73	Brush, Good, HSG D
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.1800	1.18		**Lag/CN Method,**

Summary for Subcatchment UW4:

Runoff = 0.19 cfs @ 11.94 hrs, Volume= 0.009 af, Depth> 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.03"

Area (ac)	CN	Description
0.200	65	Brush, Good, HSG C
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	150	0.2500	1.18		**Lag/CN Method,**

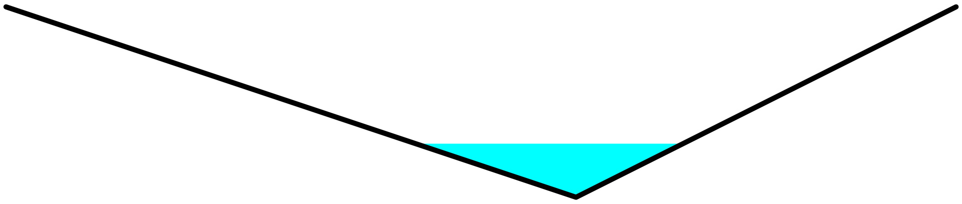
Summary for Reach DB1:

Inflow Area = 0.400 ac, 0.00% Impervious, Inflow Depth > 1.09"
Inflow = 0.89 cfs @ 11.90 hrs, Volume= 0.036 af
Outflow = 0.78 cfs @ 11.95 hrs, Volume= 0.036 af, Atten= 12%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.14 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 4.3 min

Peak Storage= 83 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 24.41 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 420.0' Slope= 0.1476 '/'
Inlet Invert= 8,752.00', Outlet Invert= 8,690.00'



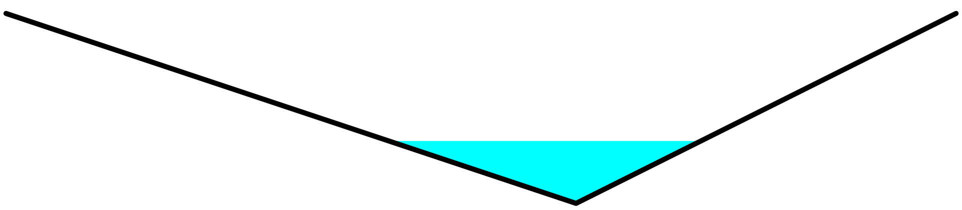
Summary for Reach DB2:

Inflow Area = 0.600 ac, 0.00% Impervious, Inflow Depth > 1.09"
Inflow = 1.33 cfs @ 11.90 hrs, Volume= 0.055 af
Outflow = 1.18 cfs @ 11.95 hrs, Volume= 0.054 af, Atten= 11%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.58 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 3.9 min

Peak Storage= 113 cf @ 11.93 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 24.41 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 420.0' Slope= 0.1476 '/'
Inlet Invert= 8,752.00', Outlet Invert= 8,690.00'



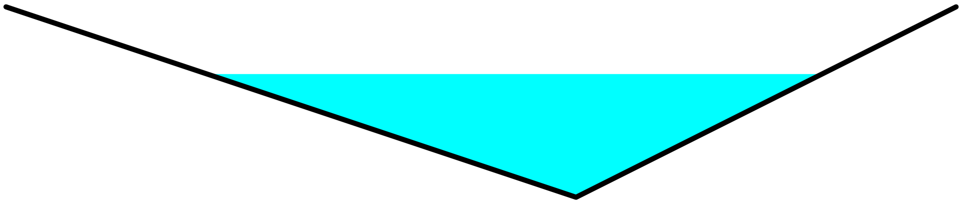
Summary for Reach UB1:

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth > 0.87"
Inflow = 4.13 cfs @ 11.96 hrs, Volume= 0.190 af
Outflow = 2.82 cfs @ 12.14 hrs, Volume= 0.188 af, Atten= 32%, Lag= 11.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.78 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 16.2 min

Peak Storage= 1,256 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 9.35 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 1,200.0' Slope= 0.0217 '/'
Inlet Invert= 8,746.00', Outlet Invert= 8,720.00'



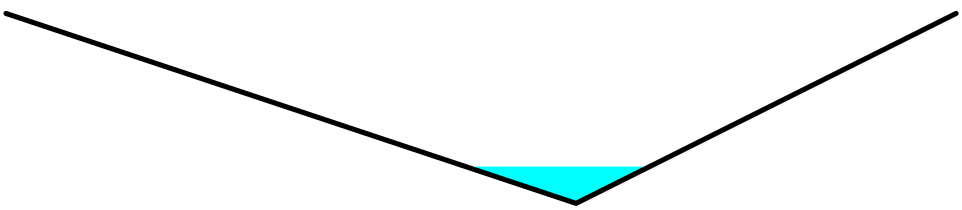
Summary for Reach UB2:

Inflow Area = 0.200 ac, 0.00% Impervious, Inflow Depth > 0.52"
Inflow = 0.19 cfs @ 11.94 hrs, Volume= 0.009 af
Outflow = 0.16 cfs @ 11.97 hrs, Volume= 0.009 af, Atten= 12%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 2.4 min

Peak Storage= 11 cf @ 11.95 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 14.21 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 120.0' Slope= 0.0500 '/'
Inlet Invert= 8,752.00', Outlet Invert= 8,746.00'



Summary for Pond P:

Inflow Area = 2.000 ac, 80.00% Impervious, Inflow Depth > 2.41"
Inflow = 8.31 cfs @ 11.89 hrs, Volume= 0.402 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 8,700.40' @ 24.00 hrs Surf.Area= 44,139 sf Storage= 17,519 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	8,683.25'	58,359 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
8,683.25	0	0.0	0	0
8,683.30	4,844	0.0	0	0
8,684.00	5,689	0.0	0	0
8,686.00	9,239	0.0	0	0
8,688.00	12,777	0.0	0	0
8,690.00	16,650	0.0	0	0
8,692.00	20,877	0.0	0	0
8,694.00	25,765	0.0	0	0
8,696.00	31,251	0.0	0	0
8,698.00	36,966	0.0	0	0
8,700.00	42,912	0.0	0	0
8,700.40	44,131	100.0	17,409	17,409
8,701.30	46,871	100.0	40,951	58,359

Summary for Pond SB:

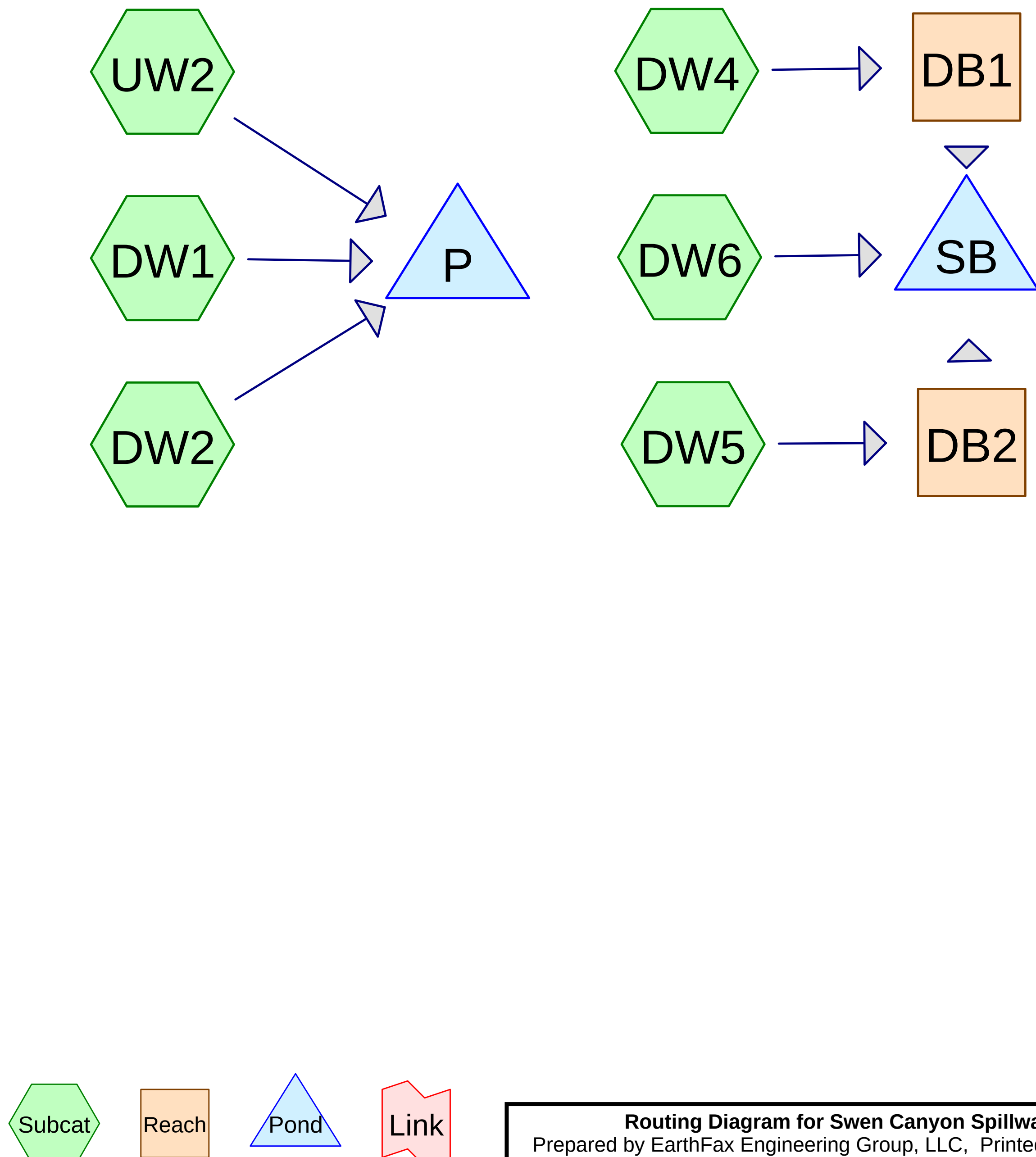
Inflow Area = 1.200 ac, 0.00% Impervious, Inflow Depth > 1.09"
Inflow = 2.32 cfs @ 11.94 hrs, Volume= 0.109 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 8,694.57' @ 24.00 hrs Surf.Area= 3,645 sf Storage= 4,746 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	8,687.50'	6,385 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
8,687.50	0	0.0	0	0
8,688.00	69	0.0	0	0
8,689.00	303	0.0	0	0
8,690.00	656	0.0	0	0
8,692.00	1,717	0.0	0	0
8,692.05	1,749	0.0	0	0
8,693.00	2,424	0.0	0	0
8,693.05	2,463	100.0	122	122
8,694.00	3,168	100.0	2,675	2,797
8,694.60	3,668	100.0	2,051	4,848
8,695.00	4,018	100.0	1,537	6,385



Routing Diagram for Swen Canyon Spillways
Prepared by EarthFax Engineering Group, LLC, Printed 1/13/2016

Summary for Subcatchment DW1:

Runoff = 1.69 cfs @ 2.89 hrs, Volume= 0.056 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
0.400	98	Unconnected pavement, HSG C
0.400		100.00% Impervious Area
0.400		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.6700	5.32		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 5.08 cfs @ 2.89 hrs, Volume= 0.169 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
1.200	98	Unconnected pavement, HSG C
1.200		100.00% Impervious Area
1.200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.3300	2.91		**Lag/CN Method,**

Summary for Subcatchment DW4:

Runoff = 0.47 cfs @ 2.91 hrs, Volume= 0.013 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
0.400	77	Brush, Poor, HSG C
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	70	0.5000	1.99		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 0.70 cfs @ 2.92 hrs, Volume= 0.020 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
0.600	77	Brush, Poor, HSG C
0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	90	0.5000	2.09		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 0.23 cfs @ 2.92 hrs, Volume= 0.007 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
0.200	77	Brush, Poor, HSG C
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	90	0.5000	2.09		**Lag/CN Method,**

Summary for Subcatchment UW2:

Runoff = 0.31 cfs @ 2.94 hrs, Volume= 0.009 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.91"

Area (ac)	CN	Description
0.400	73	Brush, Good, HSG D
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.1800	1.18		**Lag/CN Method,**

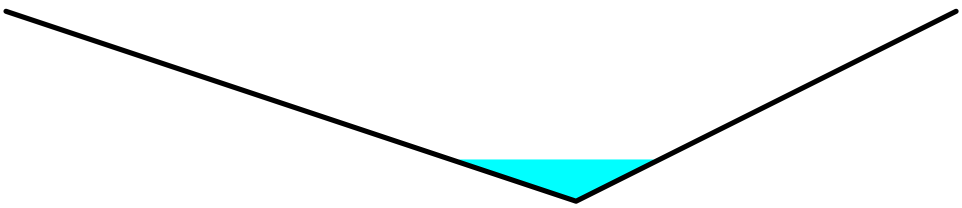
Summary for Reach DB1:

Inflow Area =	0.400 ac,	0.00% Impervious,	Inflow Depth = 0.40"	
Inflow =	0.47 cfs @	2.91 hrs, Volume=	0.013 af	
Outflow =	0.39 cfs @	2.98 hrs, Volume=	0.013 af,	Atten= 16%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 4.2 min

Peak Storage= 51 cf @ 2.94 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 24.41 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 420.0' Slope= 0.1476 '/'
Inlet Invert= 8,752.00', Outlet Invert= 8,690.00'



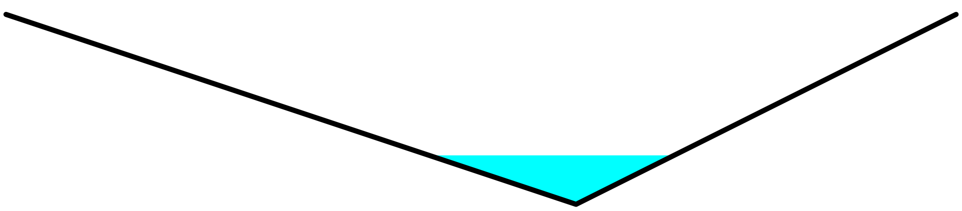
Summary for Reach DB2:

Inflow Area =	0.600 ac,	0.00% Impervious,	Inflow Depth = 0.40"	
Inflow =	0.70 cfs @	2.92 hrs, Volume=	0.020 af	
Outflow =	0.60 cfs @	2.97 hrs, Volume=	0.020 af,	Atten= 15%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.95 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 3.8 min

Peak Storage= 70 cf @ 2.94 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 24.41 cfs

0.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 3.0 2.0 '/' Top Width= 5.00'
Length= 420.0' Slope= 0.1476 '/'
Inlet Invert= 8,752.00', Outlet Invert= 8,690.00'



Summary for Pond P:

Inflow Area = 2.000 ac, 80.00% Impervious, Inflow Depth = 1.40"
Inflow = 6.98 cfs @ 2.89 hrs, Volume= 0.234 af
Outflow = 0.74 cfs @ 3.18 hrs, Volume= 0.234 af, Atten= 89%, Lag= 17.5 min
Primary = 0.74 cfs @ 3.18 hrs, Volume= 0.234 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 8,700.44' @ 3.18 hrs Surf.Area= 44,253 sf Storage= 6,175 cf

Plug-Flow detention time= 138.8 min calculated for 0.234 af (100% of inflow)
Center-of-Mass det. time= 138.6 min (324.7 - 186.1)

Volume	Invert	Avail.Storage	Storage Description
#1	8,683.25'	45,349 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
8,683.25	0	0.0	0	0
8,683.30	4,844	0.0	0	0
8,684.00	5,689	0.0	0	0
8,686.00	9,239	0.0	0	0
8,688.00	12,777	0.0	0	0
8,690.00	16,650	0.0	0	0
8,692.00	20,877	0.0	0	0
8,694.00	25,765	0.0	0	0
8,696.00	31,251	0.0	0	0
8,698.00	36,966	0.0	0	0
8,700.00	42,912	0.0	0	0
8,700.30	43,826	0.0	0	0
8,701.30	46,871	100.0	45,349	45,349

Device	Routing	Invert	Outlet Devices
#1	Primary	8,700.30'	**Special & User-Defined** Head (feet) 0.00 0.14 Disch. (cfs) 0.000 0.740

Primary OutFlow Max=0.74 cfs @ 3.18 hrs HW=8,700.44' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.74 cfs)

Summary for Pond SB:

Inflow Area = 1.200 ac, 0.00% Impervious, Inflow Depth = 0.40"
Inflow = 1.16 cfs @ 2.96 hrs, Volume= 0.040 af
Outflow = 0.64 cfs @ 3.05 hrs, Volume= 0.040 af, Atten= 45%, Lag= 5.5 min
Primary = 0.64 cfs @ 3.05 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 8,693.44' @ 3.05 hrs Surf.Area= 2,761 sf Storage= 378 cf

Plug-Flow detention time= 9.8 min calculated for 0.040 af (100% of inflow)
Center-of-Mass det. time= 9.8 min (230.1 - 220.4)

Volume	Invert	Avail.Storage	Storage Description
#1	8,688.50'	3,040 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
8,688.50	0	0.0	0	0
8,689.00	303	0.0	0	0
8,690.00	656	0.0	0	0
8,692.00	1,717	0.0	0	0
8,692.55	2,116	0.0	0	0
8,693.30	2,660	0.0	0	0
8,694.00	3,168	100.0	2,040	2,040
8,694.30	3,498	100.0	1,000	3,040

Device	Routing	Invert	Outlet Devices
#1	Primary	8,693.30'	**Special & User-Defined** Head (feet) 0.00 0.14 Disch. (cfs) 0.000 0.640

Primary OutFlow Max=0.63 cfs @ 3.05 hrs HW=8,693.44' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.63 cfs)

Runoff Conveyance System Details

Label	Depth (ft)	Velocity (ft/s)	Left Side Slope (V : H)	Bottom Width (ft)	Right Side Slope (V : H)	Discharge (cfs)	Slope (ft/ft)	Mannings Coefficient
DB-1 Max. Depth	0.35	2.84	0.33		0.50	0.89	0.050000	0.035
DB-1 Max. Velocity	0.27	4.78	0.33		0.50	0.89	0.200000	0.035
DB-2 Max. Depth	0.41	3.14	0.33		0.50	1.33	0.050000	0.035
DB-2 Max. Rock Required	0.33	4.97	0.33		0.50	1.33	0.170000	0.035
DB-2 Max. Velocity	0.33	4.78	0.33		0.50	1.33	0.200000	0.040
DD-1 Max. Depth	0.55	2.24	0.67		0.67	1.01	0.020000	0.035
DD-1 Max. Velocity	0.43	3.68	0.67		0.67	1.01	0.075000	0.035
DD-2 Max. Depth	0.46	3.16	0.67		0.67	1.01	0.050000	0.035
DD-2 Max. Velocity	0.43	3.68	0.67		0.67	1.01	0.075000	0.035
DD-3 Max. Depth	0.45	1.38	0.67		0.67	0.41	0.010000	0.035
DD-3 Max. Velocity	0.33	2.52	0.67		0.67	0.41	0.050000	0.035
Pond Spillway Bottom Section	0.05	3.72	0.50	4.00	0.50	0.74	0.330000	0.030
Pond Spillway Top Section	0.13	1.09	0.10	4.00	0.10	0.74	0.010000	0.030
Sed Basin Spillway Bottom Section	0.04	3.49	0.50	4.00	0.50	0.63	0.330000	0.030
Sed Basin Spillway Top Section	0.13	1.18	0.50	4.00	0.50	0.63	0.010000	0.030
Swale Max. Depth	0.24	1.42	0.10	1.00	0.10	1.18	0.020000	0.040
Swale Max. Velocity	0.20	2.00	0.10	1.00	0.10	1.18	0.050000	0.040
UB-1 Max. Depth	0.85	2.28	0.33		0.50	4.13	0.010000	0.035
UB-1 Max. Rock Required	0.27	5.00	0.05		0.50	4.13	0.200000	0.035
UB-1 Max. Velocity	0.26	5.46	0.05		0.50	4.13	0.330000	0.040
UB-2 Max. Depth	0.23	1.37	0.33		0.50	0.19	0.020000	0.035
UB-2 Max. Velocity	0.16	2.91	0.33		0.50	0.19	0.150000	0.035

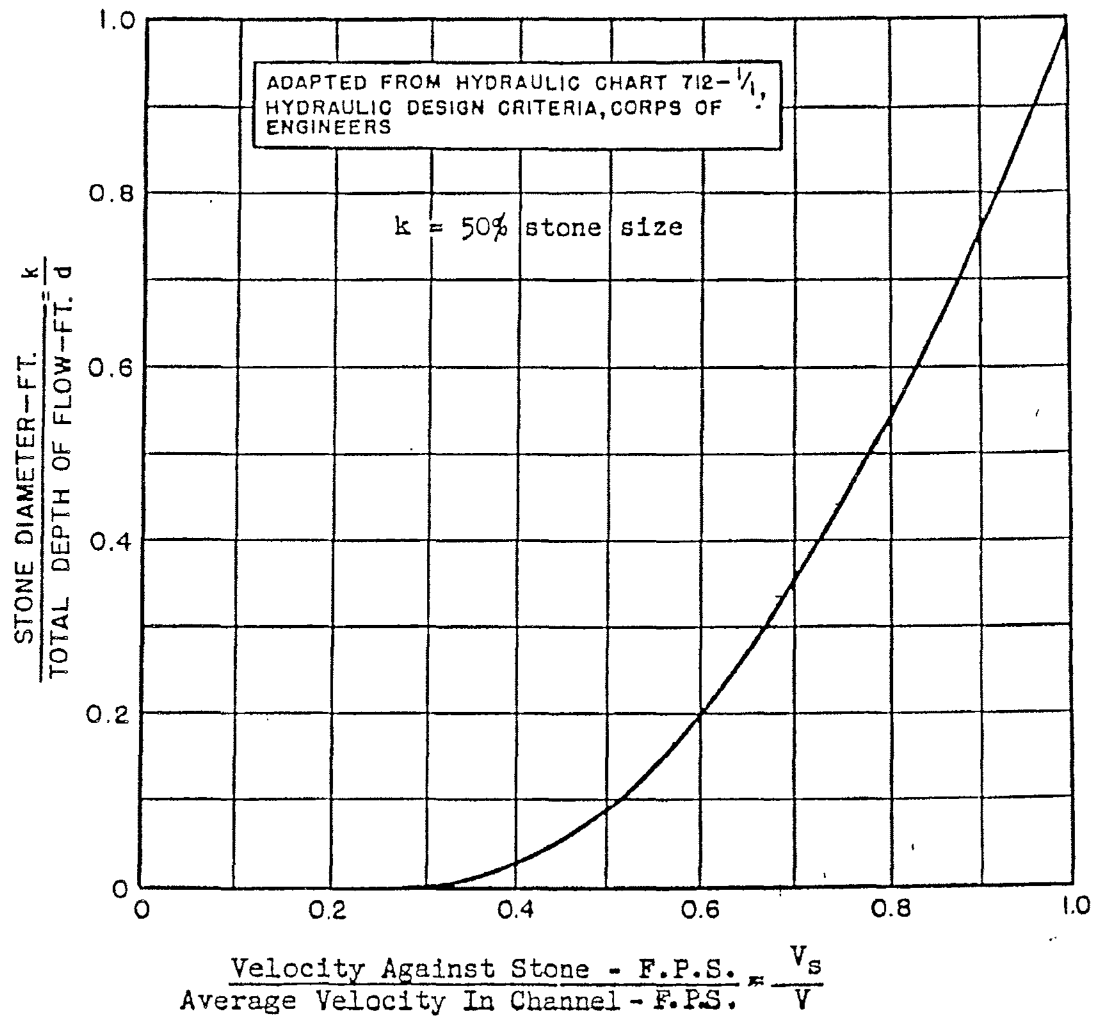


FIGURE 5-1 Velocity Against Stone on Channel Bottom (U.S. Department of Transportation, 1978).

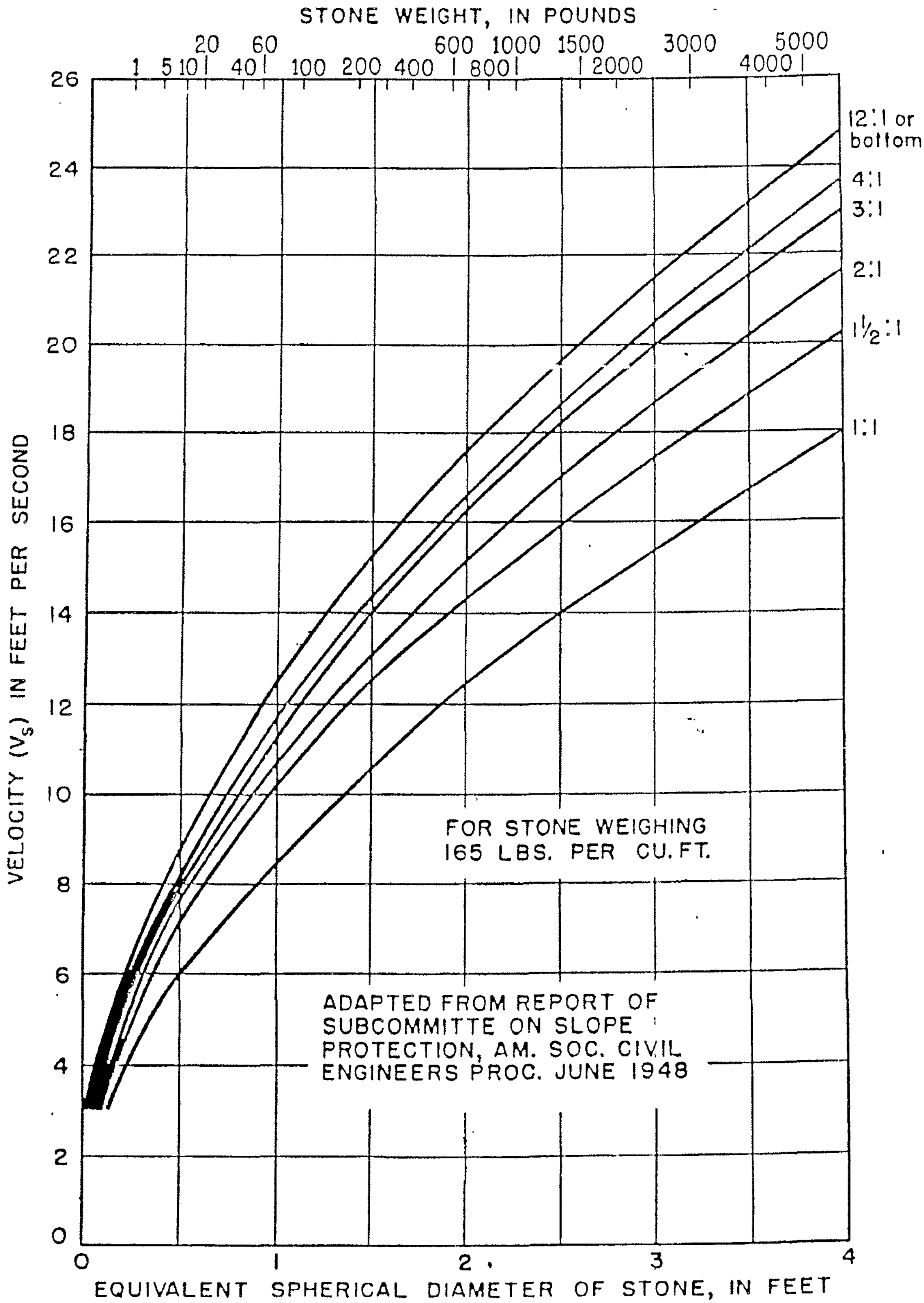
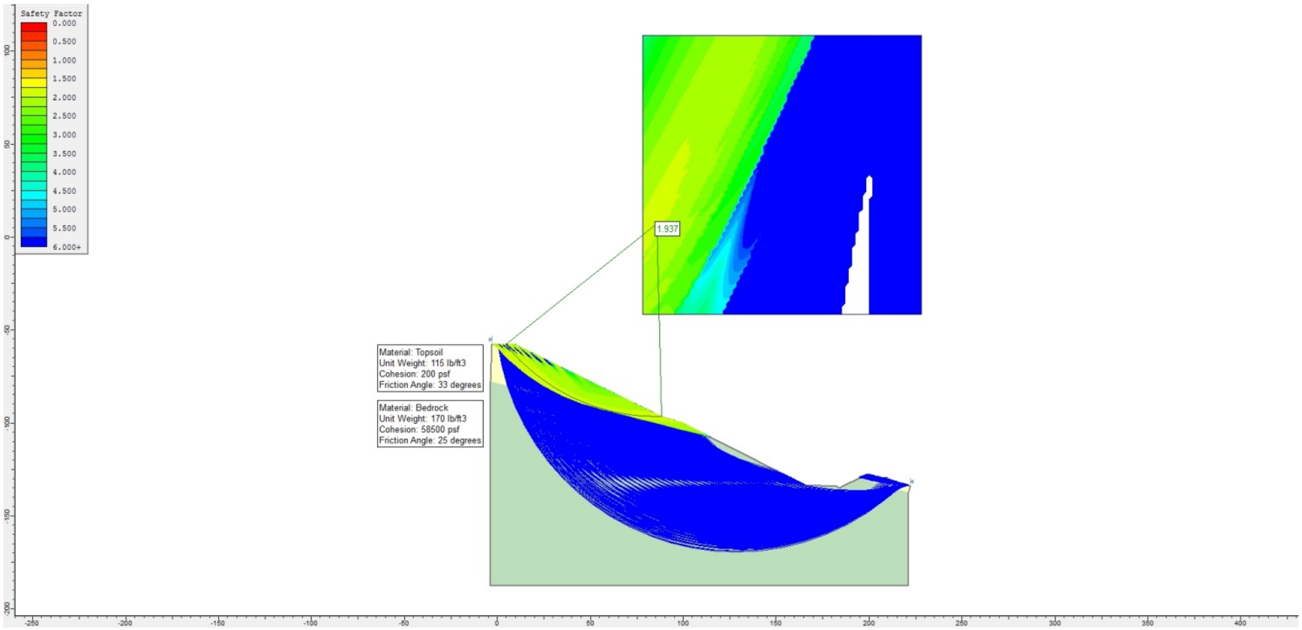


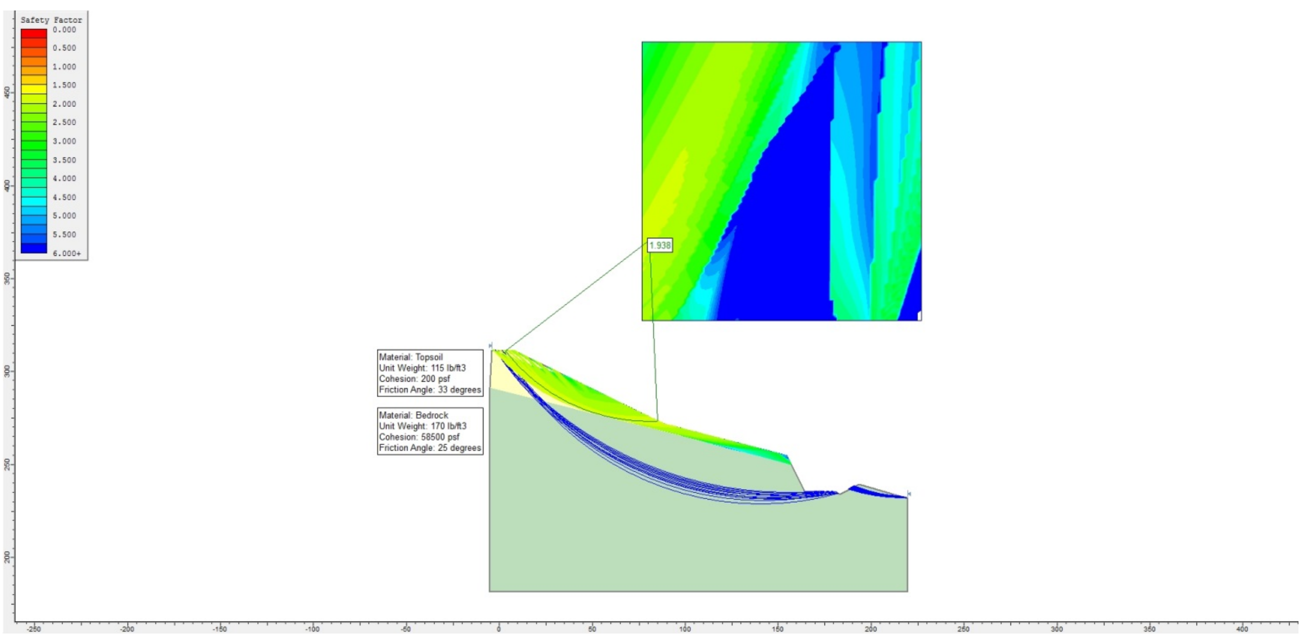
FIGURE 5-2 Size of Stone that will Resist Displacement for Various Velocities and Side Slopes (U.S. Department of Transportation, 1978).

ATTACHMENT B

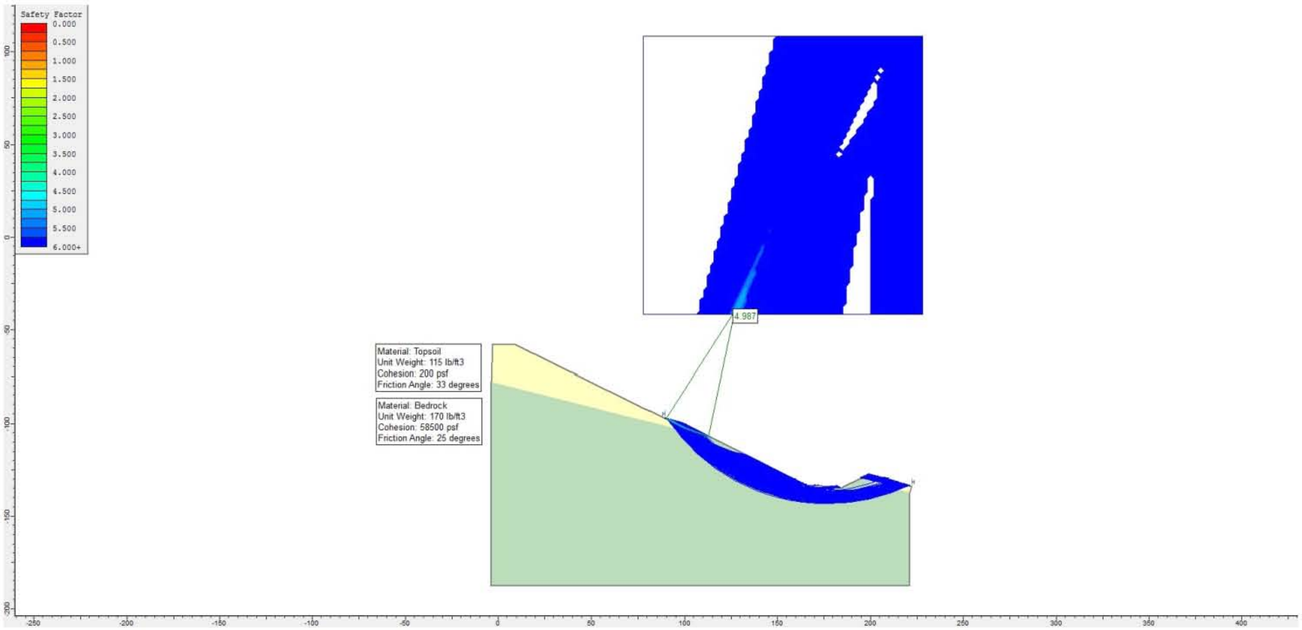
Geotechnical Analysis



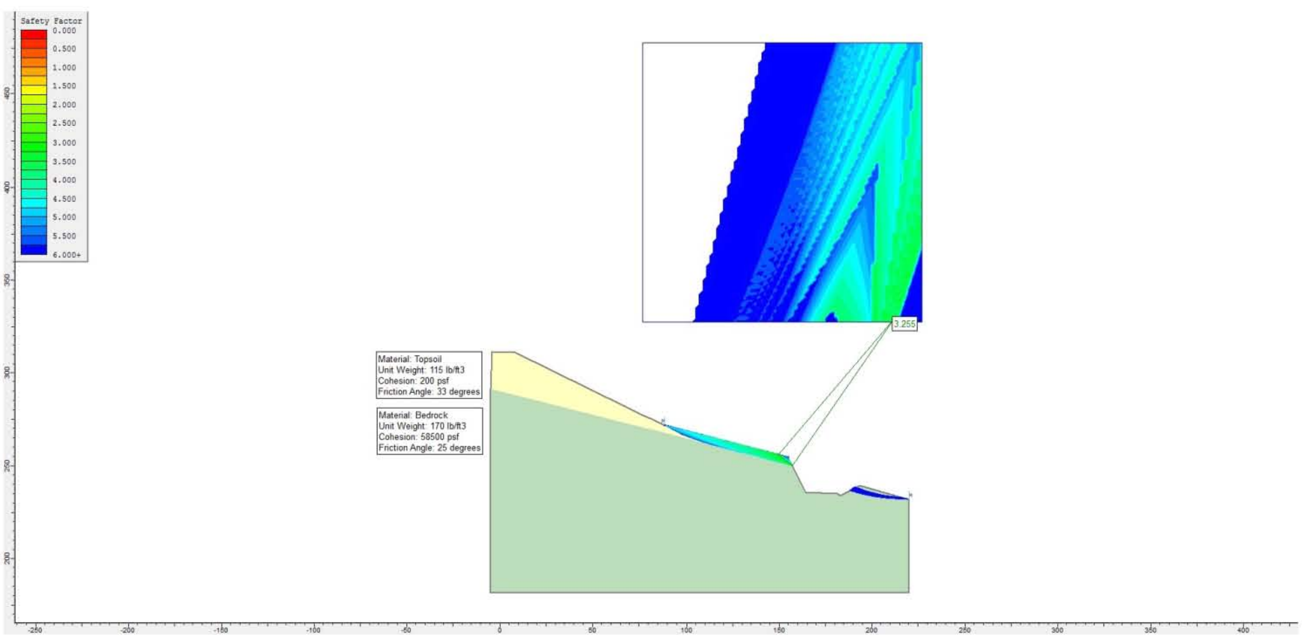
Topsoil and Access Road (STA 7+75): Topsoil stockpile and access road cut at 1.5H:1V. Stockpile.



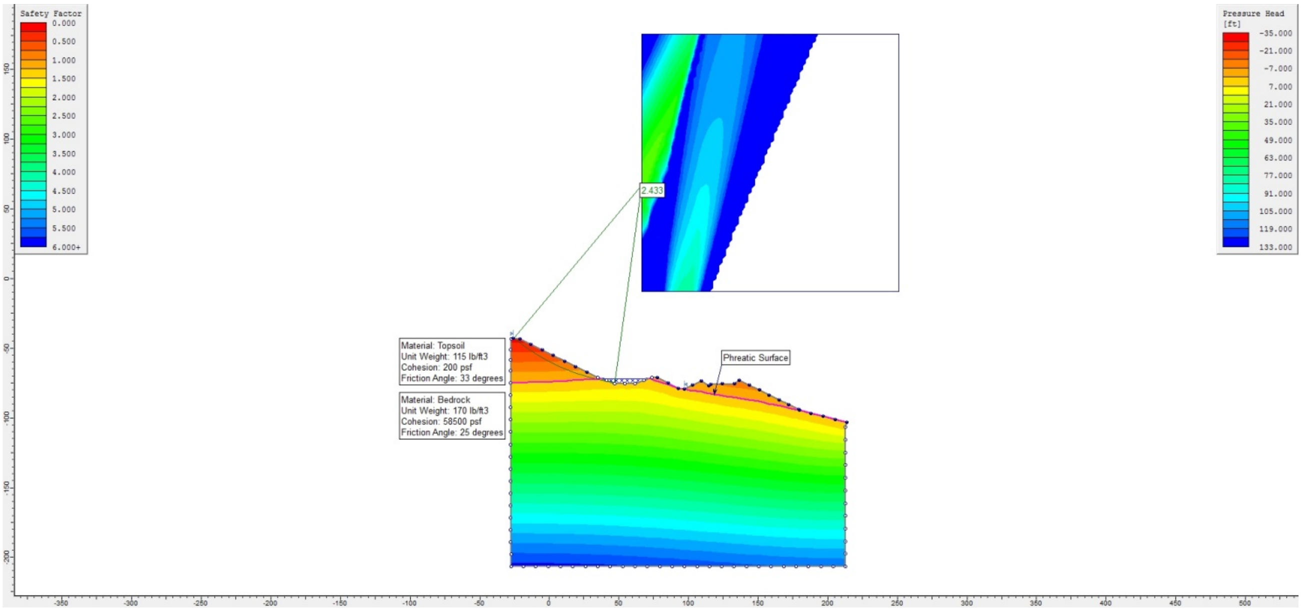
Topsoil and Access Road (STA 7+75): Topsoil stockpile and access road cut at 0.5H:1V. Stockpile.



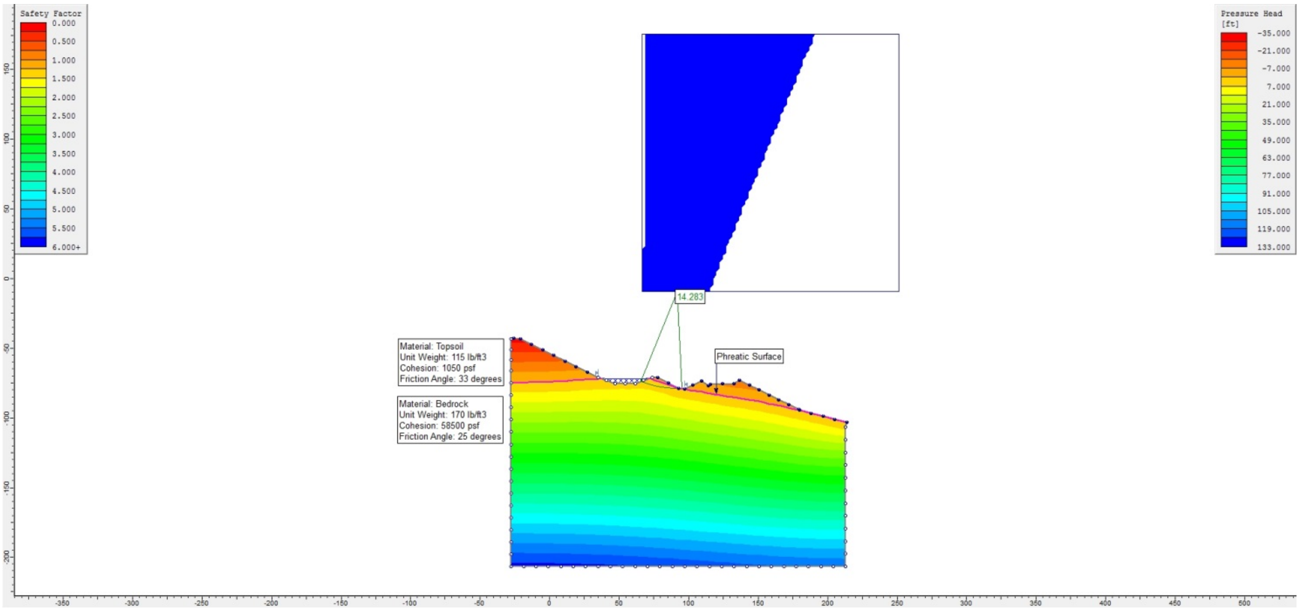
Topsoil and Access Road (STA 7+75): Topsoil stockpile and access road cut at 1.5H:1V. Road side slope.



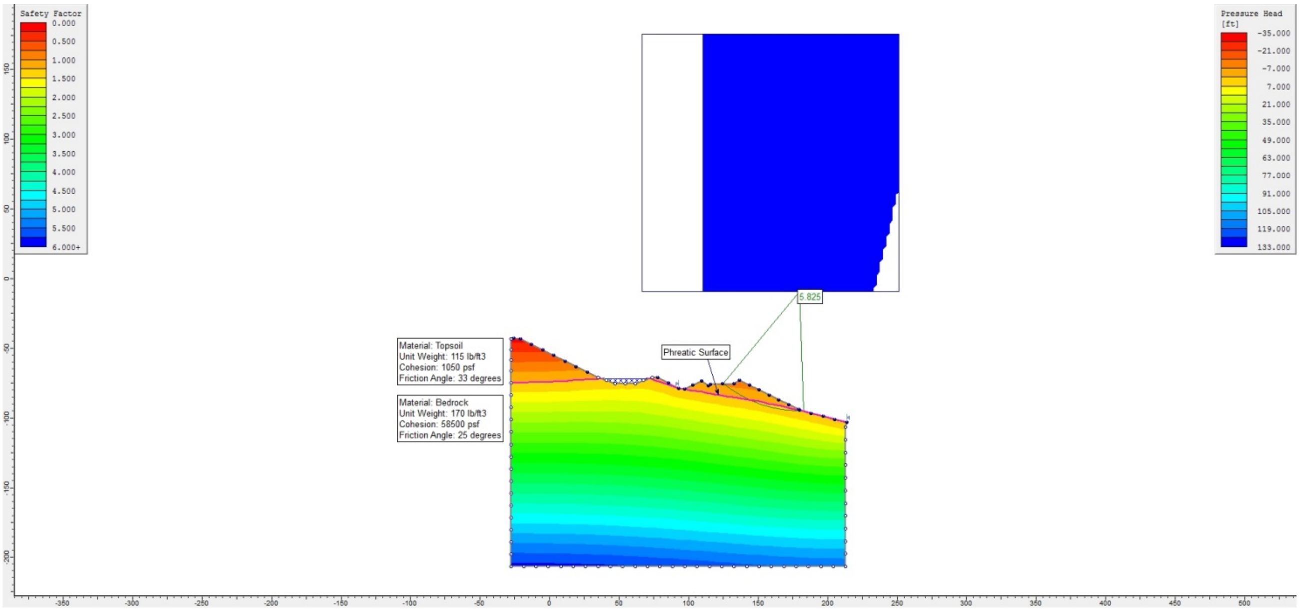
Topsoil and Access Road (STA 7+75): Topsoil stockpile and access road cut at 0.5H:1V. Road side slope.



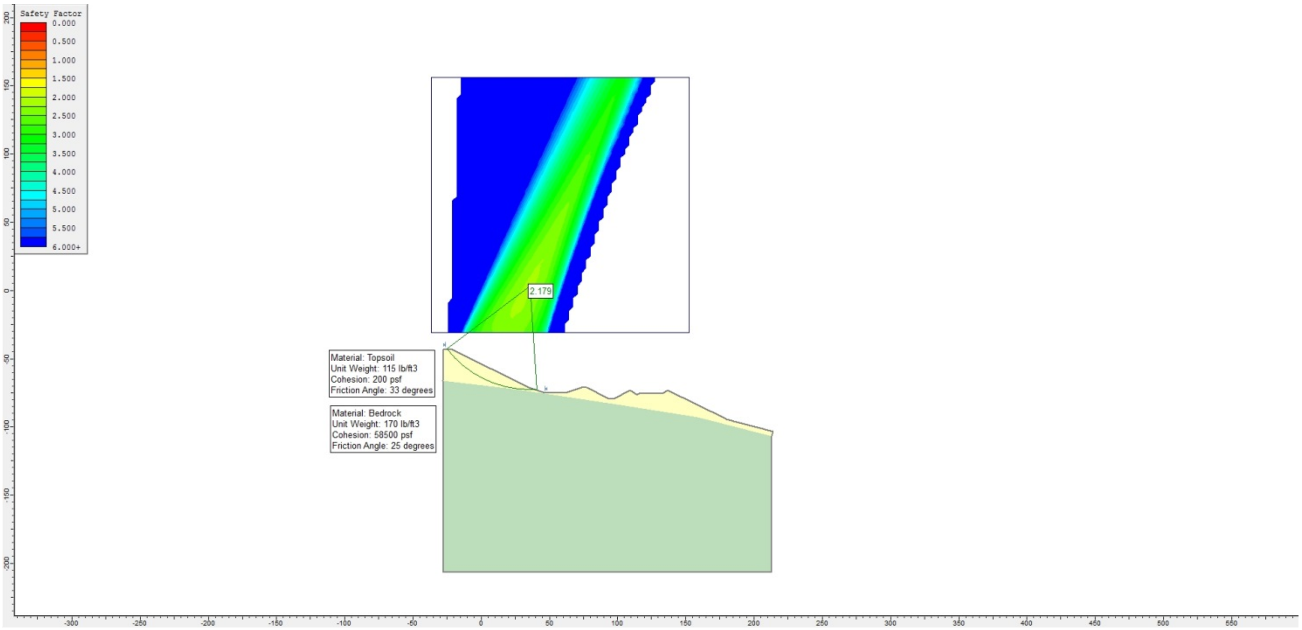
Topsoil Stockpile and Sediment Basin: Topsoil stockpile side slope with steady state.



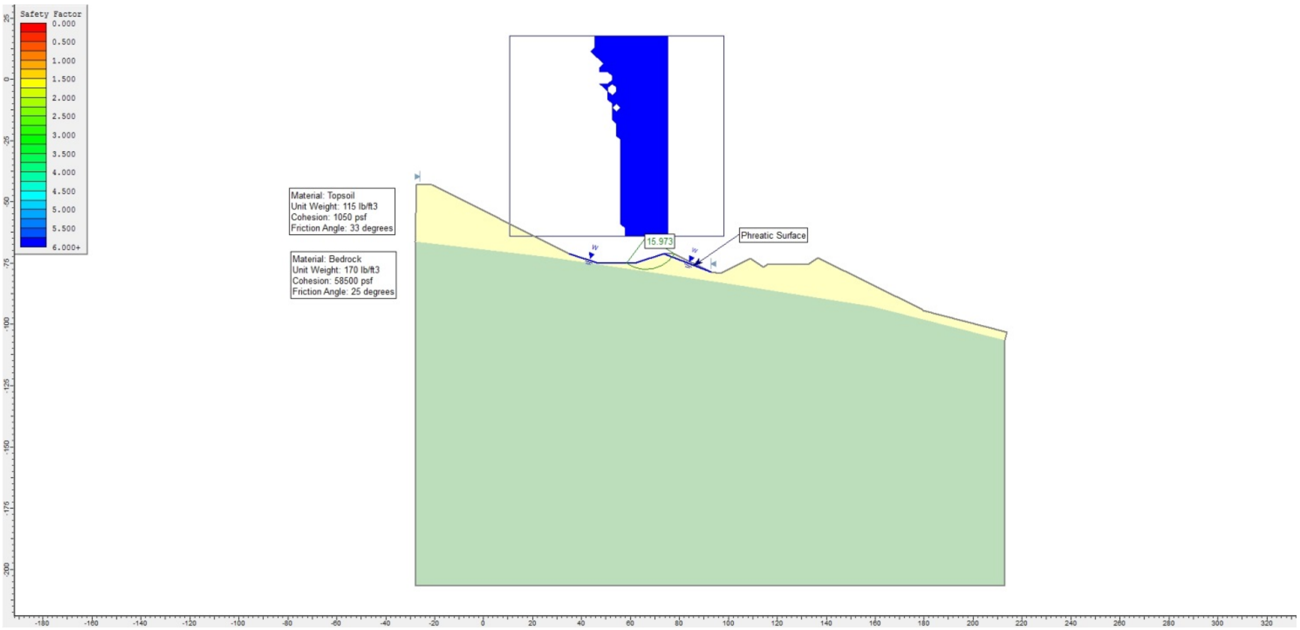
Topsoil Stockpile and Sediment Basin: Sediment basin out slope with steady state.



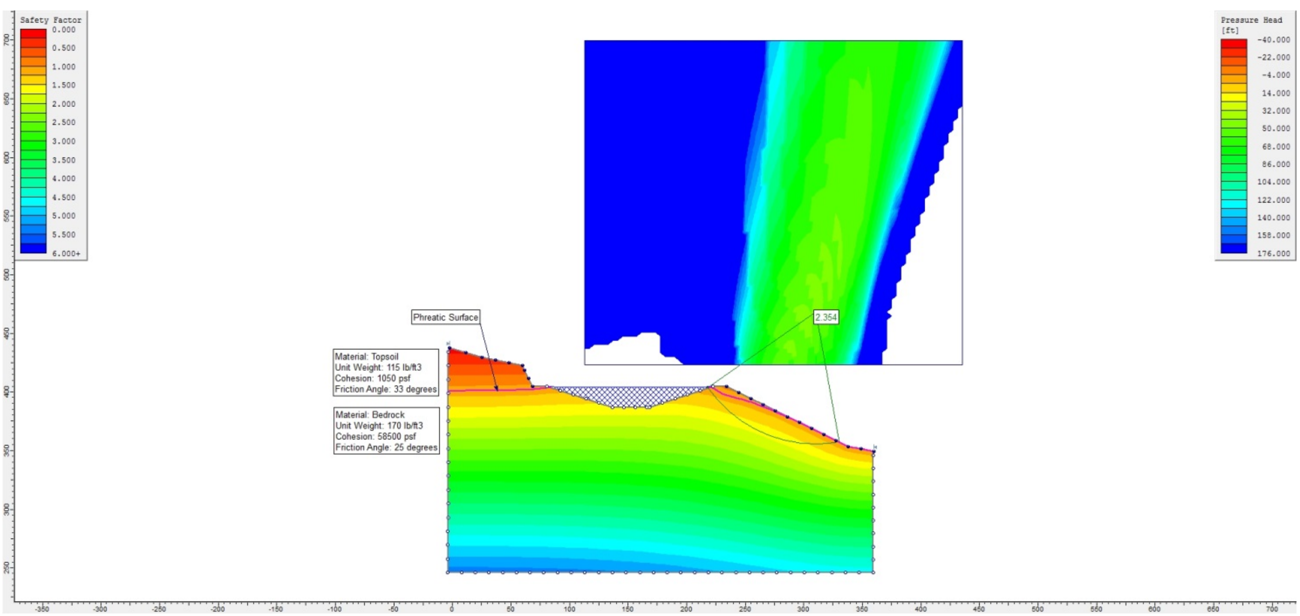
Topsoil Stockpile and Sediment Basin: Access road side slope with steady state.



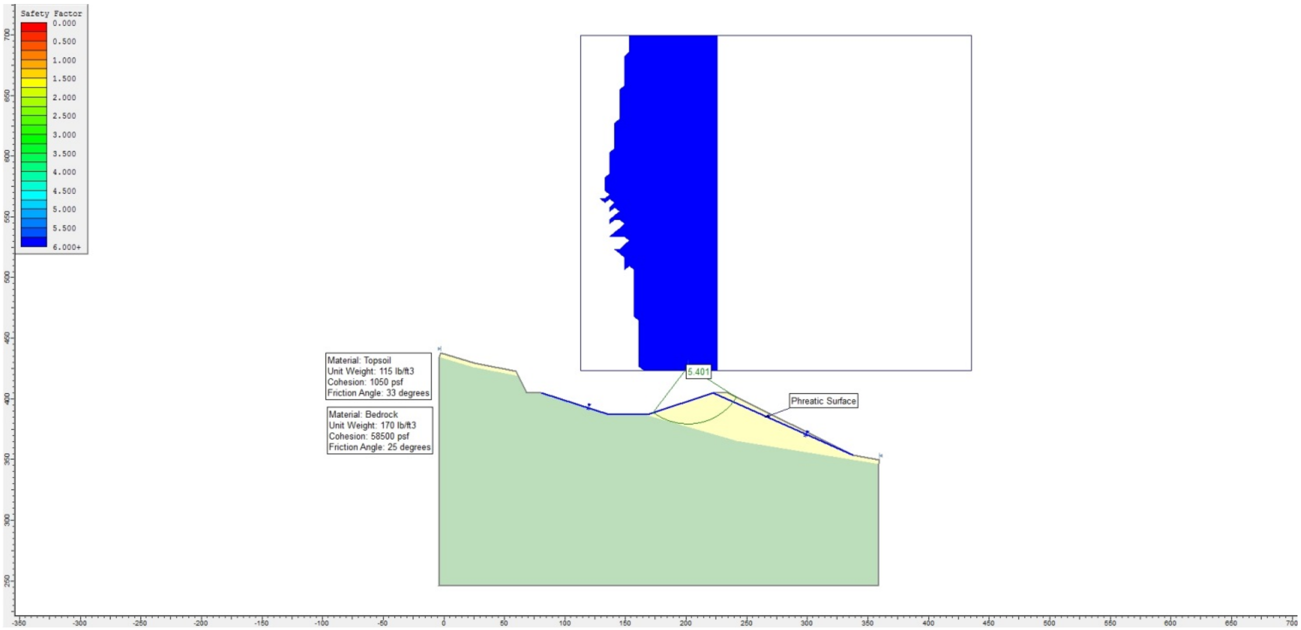
Topsoil Stockpile and Sediment Basin: Topsoil stockpile side slope with rapid drawdown.



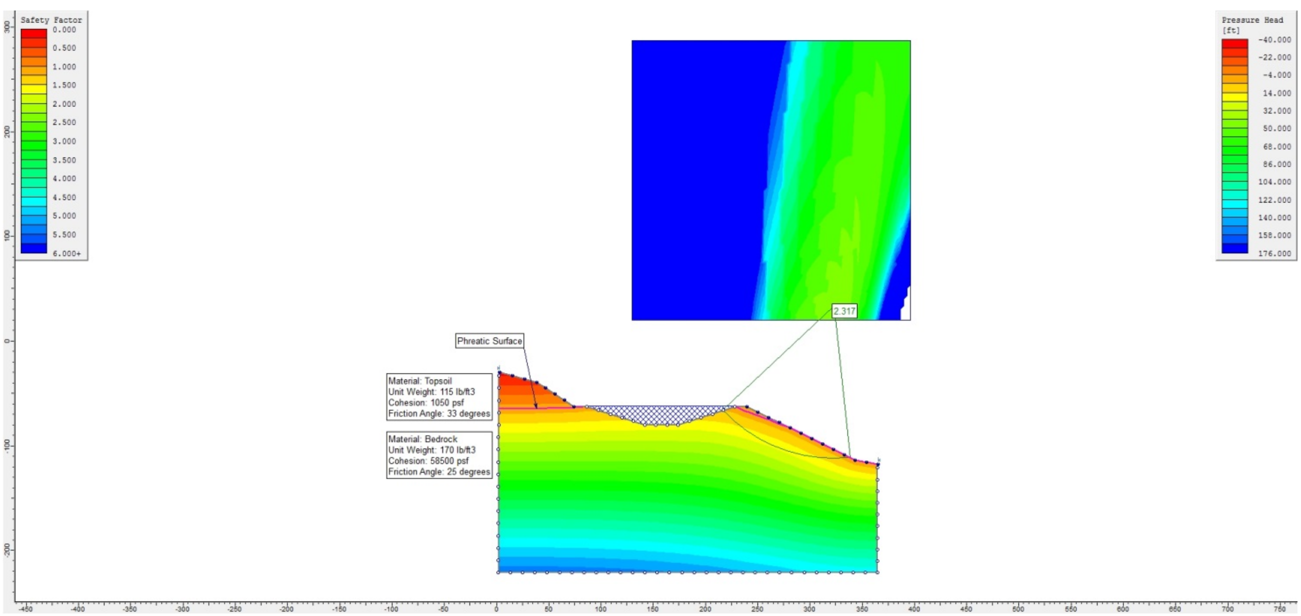
Topsoil Stockpile and Sediment Basin: Sediment basin in slope with rapid drawdown.



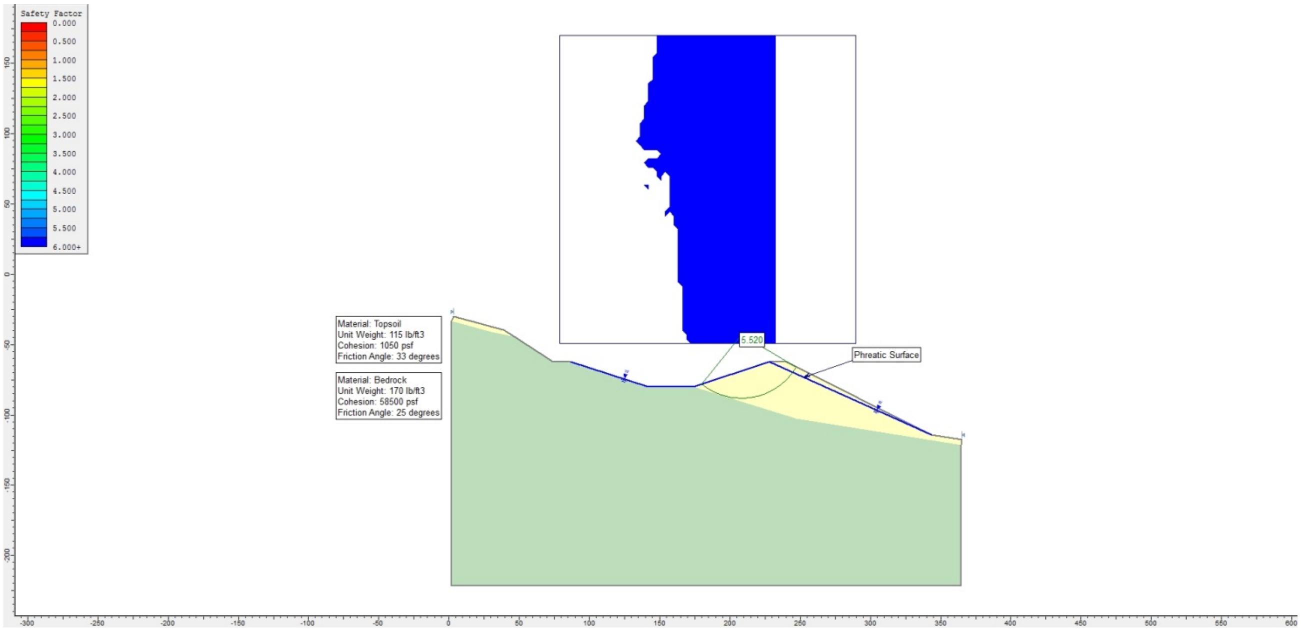
Pond: Pond out slope with steady state. Pond access road cut 0.5H:1V.



Pond: Pond in slope with rapid drawdown. Pond access road cut 0.5H:1V.



Pond: Pond out slope with steady state. Pond access road cut 1.5H:1V.



Pond: Pond in slope with rapid drawdown. Pond access road cut 1.5H:1V.

15-1048

DETERMINATION OF SIGNIFICANCE AND EFFECT

R4-2300-4 (6/04)

USDA-Forest Service - Intermountain Region
(Ref FSM 2360)

To be completed by a cultural resource specialist and attached to the CR report and project EA. Type all entries.

Project Title	Cultural Resource Report No.
A Cultural Resource Inventory for the Skyline Mine Expansion and Transmission Line Construction Project, Carbon and Emery Counties, Utah	U-14-EO-0753f; ML-14-1535

A cultural resource investigation has been conducted for this project and cultural values have been identified. Based on the attached report, the Forest Service has made the following determinations:

CULTURAL SIGNIFICANCE

Class	No. of Sites	USFS Site Numbers
I - Eligible	0	
II - Unevaluated	0	
III - Not Eligible	3	42CB3254 (ML-5134), 42EM4583 (ML-5135); 2CB3253 (ML-5136)

EFFECT - There will be no historic properties affected because:

- ☐ They are outside the project area.
- ☐ They are outside impact zones.
- ☐ Final project plans will avoid them.
- ☐ National Register characteristics will not be changed.
- ☒ Other (explain below).

☐ Check here if sites will be affected, and attach a detailed explanation.

COMMENTS AND COORDINATING REQUIREMENTS

The following actions are proposed to ensure the protection of known or suspected sites. ☒ None

None of the three sites found within the project area are recommended eligible for the National Register of Historic Places. As a result, we recommend that there will be no historic properties affected by the proposed Skyline Mine Expansion and Transmission Project.

FOREST SERVICE CERTIFICATION

Professional CRM Specialist	Date	LIne Officer Approval *	Date
Charmaine Thompson	7 Aug 2015		

* Required when significant sites may be affected and/or when non-routine action is recommended.

S.H.P.O. COMMENTS

I have reviewed the documention provided by the Forest Service.

☒ I agree with the determinations. ☐ I disagree, as explained below or in the attached letter.

Signature	Title	Date
[signature]	Deputy SHPO	8/12/15

Wildlife Survey Report
Power Line, Ventilation Hole, Access Road Analysis Area, Subsidence Area, and Spring Survey
2013

Northern Goshawk, other Raptors, Western Toad, and
General Wildlife Surveys

Prepared for:

Skyline Mine
Gregg Galecki
Environmental Engineer
Canyon Fuel Company, LLC

Prepared By:

Alpine Ecological
HC 80 Box 570
Greenwich, UT 84732

08.09.2013

Table of Contents

Contents

1.0 Introduction

The following narrative is submitted pursuant to requirements regulating potential impacts to threatened, endangered, candidate and sensitive species and their associated habitats. The following report details the results of the northern goshawk (*accipiter gentilis*) protocol surveys, raptor surveys, general wildlife surveys, and a western (boreal) toad (*bufo boreas*) survey. The areas surveyed are displayed on Figure 1, attached hereto in Appendix A.

Pre-field research was completed by Alpine wildlife biologists who utilized GIS data from the Utah Division of Wildlife Resources' (UDWR) Utah Threatened, Endangered, and Sensitive Species Occurrences (TES Shapefile 20130510); coordinated with wildlife biologists from the US Forest Service (USFS), and the Utah Division of Oil, Gas, and Mining (UDOGM); and researched species ecology, life history, known distributions, and habitat requirements. Previous surveys conducted near the area were also reviewed prior to conducting inventories.

2.0 Project Description

The 2013 wildlife survey included the following areas: a potential power line route, ventilation hole, and access roads (Figure 2); a subsidence survey (Figure 3); and a spring survey (Figure 4). Each survey area is displayed on a map attached hereto in Appendix A as Figure 1. Northern goshawk protocol surveys, general raptor surveys, and general wildlife surveys were conducted in and around the areas displayed on Figure 2 and Figure 3.

3.0 General Habitat Overview

The vegetation across the survey area is very diverse and is somewhat consistent throughout the survey area. Vegetation is dependent on elevation, slope, and available water resources. Riparian areas are dominated by typical high elevation riparian species. The bottoms of the valleys that are drier are dominated by mountain big sagebrush and silver sagebrush communities. South and East facing slopes, at higher elevations are dominated by quaking aspen communities. However, there are some areas that are open on South and East facing slopes. These open areas are typically grass and tall forb communities. However, a significant number of the open areas are dominated by false hellebore. The North and West facing slopes are dominated by conifer communities. The tree species within the conifer community are mostly dead or dying, and most areas have an abundance of deadfall due to beetle infestations. Because of the deadfall and dead trees the forbs and grasses within the conifer communities are very diverse and most areas have a solid understory. The tops of the ridges in the survey area vary with some being dominated by shrub communities such as mountain big sagebrush, elderberry or chokecherry while others are dominated by grass and tall forb communities. Some of the ridge tops are dominated by cluster tarweed.

4.0 Methodology

Northern Goshawk broadcast acoustical surveys were conducted following U.S. Department of Agriculture (USDA) Forest Service, 2006, Northern Goshawk Inventory and Monitoring Technical Guide pp.3.13-15. Using GIS, survey transects were established 250 meters apart throughout the survey area which extended 0.5 miles beyond the project footprint. Broadcast calling stations were then established every 200 meters along each transect. Upon arrival at each broadcast calling station, the surveyor looked and listened before broadcasting the pre-recorded alarm calls. Utilizing FoxPro game calls, pre-recorded northern goshawk alarm calls were broadcast for approximately 10 seconds followed by 30 seconds of looking and listening. After turning 120 degrees the sequence was then repeated. Once the sequence of 10 seconds of calling and 30 seconds of looking and listening was completed 3 times and no response was elicited the surveyor then repeated the sequence before moving to the next calling station. Surveys were timed in accordance to the survey requirements outlined in the 2006 Technical Guide and were based on local knowledge of nesting chronologies in the area and coordination with the US Forest Service. Additionally, surveyors searched for foraging raptors between calling stations when vantage points were available. Consultation with the USFS and UDOGM was conducted concerning survey timing and was within the seasonal guidelines as defined in the 2006 Technical Guide. Prior to conducting the survey, the Upper Huntington Territory was monitored for nesting activity. The nest was located and documented as blown out and therefore inactive and unoccupied.

According to the UNHP 2003 progress report there are western toad records of occurrence in the area of Skyline Mine prior to 1983. The mapping scale within the report makes it difficult to determine exact locations. The Utah Conservation Database Center (UCDC) cites the last observation within the Scofield map quadrant was on 6/18/1950. This is the same quadrant as Skyline Mine. However, as required, western toad surveys were conducted around five springs within suitable habitat; areas surveyed are displayed on Figure 4. Surveys were conducted by walking meandering transects around each of the springheads and extended into areas of surface flow.

5.0 Survey Results

Species observed during the course of the inventories included golden eagle (*Aquila chysaetos*), northern goshawk, red-tailed hawk (*Buteo jamaicensis*), common raven (*Corvus corax*), dark-eyed junco (*Junco hyemalis*), brown creeper (*Certhia americana)*, black-capped chickadee (*Poecile atricapillus*), lazuli bunting (*Passerina amoena*), Stellar's jay (*Cyanocitta stelleri*), red-naped sapsucker (*Sphyrapicus nuchalis*), Clark's nutcracker (*Nucifraga columbiana*), American robin (*Turdus migratorius*), dusky blue grouse (*Dendragapus obscurus*), mountain chickadee (*Poecile gambeli*), Rocky Mountain elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and black bear (*Urus americanus*). Information such as species, call station observed, and type of observation (e.g., audio (A) or visual (V)) were documented for species of concern such as northern goshawk, red-tailed hawk, and golden eagle. Other species are listed for reference only. A single response from a northern goshawk was elicited during the first survey at call station 56. Both audio and visual responses were documented. The adult responded between the second and third call on the last call sequence. The call station is located on the southernmost transect in the head of Burnout Canyon. Forest Service Wildlife Biologist Jeff Jewkes indicated the Burnout Canyon northern goshawk territory was occupied. After the discussion with Jeff, it is likely the response came from the adult occupying that territory. No other responses from northern goshawk were documented during the course of these surveys.

Table 1 summarizes the results of the survey by raptor species, call station, and type of observation.

Station#	Survey	Auditory	Visual	Species	Notes
52	1	Yes	Yes	NOGO	2 Adults responded to the call; 2nd call sequence; between 2nd and 3rd call. They flew south out of the project area towards Burnout Canyon.
150	1	No	Yes	GOEA	1 GOEA observed flying over call station
152	1	No	Yes	REHA	1 REHA observed soaring above station
134	1	Yes	Yes	REHA	REHA-territorial behavior
103	1	Yes	No	REHA	N/A
211	1	Yes	No	REHA	Heard between 210 and 211.
12	1	Yes	No	REHA	Heard calling stations
30	1	No	Yes	REHA	Observed REHA flying. No response to call.
75	1	Yes	No	REHA	Heard REHA call. No response to call.
179	1	Yes	Yes	REHA	Before I approached 179 a saw a REHA soaring in a circle. Responded to call intermittently.
113	1	Yes	No	REHA	Heard REHA call one time.
215	2	Yes	Yes	REHA	REHA flying and calling above station.
224	2	Yes	Yes	REHA	REHA flying and calling above station.
237	2	Yes	Yes	REHA	REHA calling from the east.
179	2	No	Yes	REHA	REHA soaring to the east.
251	2	Yes	Yes	REHA	REHA calling and soaring from the east.
36	2	Yes	No	REHA	Heard REHA call.

The vegetative communities within the Project Area are classified by the Utah Division of Wildlife Resources as crucial summer mule deer fawning habitat and crucial summer elk calving habitat. This was confirmed by biologists throughout each project area as individual mule deer fawns and elk calves were observed on numerous occasions throughout the project areas during both surveys.

There were no observations of western toad during the course of the spring inventories.

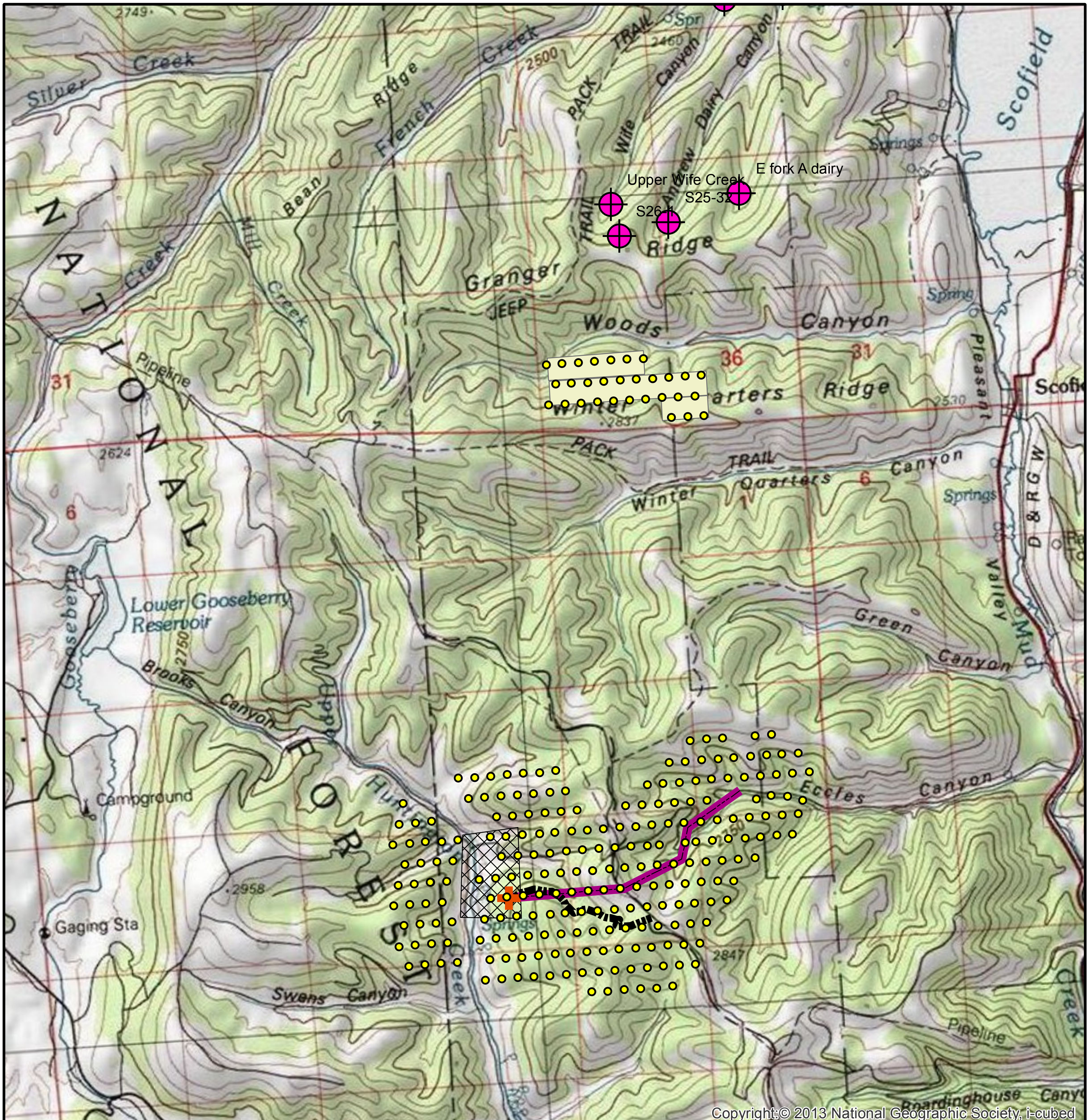
6.0 Conclusions and Recommendations

During the 2013 wildlife inventory biologists documented audible and visual detections of northern goshawks on one occasion, at call station 52. Data collected during the observation suggests that the pair were likely the adults from the Burnout Canyon Territory. There were no northern goshawk responses elicited in this area during the second inventory. Other raptors were documented on 16 occasions; 1 golden eagle and 15 red-tailed hawks. Nest searches were conducted west of the highway in areas of high activity. No nests were found during those searches.

There were no observations of western toad during the spring surveys.

We recommend in subsequent years coordination with the UNHP, UDOGM and the USFS continues to be conducted prior to inventory initiation in order to refine the survey area requirements, ensure nesting data is transferred, and up to date protocols are followed.

Appendix A-Project Maps



- Call Stations Export
- Spring Survey Area
- Vent Shaft
- East Access Road
- Powerline
- Access Road Analysis Area
- Subsidence Areas

N

Skyline Mine
2013 Wildlife Surveys

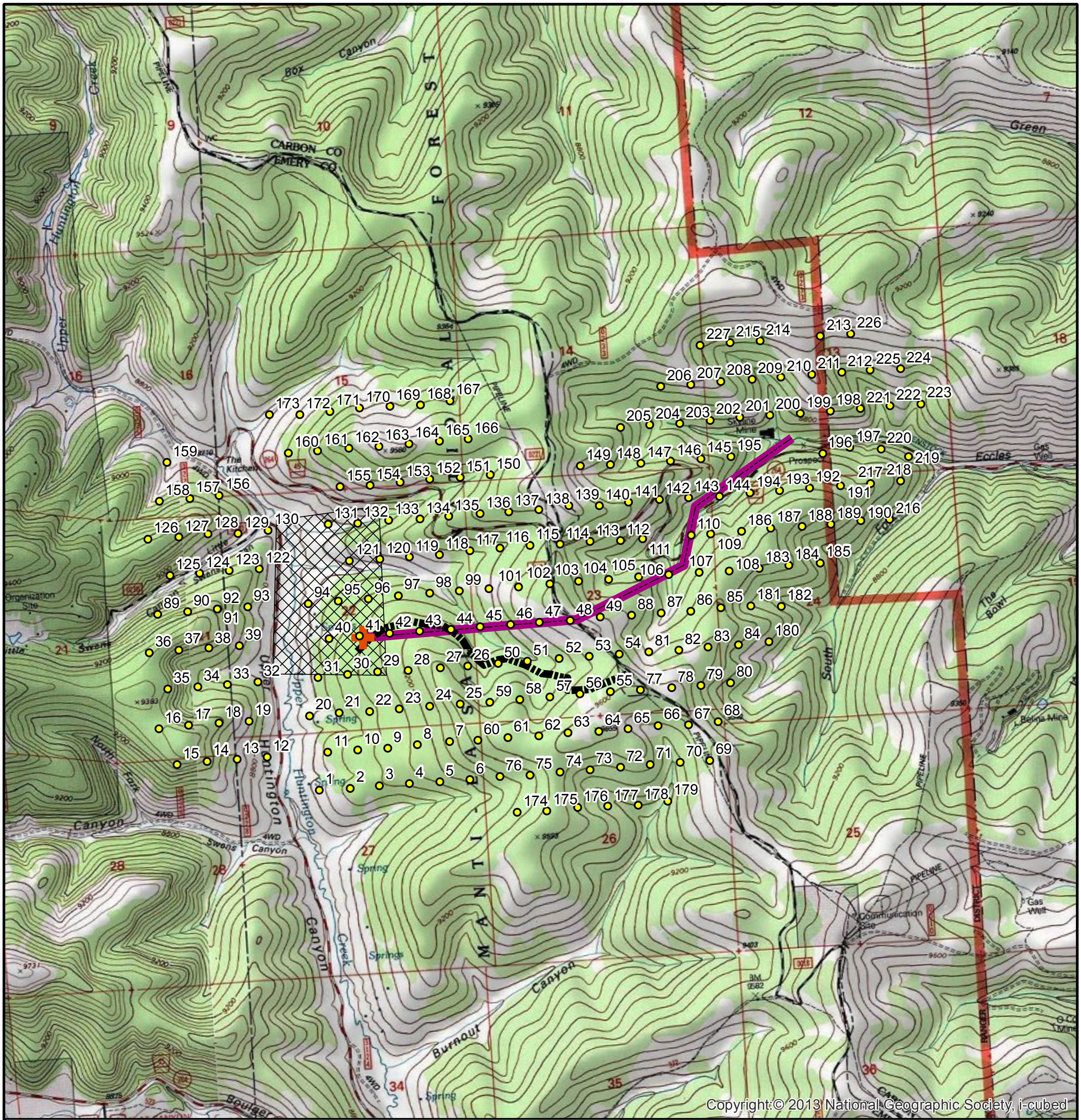
FIGURE 1
PROJECT LOCATION

DATE DRAWN

7/31/13

SCALE

0.5 0.25 0 0.5 Miles



- Call Stations Export
- Vent Shaft
- East Access Road
- Powerline
- Access Road Analysis Area
- Subsidence Areas

N

Skyline Mine
2013 Wildlife Surveys

FIGURE 2
Power line, Access Roads, and Ventilation Shaft

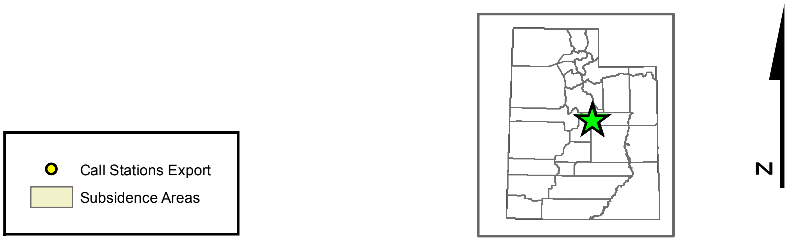
DATE DRAWN

7/31/13

SCALE

0.25 0.125 0 0.25

Miles

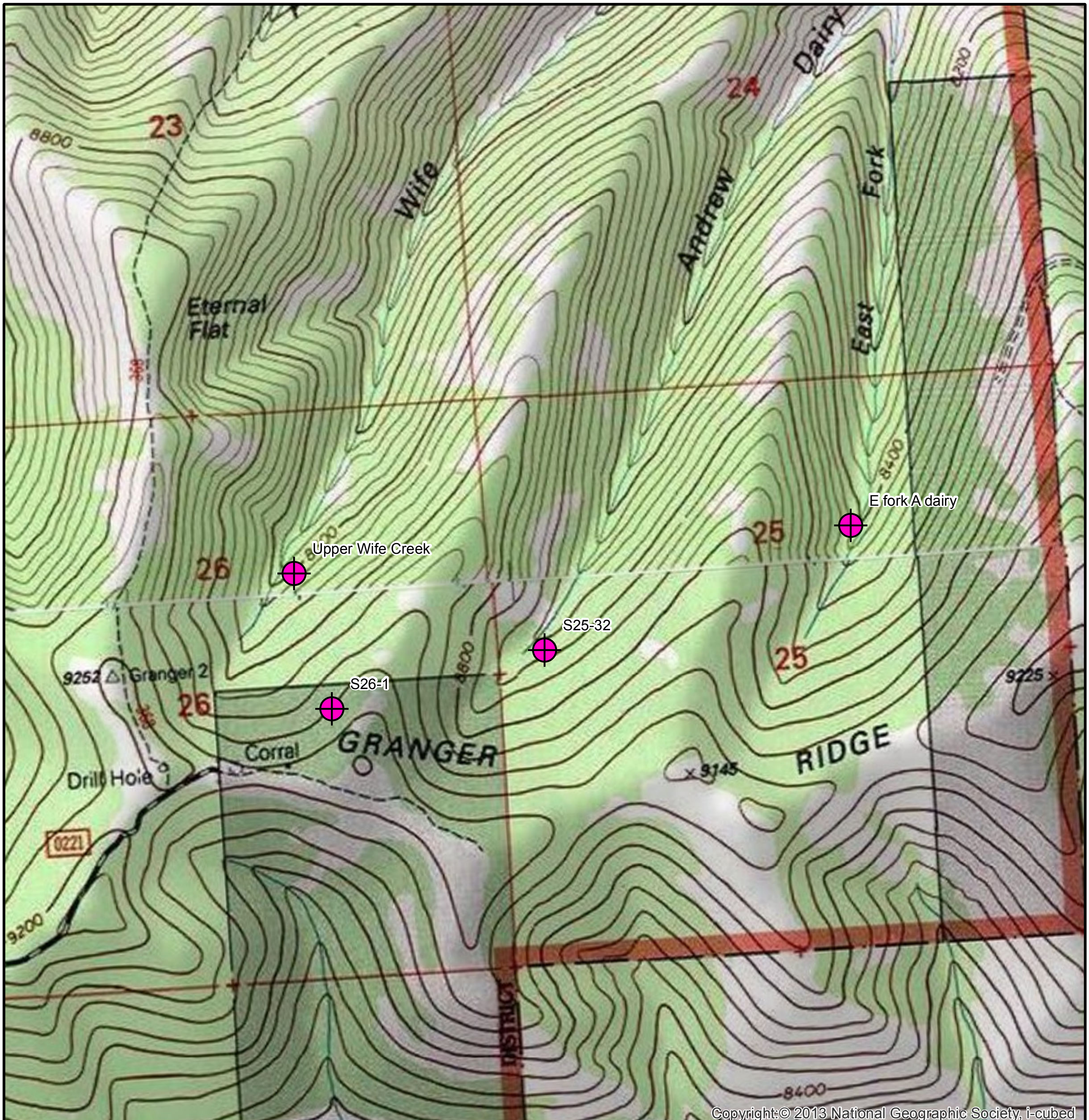


Skyline Mine
2013 Wildlife Surveys

FIGURE 3
Potential Subsidence
Survey Area

DATE DRAWN
7/31/13

SCALE



Spring Survey Area

N

Skyline Mine
2013 Wildlife Surveys

FIGURE 4
Spring Survey Area

DATE DRAWN
7/31/13

SCALE
0.1 0.05 0 0.1
Miles

2014 Wildlife Survey Report

Power Line

And

Ventilation Pad

Northern Goshawk, other Raptors, and
General Wildlife Surveys

Prepared for:

Skyline Mine
Gregg Galecki
Environmental Engineer
Canyon Fuel Company, LLC

Prepared By:

Alpine Ecological
HC 80 Box 570
Greenwich, UT 84732

11.16.2014

1.0 Introduction

The following narrative is submitted pursuant to requirements regulating potential impacts to threatened, endangered, candidate and sensitive species and their associated habitats. The following report details the results of the northern goshawk (*Accipiter gentilis*) protocol surveys, raptor surveys, and general wildlife surveys conducted for the Power line and Ventilation Pad Project. No other special status species were identified for concern within the project area. The areas surveyed are displayed on Figure 1, attached hereto in Appendix A.

Pre-field research was completed by Alpine wildlife biologists who utilized GIS data from the Utah Division of Wildlife Resources' (UDWR) Utah Threatened, Endangered, and Sensitive Species Occurrences shapefiles and mapping services. Research included species occurrences, historic records, species ecology, life histories, known distributions, and habitat requirements. Northern goshawk protocol surveys, nesting raptor surveys, and general wildlife surveys have been conducted in or near the project area by private and federal biologists over the past several years. Coordination with Forest Service Wildlife Biologist also continues to occur on an annual basis as a part of the pre-field research process.

There are no threatened, endangered, or candidate species known to occur within the project area. State or Federally listed sensitive species which were identified as species of concern included all raptors, with emphasis on northern goshawk and golden eagle.

2.0 Project Description

The 2014 wildlife survey included the following areas: a potential power line route, Swen's Canyon ventilation shaft, and access roads (Figure 1). Northern goshawk protocol surveys, general raptor surveys, and general wildlife surveys were conducted in and around the areas displayed on Figure 1.

3.0 General Habitat Overview

The vegetation across the survey area is very diverse and is somewhat consistent throughout the survey area. Vegetation is dependent on elevation, slope, and available water resources. Riparian areas are dominated by typical high elevation riparian species. The bottoms of the valleys that are drier are dominated by mountain big sagebrush and silver sagebrush communities. South and East facing slopes, at higher elevations are dominated by quaking aspen communities. However, there are some areas that are open on South and East facing slopes. These open areas are typically grass and tall forb communities. However, a significant number of the open areas are dominated by false hellebore. The North and West facing slopes are dominated by conifer communities. The tree species within the conifer community are mostly dead or dying, and most areas have an abundance of deadfall due to beetle infestations. Because of the deadfall and dead trees the forbs and grasses within the conifer communities are very diverse and most areas have a solid understory. The tops of the ridges in the survey area vary with some being dominated by shrub communities such as mountain big sagebrush, elderberry or chokecherry while others are dominated by grass and tall forb communities. Some of the ridge tops are dominated by cluster tarweed.

4.0 Methodology

Northern Goshawk broadcast acoustical surveys were conducted following U.S. Department of Agriculture (USDA) Forest Service, 2006, Northern Goshawk Inventory and Monitoring Technical Guide pp.3.13-15. Using GIS, survey transects were established 250 meters apart throughout the survey area which extended 0.5 miles beyond the project footprint. Broadcast calling stations were then established every 200 meters along each transect. Calling stations were then overlaid on NAIP aerial imagery in a GIS and call stations not located in suitable habitat were removed from the survey. Upon arrival at each broadcast calling station, the surveyor looked and listened before broadcasting the pre-recorded alarm calls. Utilizing FoxPro game calls, pre-recorded northern goshawk alarm calls were broadcast for approximately 10 seconds followed by 30 seconds of looking and listening. After turning 120 degrees the sequence was then repeated. Once the sequence of 10 seconds of calling and 30 seconds of looking and listening was completed 3 times and no response was elicited the surveyor then repeated the sequence before moving to the next calling station. Surveys were timed in accordance to the survey requirements outlined in the 2006 Technical Guide and were based on local knowledge of nesting chronologies in the area and coordination with the US Forest Service. Additionally, surveyors searched for foraging raptors between calling stations when vantage points were available. Consultation with the USFS and UDOGM was conducted concerning survey timing and was within the seasonal guidelines as defined in the 2006 Technical Guide. Prior to conducting the survey, the Upper Huntington Territory was monitored for nesting activity during 2014. The nest was located and documented as blown out.

General wildlife surveys include the identification of general terrestrial wildlife species and are conducted along transects between call stations. The results of the general survey are listed at the beginning of Section 5.

5.0 Survey Results

Species observed during the course of the inventories included, but are not limited to, red-tailed hawk (*Buteo jamaicensis*) (REHA), common raven (*Corvus corax*) (CORA), dark-eyed junco (*Junco hyemalis*), brown creeper (*Certhia americana)*, black-capped chickadee (*Poecile atricapillus*), lazuli bunting (*Passerina amoena*), Stellar's jay (*Cyanocitta stelleri*), red-naped sapsucker (*Sphyrapicus nuchalis*), Clark's nutcracker (*Nucifraga columbiana*), American robin (*Turdus migratorius*), dusky blue grouse (*Dendragapus obscurus*), mountain chickadee (*Poecile gambeli*), Rocky Mountain elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and black bear (*Urus americanus*). Information such as species, call station observed, and type of observation (e.g., audio (A) or visual (V)) were documented for species of concern; other species listed were observed and listed herein for reference only.

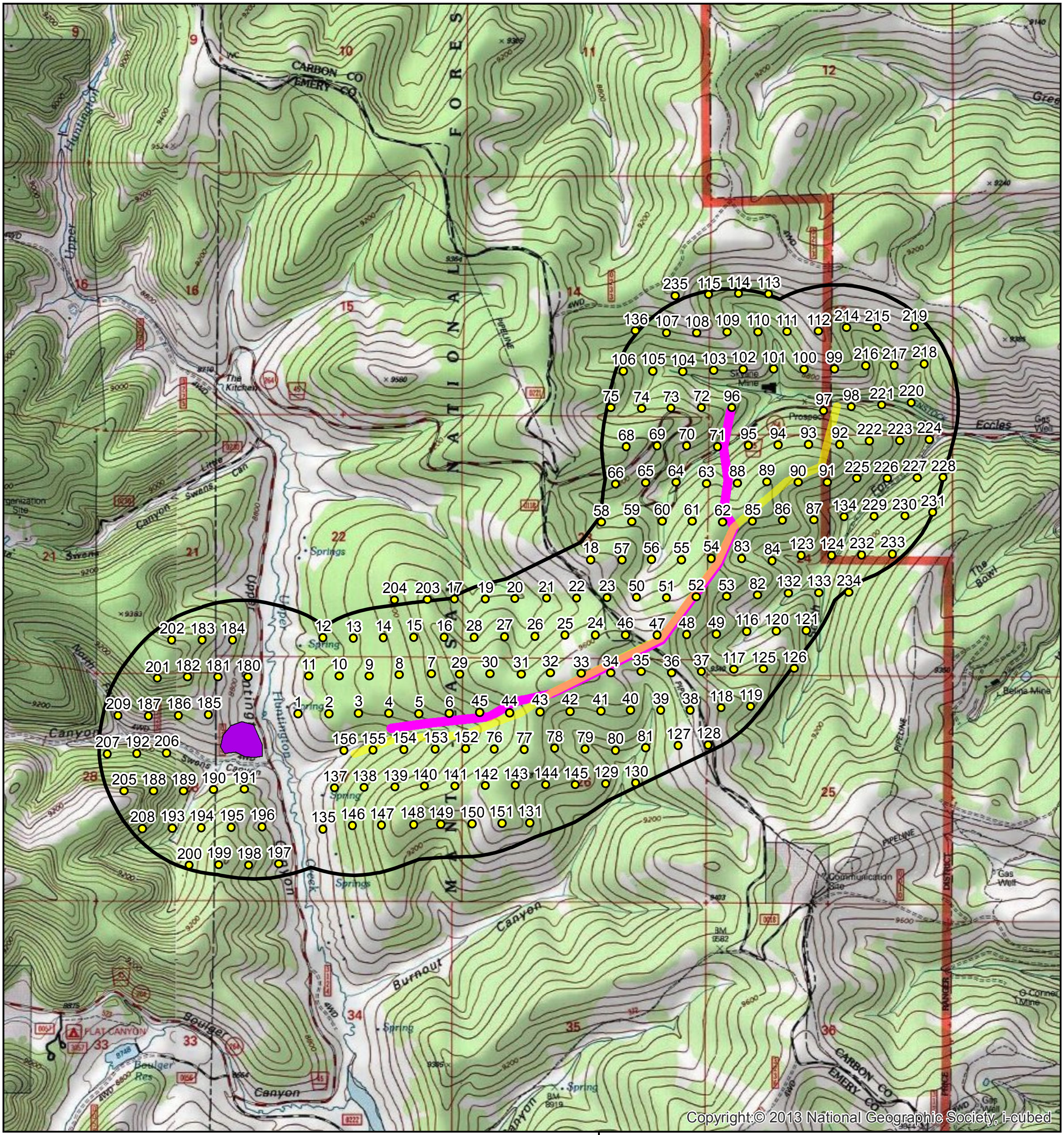
Table 1 summarizes the results of the survey by call station, raptor species, and type of observation.

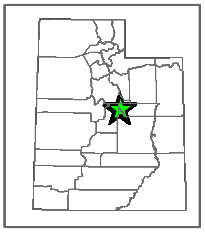
Station#	Survey	Auditory	Visual	Species	Notes
26	1	Yes	Yes	REHA	REHA perched and calling between stations

28	1	Yes	No	REHA	REHA heard during calls.
29	1	No	Yes	REHA	REHA flew over before call
136	1	No	Yes	GHOW	GHOW perched between call stations 136 and 107 briefly.
148	1	No	Yes	AMKE	AMKE perched in tree near call station.
165	1	Yes	Yes	CORA	CORA flew over call stations 165-167 calling.
166	1	Yes	Yes	CORA	CORA flew over call stations 165-167 calling.
167	1	Yes	Yes	CORA	CORA flew over call stations 165-167 calling.
92	2	No	Yes	CORA	CORA soaring to the SE.
93	2	No	Yes	CORA	CORA soaring to the SE.
107	2	No	Yes	CORA	CORA flew over call station.
204	2	No	Yes	CORA	CORA soaring to the NW. Observed while hiking to the call station.
Random Observation	2	Yes	Yes	REHA	REHA perched near County line road west of call station 75 at the top of the ridge.
Random Observation	2	Yes	Yes	REHA	REHA soaring west of ridge top towards upper Huntington Creek north of project area.

The vegetative communities within the Project Area are classified by the Utah Division of Wildlife Resources as crucial summer mule deer fawning habitat and crucial summer elk calving habitat. This was confirmed by biologists throughout each project area as individual mule deer fawns and elk calves were observed on numerous occasions throughout the project areas during both surveys.

There were no northern goshawk responses elicited in the project area during the 2014 inventory. Other raptors were documented on 5 occasions; 3 red-tailed hawks, 1 great horned owl, and 1 American kestrel. A red-tailed hawk was observed soaring in the upper Huntington Creek drainage outside of the project area.





- Call Stations
- 0.5 Mile Buffer
- Powerline Route
- Alternate Route
- Ventilation Pad

N

Skyline Mine 2014
Powerline and Vent Pad Projects

FIGURE 1

DATE DRAWN
10/11/2014

SCALE
0.25 0.125 0 0.25 Miles

Technical Memorandum

To: Gregg Galecki
Environmental Engineer
Bowie Resources Partners LLC
Canyon Fuel Company, LLC
HC 35 Box 380

From: Alpine Ecological
HC80 Box 570
Greenwich, UT 84732

Date: 8/29/2014

Re: Western (Boreal) Toad (*Bufo boreas*) Surveys

Background

According to the UNHP 2003 progress report there are records of occurrence of western toad in the area of Skyline Mine prior to 1983. The mapping scale within the report makes it difficult to determine exact locations. The Utah Conservation Database Center (UCDC) cites the last observations within the Scofield and Fairview Lakes map quadrants of documented records as 6/18/1950. Holland (2002) summarized some of the ecological requirements for this species in the southern Rocky Mountains which is applicable to the survey area:

> *"Ideal boreal toad breeding sites presumably contain still water, very shallow margins, and persistent water levels. Egg masses are typically deposited in the shallowest available areas of the breeding site. . . . For a wetland to be considered suitable it should contain at least 1 gradually sloping bank with water ≤10-cm deep during the breeding season. Potential sites should also be examined in August to ensure that breeding site persistence is sufficient to allow completion of the larval period. In addition, a deeper area of water may be necessary to provide tadpoles with a night refuge of warmer water . . . . An old, but active, American beaver pond complex seems an ideal model for a breeding locality because shallow, eutrophicated ponds exist in concert with water level maintenance by beaver." Holland (2002) found that both increased variation in daily water temperature and increased variation in water levels during summer had negative effects on tadpole development in this species. Terrestrial habitats of this species, even within Utah, are varied and include sagebrush steppe, piñon–juniper woodland, and mixed and coniferous forests of various species compositions. Adult males typically remain within a few hundred meters of breeding sites throughout the year, while adult females usually do not, often moving several kilometers from breeding sites after breeding in spring or early summer.*

Methodology

Inventories for the presence of western toads were completed during June, July, and August of 2014, in riparian areas and streams in Little Swens, Swens, Flat Canyon, and Boulger Creeks; between Huntington Creek and the end points displayed on Figure 1. Inventories were conducted by walking meandering transects in the riparian areas, which extended out to 20 feet on either side of the stream centerline. After the completion of the initial walking transects an additional night time spotlight survey was also conducted along the upper sections of the streams in Flat Canyon and Boulger Canyon. These areas contain the highest number of ecological attributes within the indicator parameters, as defined by Oliver and Tuhy (2010), necessary for western toad occupancy.

Results

Little Swens

There were no western toads observed in the stream in Little Swens Canyon.

Swens

There were no western toads observed in Swens Canyon. Although there was little or no surface water in the upper portions of the southern fork of the survey area, the inventory was conducted to the end point identified.

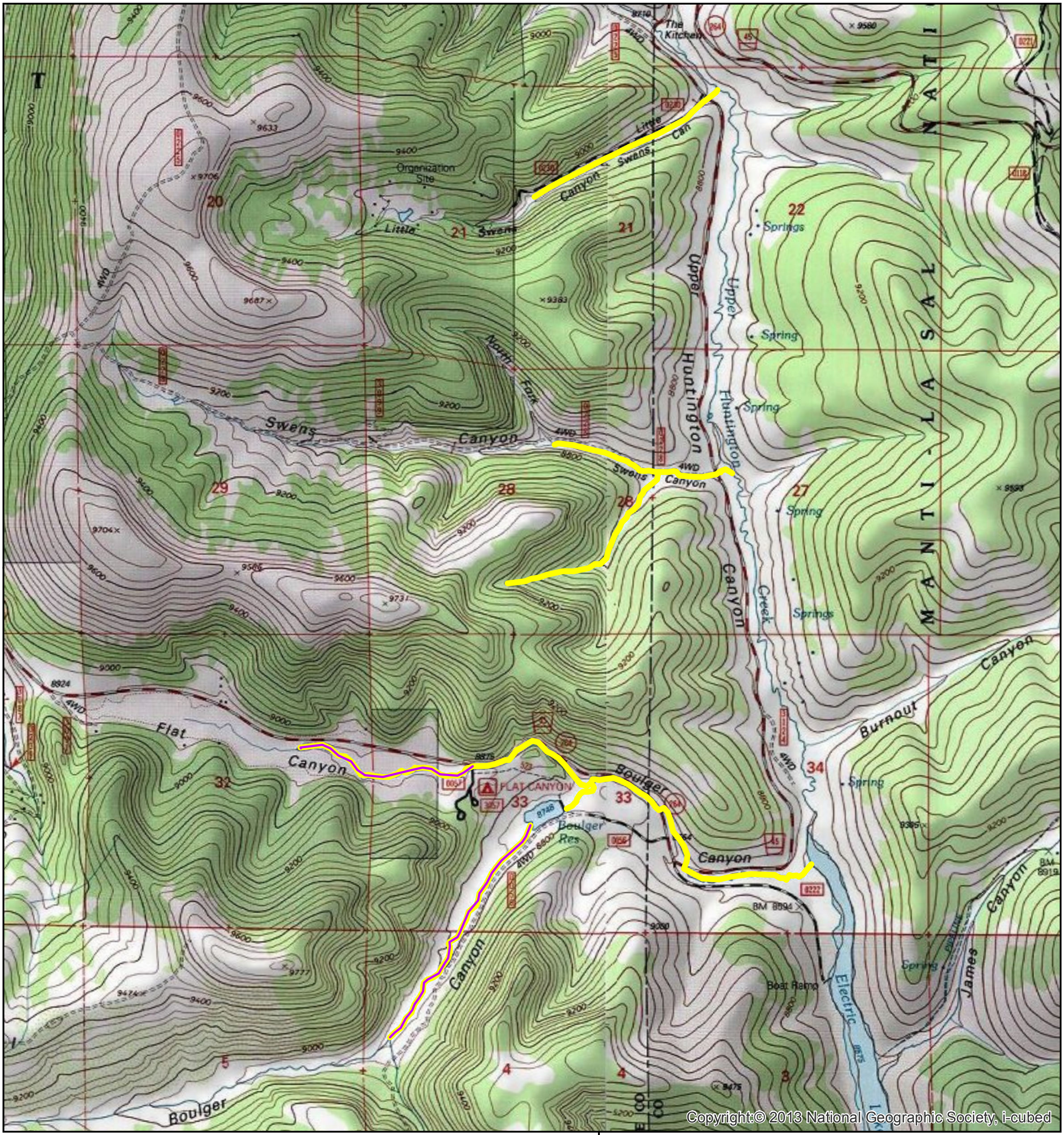
.

Flat Canyon

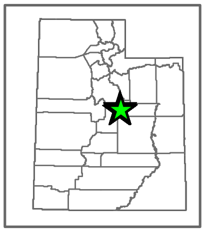
There were no western toads observed during the course of either inventory of the stream in Flat Canyon. The stream in Flat Canyon provided the best potential habitat for western toad according to ecological indicators identified by Oliver and Tuhy (2010) and the description by Holland (2002). The lower portions of the stream, next to the paved road, provides lower quality habitat, due to higher stream flow rates and steeply incised or rip-rapped constructed banks, in comparison to the upper reaches of the stream, which has slower flow rates and silted banks with small relatively deeper pools. As a result, it was determined that an additional spotlight survey should be conducted in the upper sections of the stream on private lands. There were no western toads observed during the spotlight survey of the stream in Flat Canyon.

Boulger Canyon

There were no western toads observed during the course of either inventory of the stream in Boulger Canyon. However, there was one individual western chorus frog (*Pseudacris triseriata*) observed within 200 feet of the Boulger Reservoir inlet. The stream has relatively higher flow rates when compared to those observed in Flat Canyon. There are however, micro-sites of slower flows distributed irregularly along the stream. As a result, it was determined that an additional spotlight survey should be conducted along the stream. There were no western toads observed during the spotlight survey of the stream in Boulger Canyon.



Spotlight Survey Area
Transect Survey Area



N

Skyline Mine 2014
Western Toad Survey

FIGURE 1
Western Toad Survey Area

DATE DRAWN
7/24/14

SCALE
0.2 0.1 0 0.2
Miles

2015 Wildlife Survey Report

Power Line,
Ventilation Pad,
And
Coal Pile Expansion Projects

Northern Goshawk, other Raptors, and
General Wildlife Surveys

Prepared for:

Skyline Mine
Gregg Galecki
Environmental Engineer
Canyon Fuel Company, LLC

Prepared By:
Alpine Ecological
HC 80 Box 570
Greenwich, UT 84732

08.03.2015

1.0 Introduction

The following narrative is submitted pursuant to requirements regulating potential impacts to threatened, endangered, candidate and sensitive species and their associated habitats. The following report details the results of the northern goshawk (*Accipiter gentilis*), American three-toed woodpecker (*Picoides dorsalis*), general raptor, and general wildlife surveys conducted for the Power line, Ventilation Pad, and the Coal Pile Expansion Projects. No other special status species were identified to have suitable habitat within these project areas. The areas surveyed are displayed on Figure 1.

Pre-field research was completed by Alpine wildlife biologists who utilized GIS data from the Utah Division of Wildlife Resources' (UDWR) Utah Threatened, Endangered, and Sensitive Species Occurrences shapefiles and mapping services. The US Fish and Wildlife Services' species by County list was reviewed and a search was conducted in their Information, Planning and Consultation System (IPaC). Research included species occurrences, historic records, species ecology, life histories, known distributions, and habitat requirements. Coordination with the UDOGM and the Forest Service Wildlife Biologists was conducted in the spring prior to survey initiation. Survey requirements were discussed and are in accordance with the Northern Goshawk technical guide. American three-toed woodpecker surveys were conducted using the same methodology as the Forest Service; conducted along northern goshawk transects in suitable habitat. Northern goshawk protocol surveys, nesting raptor surveys, American three-toed woodpecker, and general wildlife surveys have been conducted in or near the project area by private and federal biologists over the past several years.

There are no threatened, endangered, or candidate species known to occur within the project area. State or Federally listed sensitive species which were identified as species of concern included all raptors, with emphasis on northern goshawk and golden eagle, and American three-toed woodpecker. The remaining listed species were dismissed from further consideration, as a result of the multiple agency review, because there is no suitable habitat or the project is outside of the species known distribution.

2.0 Project Description

The 2015 wildlife survey included the following areas: the remaining call stations for the potential power line route, Swen's Canyon ventilation shaft, and the coal pile expansion area (Figure 1). The majority of the call stations for the power line and ventilation shaft were called for two consecutive years in 2013 and 2015. A shift in the route of the power line required additional call stations to the south of the original route. This survey is the second consecutive year these call stations have been called. Northern goshawk protocol surveys, general raptor surveys, American three-toed woodpecker, and general wildlife surveys were conducted in and around the areas displayed on Figure 1.

3.0 General Habitat Overview

The vegetation across the survey area is very diverse and is somewhat consistent throughout the survey area. Vegetation is dependent on elevation, slope, and available water resources. Riparian areas are dominated by typical high elevation riparian species. The bottoms of the valleys that are drier are dominated by mountain big sagebrush and silver sagebrush communities. South and East facing slopes, at higher elevations are dominated by quaking aspen communities. However, there are some areas that are open on South and East facing slopes. These open areas are typically grass and tall forb communities. However, a significant number of the open areas are dominated by false hellebore. The North and West facing slopes are dominated by conifer communities. The tree species within the conifer community are mostly dead or dying, and most areas have an abundance of deadfall due to beetle infestations. Because of the deadfall and dead trees the forbs and grasses within the conifer communities are very diverse and most areas have a solid understory. The tops of the ridges in the survey area vary with some being dominated by shrub communities such as mountain big sagebrush, elderberry or chokecherry while others are dominated by grass and tall forb communities. Some of the ridge tops are dominated by cluster tarweed.

4.0 Methodology

Northern Goshawk broadcast acoustical surveys were conducted following U.S. Department of Agriculture (USDA) Forest Service, 2006, Northern Goshawk Inventory and Monitoring Technical Guide pp.3.13-15. Using GIS, survey transects were established 250 meters apart throughout the survey area which extended 0.5 miles beyond the project footprint. Broadcast calling stations were then established every 200 meters along each transect. Calling stations were then overlaid on NAIP aerial imagery in a GIS and call stations not located in suitable habitat were removed from the survey. Upon arrival at each broadcast calling station, the surveyor looked and listened before broadcasting the pre-recorded alarm calls. Utilizing FoxPro game calls, pre-recorded northern goshawk alarm calls were broadcast for approximately 10 seconds followed by 30 seconds of looking and listening. After turning 120 degrees the sequence was then repeated. Once the sequence of 10 seconds of calling and 30 seconds of looking and listening was completed 3 times and no response was elicited the surveyor then repeated the sequence before moving to the next calling station. Surveys were timed in accordance to the survey requirements outlined in the 2006 Technical Guide and were based on local knowledge of nesting chronologies in the area and coordination with the US Forest Service. Additionally, surveyors searched for foraging raptors between calling stations when vantage points were available. Consultation with the USFS and UDOGM was conducted concerning survey timing and was within the seasonal guidelines as defined in the 2006 Technical Guide. The project area has had two years of consecutive surveys conducted over a vast majority of the project. The focus of the 2015 surveys was to complete a small number of call stations created due to an alignment adjustment made in 2014. These call stations were first called in 2014 and the survey in 2015 was the second year of surveys.

American three-toed woodpecker surveys are conducted simultaneously with the northern goshawk survey. Biologists listened for drumming activity while at the call stations and inventoried for three-toed woodpeckers in suitable habitat while walking linear transects between call stations. This methodology is also used by the USFS and was discussed and approved on a pre-survey conference call by USFS and UDOGM biologists.

General wildlife surveys include the identification of general terrestrial wildlife species and were conducted along transects between call stations. The results of the general survey are listed at the beginning of Section 5.

5.0 Survey Results

Species observed during the course of the inventories included, but are not limited to, red-tailed hawk (*Buteo jamaicensis*) (REHA), common raven (*Corvus corax*) (CORA), dark-eyed junco (*Junco hyemalis*), brown creeper (*Certhia americana),* black-capped chickadee (*Poecile atricapillus*), lazuli bunting (*Passerina amoena*), Stellar's jay (*Cyanocitta stelleri*), red-naped sapsucker (*Sphyrapicus nuchalis*), Clark's nutcracker (*Nucifraga columbiana*), American robin (*Turdus migratorius*), dusky blue grouse (*Dendragapus obscurus*), mountain chickadee (*Poecile gambeli*), ruby-crowned kinglet (*Regulus calendula),* Rocky Mountain elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and black bear (*Urus americanus*). Information such as species, call station observed, and type of observation (e.g., aural (A) or visual (V)) were documented for species of concern; other species listed were observed and listed herein for reference only.

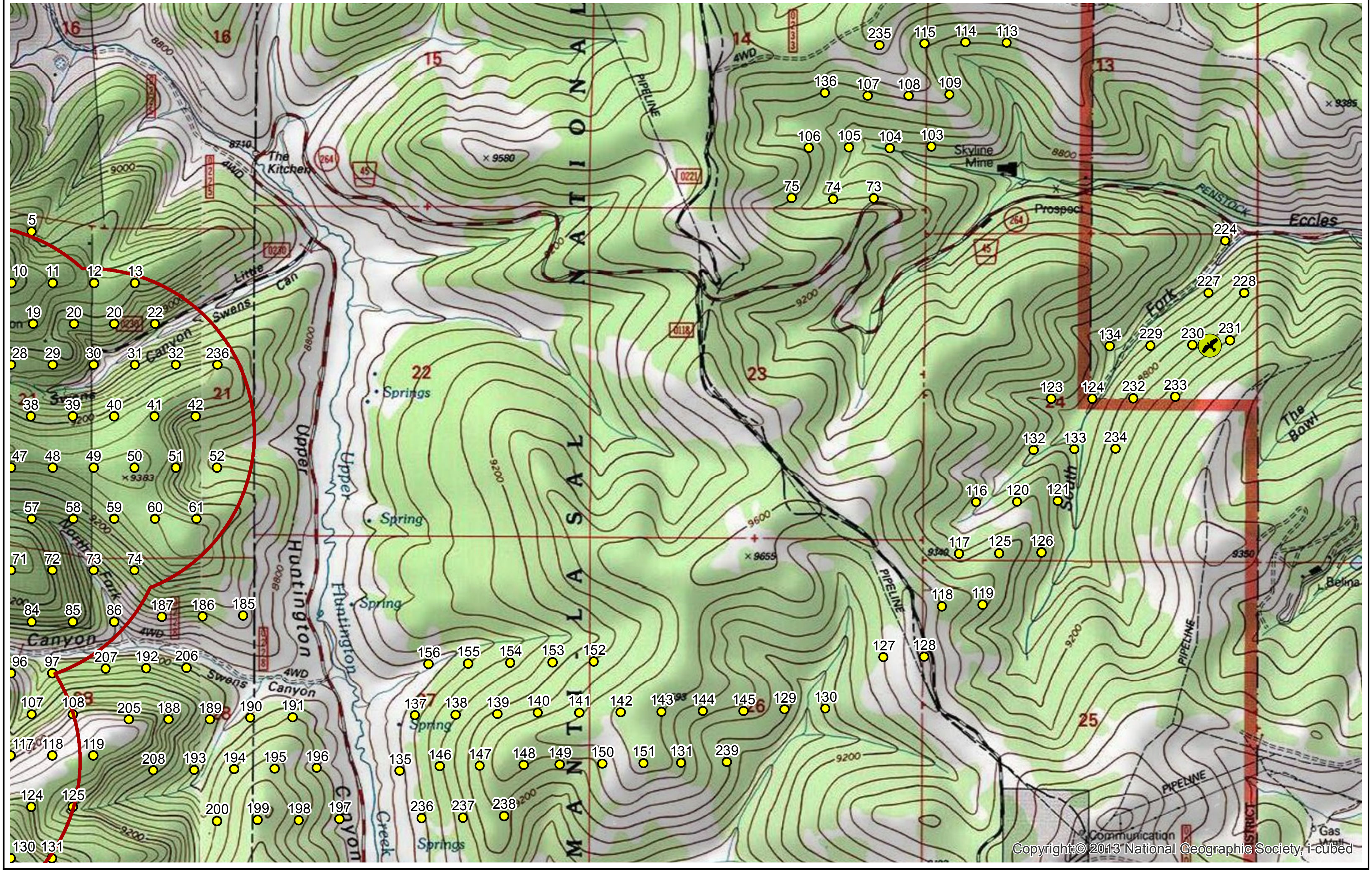
Table 1 summarizes the results of the survey by call station, raptor species, and type of observation.

Station#	Survey	Aural	Visual	Species	Notes
125	1	X		CORA	CORA heard to the N.
133	1	X		CORA	CORA heard to the N.
124	1		X	AMKE	AMKE observed near drainage bottom.
232	1		X	REHA	REHA seen soaring to the NE across Eccles Canyon Road.
231	1	X	X	NOGO	NOGO response elicited, nest located between call station 230 and 231.
106	1	X	X	REHA	REHA observed soaring in basin
136	1	X	X	REHA	REHA observed soaring in basin
107	1	X	X	REHA	REHA observed soaring in basin
136	2	X	X	REHA	REHA observed soaring above 106
107	2	X	X	REHA	REHA soaring above 106 and 75
106	2	X	X	REHA	REHA observed soaring at ridge top.
Nest Monitoring	2	X	X	NOGO	3 fledglings were observed in trees around the nest. Nest has had significant construction since the first observation. Nest tree is extremely small, dbh <12 in., persistence is unlikely.

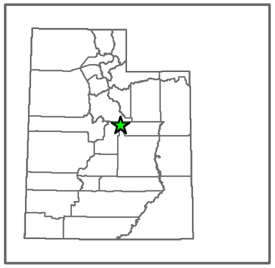
The vegetative communities within the Project Area are classified by the Utah Division of Wildlife Resources as crucial summer mule deer fawning habitat and crucial summer elk calving habitat. This was confirmed by biologists throughout each project area as individual mule deer fawns and elk calves were observed on numerous occasions throughout the project areas during both surveys.

During the first round of inventories, an active northern goshawk nest was documented between call stations 230 and 231 (See Figure 1). A response was elicited between the second and third calling sequence. The nest was located in a small aspen tree; height approximately 25 feet; nest size was small; nest appeared to be made of entirely new material. Likelihood of nest site persistence on the landscape is low. Productivity monitoring was conducted during the second round of surveys. Biologists were able to identify three individual fledglings during the monitoring period.

Other raptors documented include red-tailed hawk, and American kestrel. One red-tailed hawk was observed soaring across the road on the north side of Eccles Canyon outside of the project area; another red-tailed hawk was observed soaring in the basin and ridge top above the Mine site; and an American kestrel observed flying near the drainage bottom in the south fork of Eccles Canyon. There were no audio or visual observations of American three-toed woodpecker during the course of the 2015 surveys.



- 2015 Call Stations
- 2015 Raptor Nests
- 2015 Drill Sites Buffer



Skyline Mine 2015
Powerline and Vent Shaft Project

FIGURE 1

08/02/2015

1:24,000

RAPTOR SURVEY FORM

Division of Oil Gas and Mining
Coal Regulatory Program

Instructions:

Complete the following form including as much information as possible. This form is to be used for hand entry if direct electronic data entry is not possible. All data collected with this form must be submitted to the Division in an electronic format suitable for uploading into ArcGIS. Only nest status information should be collected aerially. All other data can be collected in a subsequent ground visit. Additional reporting requirements are located in the Raptor Survey Procedures provided by the Division of Oil, Gas and Mining.

1. Qualified Biologist: M.Crane
2. Mine: Skyline MIne
3. Survey Date: June and July 2015

4. Survey Type: (Check One)
- [ ] Aerial
- [x] Ground (for tree or cliff nesting species)
- [ ] Ground (for ground nesting species)
- [ ] Calling

Nest Number or "NEW"	Species	Nest Status *(See Back)	Nest Condition *(See Back)	Number of Eggs in the nest:	Number of Young in nest	Age of young in nest (days)	Substrate *(See Back)	Productivity (# fledged)	Elevation/ Exposure of nest (optional)	Comments
New	NOGO	Active-2	Excellent	Unk	2	<7	BLT	3	NE	Observed 3 Fledglings during monitoring