Alton Coal Development, LLC
463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435) 867-5311 Fax (435) 867-1192

June 19, 2017

Daron R. Haddock
Coal Program Manager
Oil, Gas & Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114-5801

Re: **Resubmittal for the North Private Lease, Alton Coal Development, LLC, Coal Hollow Mine, Kane County, Utah, C/025/0005, Task ID#5369**

Dear Mr. Haddock:

Alton Coal Development, LLC (ACD) is resubmitting an amendment to expand the Coal Hollow Mine in Kane County to include the private properties known as the North Private Lease (NPL).

This resubmittal incorporates the deficiencies identified in Task ID #5369. A list of deficiencies and how they were addressed are included in this cover letter.

Changes to the MRP associated with this amendment have been uploaded to the DOGM's server for review. PDF versions of the drawings are not certified. Upon approval, 2 (two) clean hard copies of the text and certified drawings for insertion into the MRP will be submitted. Please do not hesitate to contact me if you have any questions 435-691-1551.

Very truly yours,

B. Kirk Nicholes

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Environmental Specialist
Alton Coal Development

1. The amendment is missing Appendix 7-3N providing water right data associated with the NPL. The drawing associated with this amendment Drawing 7-3N 'Project Area Water Rights', must also be submitted.

Appendix 7-3N and Drawing 7-3N have been included with this submittal.

2. R645-301-230, Confirm expected recovery volumes for Area 3, Map Unit C with field investigation, because the recovery volumes expected for storage in the combined Area 3 Map Unit C stockpile (0.25 ft layer of topsoil with 1.25 feet of underlying subsoil) do not agree with soil map unit descriptions presented in the soil survey found in volume 11. Since this combined topsoil from Map Unit C will be the final topsoil redistributed in the North Lease, a severe shortage can not be recovered elsewhere.

The expected recovery volumes for map Unit C in Area 3 have been reevaluated based on the soil pedons within Unit C and their weighted average predominance within Unit C (found in Vol. 11 Soil Survey, Section 3. Recovery volumes expected have been modified on Drawing 2-4. It should be noted that it appears the Division under task #5369 did not include the C2 horizon in the subsoil or total depth analysis for Pedon ID 12AS005. While the carbonate value for this sample is 24.4, this horizon would still be categorized as 'fair' and is suitable for inclusion in salvaged materials.

Soil Unit C

Pedon ID	Topsoil Depth	Subsoil Depth	Total Depth	Soil Unit 'C' Fraction
12AS005	0.17	2.39	2.56	50%
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12AS006	-	-	-	15%
12AS007	0.23	2.49	2.73	5%
WT. Avg	0.18	1.46	1.64	

3. The water monitoring map 7-10 must be updated to show the water monitoring locations detailed in Table 7-5. The map name should be updated to indicate these are operational water monitoring locations.

Drawing 7-10 shows all the monitoring locations in Chapter 7, Table 7. The title has been changed to "Water Monitoring Locations"

4. The amendment should provide a narrative detailing that excavated material for UD-14 will be placed on the disturbed area side of the ditch to form a berm.

Narrative has been added to Chapter 7, section 742 detailing that excavated material for ditch UD-14 will be placed on the disturbed area side of the ditch to form a berm.

5. R645-302-317.410, Provide a commitment in Chapter 9, Section 317.400 that the prime farmland soils will be sampled as described prior to salvage and salvaged when soils are not saturated. The Division recommends that all prime farmland within a bonding unit is sampled and recovered at one time allow for soil recovery during an appropriate season and to allow mining to continue uninterrupted.

Section 317.410 has been amended to include the following text "ACD will also endeavor to minimize prime farmland soil removal and stockpiling activities during periods of soil saturation following storm events or spring runoff."

6. Vegetation to be planted (Section 302-317.610) and Reference crop selection (302-317.626 through 317.627.2): Chapter 9 must state "the landowners of each parcel work with local NRCS staff to develop a seeding mix suited to their specific site (irrigated vs. non-irrigated) and operation goals. A specialized seeding mix will likely be more successful, more productive, and potentially less expensive than the mix recommended in Table 3-38." In the NRCS communication dated June 12, 2017, several contacts for Kane County are provided.

The statement "However, it is recommended that the landowner of each parcel work with local NRCS staff to develop a seeding mix suited to their specific site (irrigated vs. non-irrigated) and operation goals." Has been added to section 317.627.2.

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APPLICATION FOR COAL PERMIT PROCESSING

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

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine **Permit Number:** C/025/0005
Title: North Private Lease Areas 2 and 3
Description, Include reason for application and timing required to implement:

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

- ☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 295.60 Disturbed Area: 224.80 ☒ increase ☐ decrease.
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- ☒ Yes ☐ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies, thank you. (These numbers include a copy for the Price Field Office)

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.

B. Kirk Nicholes | Environmental Specialist | 06/24/2016 | B. Kirk Nicholes
Print Name | Position | Date | Signature (Right-click above choose certify then have notary sign below)

Subscribed and sworn to before me this 24th day of June, 2016

Notary Public: W Young, state of Utah.

My commission Expires: 04/02/2018
Commission Number: 671357
Address: 444 S. Main #B2
City: Cedar City State: UT Zip: 84720 } ss:

WINSTON YOUNG
NOTARY PUBLIC
STATE OF UTAH
COMMISSION #671357
My Commission Expires April 2, 2018

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

Form DOGM- C1 (Revised December 10, 2007)

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

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine
Permit Number: C/025/0005
Title: North Private Lease Areas 2 and 3

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Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐	☒	☐	(01) Chapter 1 Text
☐	☒	☐	(02) Chapter 1, Drawing 1-1
☐	☒	☐	(03) Chapter 1, Drawing 1-7
☐	☒	☐	(04) Chapter 2 TOC
☐	☒	☐	(05) Chapter Text
☒	☐	☐	(06) Chapter 2, Appendix 2-6
☐	☒	☐	(07) Chapter 2 Drawing 2-3
☐	☒	☐	(08) Chapter 2 Drawing 2-4
☐	☒	☐	(09) Chapter 3 Text
☐	☒	☐	(10) Chapter 3, Drawing 3-1
☐	☒	☐	(11) Chapter 3, Drawing 3-5
☐	☒	☐	(12) Chapter 3 Drawing 3-11
☐	☒	☐	(13) Chapter 4, Text
☐	☒	☐	(14) Chapter 5, Text
☐	☒	☐	(15) Chapter 5, Drawing 5-46
☐	☒	☐	(16) Chapter 5 Drawing 5-47
☐	☒	☐	(17) Chapter 5 Drawing 5-48
☐	☒	☐	(18) Chapter 5 Drawing 5-48A
☐	☒	☐	(19) Chapter 5 Drawing 5-49
☐	☒	☐	(20) Chapter 5 Drawing 5-50
☐	☒	☐	(21) Chapter 5, Drawing 5-51A
☐	☒	☐	(22) Chapter 5, Drawing 5-51B
☐	☒	☐	(23) Chapter 5, Drawing 5-52
☐	☒	☐	(24) Chapter 5, Drawing 5-53
☐	☒	☐	(25) Chapter 5, Drawing 5-57
☐	☒	☐	(26) Chapter 5, Drawing 5-58
☐	☒	☐	(27) Chapter 5, Drawing 5-59
☐	☒	☐	(28) Chapter 5, Drawing 5-60

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

Form DOGM - C2 (Revised December 10, 2007)

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☐	☒	☐	(29) Chapter 5 Drawing 5-61
☐	☒	☐	(30) Chapter 5 Drawing 5-62
☐	☒	☐	(31) Chapter 5 Drawing 5-65
☐	☒	☐	(32) Chapter 5 Drawing 5-65A
☐	☒	☐	(33) Chapter 5 Drawing 5-66
☐	☒	☐	(34) Chapter 5 Drawing 5-66A
☐	☒	☐	(35) Chapter 5 Drawing 5-67
☐	☒	☐	(36) Chapter 5 Drawing 5-68
☐	☒	☐	(37) Chapter 5 Drawing 5-69
☐	☒	☐	(38) Chapter 5 Drawing 5-70
☐	☒	☐	(39) Chapter 5 Drawing 5-71
☐	☒	☐	(40) Chapter 5 Drawing 5-71A
☐	☒	☐	(41) Chapter 5 Drawing 5-74A
☐	☒	☐	(42) Chapter 5 Drawing 5-74B
☐	☒	☐	(43) Chapter 5 Drawing 5-74C
☐	☒	☐	(44) Chapter 5 Drawing 5-76A
☐	☒	☐	(45) Chapter 5 Drawing 5-76B
☐	☒	☐	(46) Chapter 5 Drawing 5-77
☐	☒	☐	(47) Chapter 5 Drawing 5-79
☐	☒	☐	(48) Chapter 7 TOC
☐	☒	☐	(49) Chapter 7 Text
☐	☒	☐	(50) Chapter 7, Monitoring Plan Tables
☒	☐	☐	(51) Chapter 7, Appendix 7-18
☒	☐	☐	(52) Chapter 9, TOC
☒	☐	☐	(53) Chapter 9, Text
☐	☒	☐	(54) Volume 9, TOC
☒	☐	☐	(55) Volume 9, Chapter 4, Appendix 4-7
☐	☒	☐	(56) Chapter 2, Appendix 2-2

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☒ Add	☐ Replace	☐ Remove	(58) Chapter 7, Appendix 7-19
☐ Add	☒ Replace	☐ Remove	(59) Chapter 5, Drawing 5-45
☐ Add	☒ Replace	☐ Remove	(60) Chapter 5, Drawing 5-54
☐ Add	☒ Replace	☐ Remove	(61) Chapter 5, Drawing 5-55
☐ Add	☒ Replace	☐ Remove	(62) Chapter 5, Drawing 5-56
☐ Add	☒ Replace	☐ Remove	(63) Chapter 5, Drawing 5-74
☒ Add	☐ Replace	☐ Remove	(64) Chapter 7, Appendix 7-20
☐ Add	☒ Replace	☐ Remove	(65) Chapter 7, Appendix 7-3N
☐ Add	☒ Replace	☐ Remove	(66) Chapter 7, Drawing 7-10
☐ Add	☒ Replace	☐ Remove	(67) Chapter 7, Drawing 7-3N
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B. Kirk Nicholes	Environmental Specialist	06/24/2016	B. Kirk Nicholes
Print Name	Position	Date	Signature (Right-click above choose certify then have notary sign below)

Subscribed and sworn to before me this 24th day of June, 2016

Notary Public: W Young, state of Utah.

My commission Expires: 04/02/2018 }
Commission Number: 671357 } ss:
Address: 444 S. Main #B2 }
City: Cedar City State: UT Zip: 84720 }

WINSTON YOUNG
NOTARY PUBLIC
STATE OF UTAH
COMMISSION #671357
My Commission Expires April 2, 2018

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

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☐	☒	☐	(11) Chapter 3, Drawing 3-5
☐	☒	☐	(12) Chapter 3 Drawing 3-11
☐	☒	☐	(13) Chapter 4, Text
☐	☒	☐	(14) Chapter 5, Text
☐	☒	☐	(15) Chapter 5, Drawing 5-46
☐	☒	☐	(16) Chapter 5 Drawing 5-47
☐	☒	☐	(17) Chapter 5 Drawing 5-48
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☐	☒	☐	(27) Chapter 5, Drawing 5-59
☐	☒	☐	(28) Chapter 5, Drawing 5-60

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

Form DOGM - C2 (Revised December 10, 2007)

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

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine **Permit Number:** C/025/0005
Title: North Private Lease Areas 2 and 3

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
[ ]	[X]	[ ]	(29) Chapter 5 Drawing 5-61
[ ]	[X]	[ ]	(30) Chapter 5 Drawing 5-62
[ ]	[X]	[ ]	(31) Chapter 5 Drawing 5-65
[ ]	[X]	[ ]	(32) Chapter 5 Drawing 5-65A
[ ]	[X]	[ ]	(33) Chapter 5 Drawing 5-66
[ ]	[X]	[ ]	(34) Chapter 5 Drawing 5-66A
[ ]	[X]	[ ]	(35) Chapter 5 Drawing 5-67
[ ]	[X]	[ ]	(36) Chapter 5 Drawing 5-68
[ ]	[X]	[ ]	(37) Chapter 5 Drawing 5-69
[ ]	[X]	[ ]	(38) Chapter 5 Drawing 5-70
[ ]	[X]	[ ]	(39) Chapter 5 Drawing 5-71
[ ]	[X]	[ ]	(40) Chapter 5 Drawing 5-71A
[ ]	[X]	[ ]	(41) Chapter 5 Drawing 5-74A
[ ]	[X]	[ ]	(42) Chapter 5 Drawing 5-74B
[ ]	[X]	[ ]	(43) Chapter 5 Drawing 5-74C
[ ]	[X]	[ ]	(44) Chapter 5 Drawing 5-76A
[ ]	[X]	[ ]	(45) Chapter 5 Drawing 5-76B
[ ]	[X]	[ ]	(46) Chapter 5 Drawing 5-77
[ ]	[X]	[ ]	(47) Chapter 5 Drawing 5-79
[ ]	[X]	[ ]	(48) Chapter 7 TOC
[ ]	[X]	[ ]	(49) Chapter 7 Text
[ ]	[X]	[ ]	(50) Chapter 7, Monitoring Plan Tables
[X]	[ ]	[ ]	(51) Chapter 7, Appendix 7-18
[X]	[ ]	[ ]	(52) Chapter 9, TOC
[X]	[ ]	[ ]	(53) Chapter 9, Text
[ ]	[X]	[ ]	(54) Volume 9, TOC
[X]	[ ]	[ ]	(55) Volume 9, Chapter 4, Appendix 4-7
[ ]	[X]	[ ]	(56) Chapter 2, Appendix 2-2

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

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

Permittee: Alton Coal Development, LLC
Mine: Coal Hollow Mine
Permit Number: C/025/0005
Title: North Private Lease Areas 2 and 3

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
☒	☐	☐	(57) Chapter 2, Appendix 2-7
☒	☐	☐	(58) Chapter 7, Appendix 7-19
☐	☒	☐	(59) Chapter 5, Drawing 5-45
☐	☒	☐	(60) Chapter 5, Drawing 5-54
☐	☒	☐	(61) Chapter 5, Drawing 5-55
☐	☒	☐	(62) Chapter 5, Drawing 5-56
☐	☒	☐	(63) Chapter 5, Drawing 5-74
☒	☐	☐	(64) Chapter 7, Appendix 7-20
☐	☒	☐	(65) Chapter 7, Appendix 7-3N
☐	☒	☐	(66) Chapter 7, Drawing 7-10
☐	☒	☐	(67) Chapter 7, Drawing 7-3N
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

R645-301-100. GENERAL CONTENTS

110 LEGAL, FINANCIAL, COMPLIANCE, and RELATED INFORMATION

110 INTRODUCTION

Alton Coal Development, LLC is submitting a Mining and Reclamation Plan for the Coal Hollow Project to the Utah Division of Oil, Gas and Mining pursuant to rules governing coal mine permitting at R645-301-100 et seq. Permit Area Base Drawing – Drawing 1-1. Following is the legal descriptions of the permit areas for the Coal Hollow Mine and the North Private Lease. ~~For the Coal Hollow Mine and Area 1 of the North Private Lease (legal description also included), the permittee is authorized to conduct mining and reclamation activities. Area 2 and Area 3 of the North Private Lease at this time are still under Technical Review.~~

Coal Hollow Mine Legal Description

TOWNSHIP 39 SOUTH-RANGE 05 WEST. SLB&M
Section 30: All of Section Lot #l (NW ¼ NW ¼); NE ¼ NW ¼ ; N ½ NE ¼ ; ALSO: BEGINNING 3.50 chains West of the East Quarter corner of Said Section 30, and running South 34° 34' West 22.64 chains of the l/16 section line; thence West 2.64 chains to the Southwest comer of NE ¼ SE ¼ of Said Section 30; thence North 40.00 chains; thence East 20.00 chains; thence South 14.69 chains; thence southwesterly to the point of beginning...containing 2l7.64 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST. SLB&M
Section 29: BEGINNING at the Northwest corner of Said Section 29, and running thence South 34.69 chains; thence North 33°22' East 35.50 chains; thence North 40° West 0.58 chains; thence North 37°30' East 12.30 chains; thence West 22.23 chains to the point of beginning...containing 36.04 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST. SLB&M
Section 19: SW ¼ SE ¼ , E ½ SE ¼., SE ¼ NE ¼ ...containing 160.0 acres, more or less.

TOWNSHIP 39 SOUTH.RANGE 05 WEST. SLB&M
Section 20: SW ¼ ...containing 160.00 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST. SLB&M
Section 30: BEGINNING at a point 5.3 I chains North of the E ¼ corner of Said Section 30, and running thence South 45.31 chains; thence West 20.00 chains; thence North 20.00 chains; thence East 2.64 chains; thence North 34° 34' East 22.64 chains to the l/16 section line; thence North 33° 22' East to the point of beginning…containing 61.96 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M

Section 29: BEGINNING at the Northeast Corner of the Northwest Quarter of Said Section 29, and running thence South 14.97 chains; thence West 73 degrees North, 12.41 chains; thence South 36 degrees 45 minutes West to the Quarter Section Line of Section 29; thence South 36 degrees 45 minutes West 15.61 chains; thence South 5.20 chains to the center section line of Section 29; thence South 20.0 chains; thence West 10.96 chains to the west section line of Section 29; thence North 20.0 chains to the Quarter Section Corner of Section 29; thence North 25.31 chains; thence North 33 degrees 22 minutes East 35.50 chains; thence in a Northwesterly direction 2 rods; thence North 37 degrees 30 minutes East 12.30 chains to the North Section Line of Section 29; thence East 17.77 chains to the point of beginning…containing 85.88 acres, more or less.

This legal description is for the permit area (721 acres) of the Coal Hollow Mine

North Private Lease Legal Description

The following described lands located in Kane County, Utah within Sec. 12 &13, T39S, R6W and within Sec. 7 &18, T39S, R5W:

Beginning S 58^0 16’ 29” W a distance of 1,920.87 ‘ from Section Corner 7-18-12-13, T39S, R5 R6W;thence N 89°29'27\ W a distance of 823.81'; thence S 00°00'38\ E a distance of 1313.93'; thence S 65°46'32\ E a distance of 479.40'; thence S 89°44'30\ E a distance of 1861.86'; thence S 54°58'33\ E a distance of 226.53'; thence S 89°45'07\ E a distance of 1235.50'; thence N 00°41'09\ E a distance of 1322.97'; thence N 00°41'09\ E a distance of 1322.97'; thence S 89°30'20\ E a distance of 241.42'; thence N 00°51'49\ E a distance of 1323.52'; thence N 89°22'59\ W a distance of 249.30'; thence N 89°56'02\ W a distance of 2923.34'; thence S 00°24'59\ W a distance of 2326.09'; which is the point of beginning, having an area of 12,877,780.47 square feet, or **295.633 acres**

~~**North Private Lease Area 1**~~

~~Beginning N 00°13'43\ E a distance of 32.93’ from the Quarter Corner of Section 13, T39S, R6W and Section 18, T39S, R5W; thence N 31°31'50\ E a distance of 154.24'; thence N 57°23'16\ W a distance of 226.20'; thence N 88°59'49\ W a distance of 333.21; thence N 00°00'00\ W a distance of 406.49'; thence N 14°40'41\ W a distance of 203.34'; thence N 00°00'00\ W a distance of 84.00'; thence N 63°22'32\ E a distance of 42.57; thence N 10°23'07\ E a distance of 139.17'; thence N 03°40'08\ E a distance of 507.46; thence N 90°00'00\ W a distance of 1209.70'; thence S 89°29'27\ W a distance of 823.81; thence S 00°00'38\ E a distance of 1313.93'; thence S 65°46'32\ E a distance of 479.40'; thence S 89°44'30\ E a distance of 1861.86'; thence S 55°10'50\ E a distance of 162.02'; which is the point of beginning, having an area of 3,039,851.16 square feet, or **69.785 acres**~~

112 IDENTIFICATION OF INTERESTS

112.100 Business Entity

Applicant, Alton Coal, LLC, is a limited liability company duly organized and validly existing under the laws of the State of Nevada, and authorized to conduct business under the laws of the State of Utah.

112.200 Names, address, telephone number, and employer identification number of:

112.210 **Applicant:**

Alton Coal Development, LLC
463 N. 100 W, Suite 1
Cedar City, UT 84721
Telephone (435) 867- 5331
EIN: 42-1655092

112.220 Resident Agent for **Applicant**:
B. Kirk Nicholes
463 N. 100 W., Suite 1
Cedar City, Utah 84721
(435) 867-5331

112.230 Person who will pay the Abandoned Mine and Reclamation Fee:

Robert C. Nead, Jr.

112.300 Ownership and Control Information

Description of Ownership and Chart showing the "Family Tree" for Alton Coal Development, LLC, attached in Appendix 1-10

112.310 **Applicant:**

Members Holding Ten Percent (10%) or more of Ownership of Applicant:
James Wayland
2841 Capistrano Way
Naples, FL 34105

SH Coal Investment, LLC
2375 Cambridge Rd.
Coshocton, Ohio 43818
EIN: 27-3192975

Owners of SH Coal Investment, LLC:

SH Coal Investment, LLC, is a Delaware limited liability company, which is a wholly owned company of Sleepy Hollow Mineral Investors, LLC, which is a Delaware limited liability company.

Sleepy Hollow Mineral Investors, LLC 100%
P.O. Box 1058
Coshocton, Ohio 43812
EIN: 27-3192842

Sleepy Hollow Mineral Investors, LLC, is owned as follows:

Charles Ungurean 50%
2375 Cambridge Road
Coshocton, Ohio 43812

Thomas Ungurean 50%
1690 Sleepy Hollow Drive
Coshocton, Ohio 43812

Managers and Officers of **Applicant**:

James Wayland – Manager

Larry Johnson – President for Operations
463 N. 100 W., Suite 1
Cedar City, Utah 84721
(435) 867-5331

Social Security numbers of Alton Coal Development, LLC's individual member, manager and officer and for Charles Ungurean and Thomas Ungurean provided in "CONFIDENTIAL BINDER" Appendix 1-1

112.320 Relationship to the **Applicant**

Ownership:

James Wayland	25.5%
SH Coal Investment, LLC	49.0%

Control:

James Wayland	Manager
Larry Johnson	President of Operations

SH Coal Investment, LLC (Owner) and Sleepy Hollow Mineral Investors, LLC:

Charles Ungurean	Manager
Thomas Ungurean	Manager

112.330 Title and Date of Position

Applicant:

James Wayland Manager
September 9, 2004 (begin date)

Larry Johnson President of Operations
February 1, 2011 (begin date)

Robert C. Nead, Jr.
Person in charge of payments pursuant to R645-300-147
September 9, 2004 (begin date)

SH Coal Investments, LLC Owner
Sleepy Hollow Mineral Investors, LLC Manager of SH Coal Investments, LLC
August 2, 2010 (begin date)
Sleepy Hollow Mineral Investors, LLC
Charles Ungurean Manager
August 2, 2010 (begin date)
Thomas Ungurean Manager
August 2, 2010 (begin date)

112.340. Ownership or control of Other Coal Mining and Reclamation Operations

Applicant:

With the exception of Charles Ungurean and Thomas Ungurean, neither Alton Coal Development, LLC nor its manager or members has owned or controlled other coal mining or reclamation operations. *See* attached Appendix 1-10 for listing of Ungurean's operations.

112.350 Application Number – Other Pending Coal Mining and Reclamation Operations

Applicant:

With the exception of Charles Ungurean and Thomas Ungurean, neither, Alton Coal Development, LLC nor its manager or members has owned or controlled other coal mining or reclamation operations. The Ungurean's operations are described at Appendix 1-10.

112.400 Coal Mining and Reclamation Operations Owned or Controlled

Applicant:

With the exception of Charles Ungurean and Thomas Ungurean, neither, Alton Coal Development, LLC nor its manager or members has owned or controlled other coal mining or reclamation operations. The Ungurean's operations are described at Appendix 1-10.

112.410 Coal Mining and Reclamation Operations Owned or Controlled by Managers or Members of Alton Coal Development, LLC

Applicant:

With the exception of Charles Ungurean and Thomas Ungurean, neither, Alton Coal Development, LLC nor its manager or members has owned or controlled other coal mining or reclamation operations. The Ungurean's operations are described at Appendix 1-10.

112.420 Ownership and Control Relationship of Managers and Members of Alton Coal Development, LLC

Relationship to the **Applicant**

Applicant:

James Wayland Manager
September 9, 2004 (begin date)

Larry Johnson President of Operations
February 1, 2011 (begin date)

Robert C. Nead, Jr.
Person in charge of payments pursuant to R645-300-147
September 9, 2004 (begin date)
SH Coal Investments, LLC Owner

Sleepy Hollow Mineral Investors, LLC Manager of SH Coal Investment, LLC
August 2, 2010 (begin date)
Sleepy Hollow Mineral Investors, LLC
Charles Ungurean Manager
August 2, 2010 (begin date)
Thomas Ungurean Manager
August 2, 2010 (begin date)

112.500 Legal or Equitable Owner of the Surface and Mineral Properties

The legal and equitable owners of the properties to be affected by this mining operation during the duration of the permit period along with legal descriptions are included in this section.

Surface and coal ownership are also shown on Drawings 1-3 and 1-4. The following table is a summary of the ownership within the Permit boundary.

Coal Hollow Permit Area Ownership (Acres)**				
	Fee	Federal	State	Total
Surface	721	0	0	721
Coal*	521	200	0	721
Total				
Note*: Federal minerals located within the Permit area are not planned for mining as part of this application. These areas have been included as part of the LBA application described in 112.800. Note**: Acreages are approximate based on legal descriptions				

The legal description for lands included within the Permit Boundary is provided below for each surface owner.

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
C. Burton Pugh 533 N 650 E Lindon, Utah 84042-1567 801-785-6220	Alton Coal Development, LLC

Legal Description (C. Burton Pugh Property):

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 30: All of Section Lot #1 (NW¼ NW¼); NE¼ NW¼ ; N½ NE¼ ; ALSO: BEGINNING 3.50 chains West of the East Quarter corner of Said Section 30, and running South 34˚ 34’ West 22.64 chains to the 1/16 section line; thence West 2.64 chains to the Southwest corner of NE¼ SE¼ of Said Section 30; thence North 40.00 chains; thence East 20.00

chains; thence South 14.69 chains; thence southwesterly to the point of beginning.

….containing 217.64 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 29: BEGINNING at the Northwest corner of Said Section 29, and running thence South 34.69 chains; thence North 33˚22’ East 35.50 chains; thence North 40˚ West 0.58 chains; thence North 37˚30’ East 12.30 chains; thence West 22.23 chains to the point of beginning.

….containing 36.04 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 19: SW¼SE¼, E½SE¼, SE¼NE¼

….containing 160.0 acres, more or less

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 20: SW¼

….containing 160.0 acres, more or less

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
C. Burton Pugh 533 N 650 E Lindon, Utah 84042-1567 801-785-6220	Alton Coal Development, LLC
Roger M. Pugh 140 South 100 West Kanab, UT 84741	
Mark and Margaret Moyers 9397 Avanyu Drive Pleasant Grove, UT 84062	

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
Alecia Swapp Dame Trust Through Richard Dame, Trustee 1620 Georgia Ave. Boulder City, NV 89005 702-293-4773	Alton Coal Development, LLC

Legal Description (Alecia Dame Swapp Trust):

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 30: BEGINNING at a point 5.31 chains North of the E¼ corner of Said Section 30, and running thence South 45.31 chains; thence West 20.00 chains; thence North 20.00 chains; thence East 2.64 chains; thence North 34˚ 34’ East 22.64 chains to the 1/16 section line; thence North 33˚ 22’ East to the point of beginning.

….containing 61.96 acres, more or less.

The following description is an addition to the original permit and constitutes an Incidental Boundary Change(IBC) as shown on Drawing 1-1. Coal contained in the IBC will be mined by highwall mining, no surface mining may take place on the leased premises.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 29: BEGINNING at the Northeast Corner of the Northwest Quarter of Section 29, Township 39 South, Range 5 West, Salt lake Base and Meridian and running thence South 14.97 chains; thence West 73 degrees North, 12.41 chains; thence South 36 degrees 45 minutes West to the Quarter Section Line of Section 29, Township 39 South, Range 5 West, Salt Lake Base and Meridian; thence South 36 degrees 45 minutes West 15.61 chains; thence South 5.20 chains to the center section line of Section 29, Township 29 South, Range 5 West, Salt lake Base and meridian; thence South 20.0 chains; thence West 10.96 chains to the west section line of Section 29, Township 39 South, Range 5 West, Salt lake Base meridian; thence North 20.0 chains to the Quarter Section Corner of Section 29, Township 39 South, Range 5 West, Salt Lake Base and meridian; thence North 25.31 chains; thence North 33 degrees 22 minutes East 35.50 chains; thence in a Northwesterly direction 2 rods; thence North 37 degrees 30 minutes East 12.30 chains to the North Section Line of Section 29, Township 39 South, Range 5 West, Salt Lake Base meridian; thence East 17.77 chains to the point of beginning.

….containing 85.88 acres, more or less.

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
Alecia Swapp Dame Trust Through Richard Dame, Trustee 1620 Georgia Ave. Boulder City, NV 89005 702-293-4773	Alton Coal Development, LLC

North Private Lease Permit Area Ownership (Acres)**				
	Fee	Federal	State	Total
Surface	296	0	0	296
Coal*	262	34	0	296
Total				
Note*: Federal minerals located within the Permit area are not planned for mining as part of this application. These areas have been included as part of the LBA application described in 112.800.				

Note**: Acreages are approximate based on legal descriptions

The legal description for lands included within the Permit Boundary is provided below for each surface owner.

<u>SURFACE OWNERSHIP:</u>

Owner/Lessor:	*Lessee:*
Heaton Brothers, LLC P. O. Box 100008 Alton, Utah 84710	Alton Coal Development, LLC

Legal Description (Heaton Brothers, LLC Property Tract 9-6-13-1 & 9-6-12-5):

<u>TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M</u>
Section 13: E½NE¼: SW¼NE¼

….containing 120.0 acres, more or less.

<u>TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M</u>
Section 12: BEGINNING at a point 20 chains West and 10 chains North of the South East corner of said Section 12; thence North 10 chains, thence East 3 chains, thence South 10 chains, thence West 3 chains to the point of beginning.

….containing 3.00 acres, more or less.

<u>COAL OWNERSHIP:</u>

Owner/Lessor:	*Lessee:*
Heaton Brother, LLC P.O. Box 100008 Alton, Utah 84010	Alton Coal Development, LLC

<u>SURFACE OWNERSHIP:</u>

Owner/Lessor:	*Lessee:*
G. Ferril & Dorothy M. Heaton P.O. Box 100063 Alton, UT 84710	Alton Coal Development, LLC

Legal Description (G. Ferril & Dorothy M. Heaton Property Tract 9-6-12-1, 9-5-7-3A, 9-5-18-5):

> TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M
> Section 12: E½E½SE½SE½: BEGINNING at a Southeast corner of Said Section 12, and running thence West 5.00 chains; thence North 20.00 chains; thence East 5.00 chains; thence South 20.00 chains to the point of beginning.
>
> ….containing 10.00 acres, more or less.
>
> TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
> Section 7: BEGINNING at a point Southwest corner Said Section 7, and running thence East 15.00 chains; thence North 20.00 chains; thence West 15.00 chains; thence South 20.00 chains to the point of beginning.
>
> ….containing 30.00 acres, more or less.
>
> TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
> Section 18: BEGINNING at the Northwest corner of Said Section 18, and running thence East 15.00 chains; thence South 20.00 chains; thence West 15.00 chains; thence North 20.00 chains to the point of beginning.
>
> ….containing 30.00 acres, more or less

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
Delbert R. Palmer P.O. Box 6 Orderville, Utah 84758-0006	Alton Coal Development, LLC
Elgin R. Palmer and 9670 Cove Avenue Pensacola, Florida 32534-1034	Alton Coal Development, LLC

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
G. Ferril & Dorothy M. Heaton P.O. Box 100063 Alton, UT 84710	Alton Coal Development, LLC

Legal Description (G. Ferril & Dorothy M. Heaton Property Tract 9-5-18-3A):

> TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
> Section 18: The SW¼NW¼ (Lot 2) of Said Section 18.
>
> ….containing 38.34 acres, more or less.

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
Heaton Brothers, LLC P.O. Box 100773 Alton, UT 84710	Alton Coal Development, LLC
Delila B. Heaton Inter Vivos Trust, P.O. Box 100063 Alton, UT 84710	
Ross E. Heaton Family Trust, P.O. Box 100063 Alton, UT 84710	

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
Dean R. Heaton-Successor Trustee of the Trust Dated 11/12/90 c/o Dean R. Heaton P.O. Box 435 Fredonia, AZ 86022	Alton Coal Development, LLC

Legal Description (Dean R. Heaton Property Tracts 9-6-12-2, 9-5-18-3, & 9-5-7-4A):

> TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M
> Section 12: BEGINNING at a point 5.00 chains West from the SE Corner of Said Section 12, and running thence North 20.00 chains; thence South 10.00 chains; thence West 5.00 chains; thence South 10.00 chains; thence

West 10.00 chains; thence South 10.00 chains; thence East 15.00 chains to the point of beginning.

….containing 20.00 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 18: BEGINNING at a point 60.00 rods East of the Northwest corner of Said Section 18, and running thence East 20.00 rods; thence South 80.00 rods; thence West 20.00 rods; thence North 80.00 rods to the point of beginning.

….containing 10.00 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 05 WEST, SLB&M
Section 18: BEGINNING at a point 60 rods East of the Southwest corner of Said Section 7, and running thence North 80.00 rods; thence East 33.00 rods; thence South 80.00 rods; thence West 33.00 rods to the point of beginning.

….containing 15.00 acres, more or less.

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
Dean R. Heaton-Successor Trustee of the Trust Dated 11/12/90 c/o Dean R. Heaton P.O. Box 435 Fredonia, AZ 86022	Alton Coal Development, LLC

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
Orval & Greta Palmer P.O. Box 100144 Alton, UT 84710-0144	Alton Coal Development, LLC

Legal Description (Orval & Greta Palmer Property Tract 9-6-12-3):

TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M
Section 12: BEGINNING at a point 20.0 chains North & 10.0 chains West of the Southeast corner of Section 12 Township 39 South, Range 6 West,

SLB&M; & run th South 10.0 chains; th West 7.0 chains; th North 10.0 chains; th East 7.0 chains to the point of beginning.

….containing 7.0 acres, more or less.

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
Orval & Greta Palmer P.O. Box 100144 Alton, UT 84710-0144	Alton Coal Development, LLC

SURFACE OWNERSHIP:

Owner/Lessor:	*Lessee:*
Heaton Brothers, LLC P.O. Box 100773 Alton, Utah 84710	

Legal Description (Heaton Brothers, LLC Property Tract 9-6-12-5 and 9-6-13-2):

TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M
Section 12: BEGINNING 20.00 chains West from the Southeast corner of Section 12, T39S-R6W, S.L.B.&M., Running Thence North 20 chains, thence West 5 chains, thence South 20 chains, thence East 5 chains to the point of beginning.

….containing 10.00 acres, more or less.

TOWNSHIP 39 SOUTH-RANGE 06 WEST, SLB&M
Section 12: BEGINNING 20.00 chains West from the Southeast corner of Section 12, T39S-R6W, S.L.B.&M., Running Thence South 20 chains, thence West 20 chains, thence North 5 chains, thence East 15 chains, thence North 15 chains, thence East 5 chains to the point of beginning.

….containing 17.50 acres, more or less.

COAL OWNERSHIP:

Owner/Lessor:	*Lessee:*
USA	Not Leased

112.600 Owners of Record of Property Contiguous to Proposed Permit Area

Owners of surface properties contiguous to the proposed permit area are shown on Drawing 1-3 and the name and address of each such owner is as follows:

Department of the Interior, Bureau of Land Management
District and Regional Office
Salt Lake City, Utah

Darlynn and Arlene Sorensen
Orderville, Utah
435-648-2462

Ann Marie Stanworth 9-5-18-2
1757 N 2975 W
Cedar City, Utah 84720-2507

Darrel A. & Georgia T. Heaton 9-6-12-4
PO Box 232
Fredonia, Arizona 86022-0232

William J. Mackelprang 9-5-18-1
6562 Begonia Bay Ave.
Las Vegas, Nevada 89142

Gene Edward Roundy 9-6-12-8
440 E 200S
Cedar City, Utah 84720-3313

112.700 MSHA Numbers

The MSHA Mine Identification Number for the Coal Hollow and North Private Lease Project is 42-02519. The Burton #1, underground mine, has been issued MSHA Mine Identification Number 42-02639.

112.800 Interest in Contiguous Lands

The applicant has interest in lands contiguous to the permit area. A Lease by Application (LBA) is currently being processed by the United States Department of the Interior, Bureau of Land Management, Salt Lake City, Utah. Alton Coal Development, LLC, the sole party in interest, submitted the LBA application in September, 2004. The LBA is contiguous to the permit area and contains approximately 3,581 acres. Coal recovery within the LBA is amenable to both surface and underground mining. See Drawing 1-2 for LBA delineation.

In addition to the LBA application, Alton Coal Development, LLC also has property leased from C. Burton Pugh located east of the permit boundary. This property which is contiguous to the permit area, is part of a land tract (9-5-20-2) owned by Mr. Pugh that is split across the permit boundary and is located in Section 20, Township 30 South, Range 5 West. This entire tract was leased prior to the final determination of the Permit Boundary (9/10/04). The area leased from Mr. Pugh outside the Permit Boundary are not planned for development except for approximately 43 acres located in the SW¼, NW¼ Section 20 which is included as part of the LBA application. The 43 acres would possibly be developed for surface coal mining operations if the LBA mining rights are successfully acquired. Land tracts leased by Alton Coal Development, LLC within and contiguous to the permit area are identified on Drawing 1-3.

112.900 Certification of Submitted Information

After Alton Coal Development, LLC is notified that the application is approved, but before the permit is issued, Alton Coal will update, correct or indicate that no change has occurred in the information submitted under R645-301-112.100 through .800.

113 VIOLATION INFORMATION

Neither the applicant, affiliates, members or managers or persons controlled by or under common control with the applicant (including Charles Ungurean and Thomas Ungurean, as confirmed by the Applicant/Violator System (AVS) search, dated December 23, 2013) has: (i) had a federal or state mining permit suspended or revoked in the last five years; (ii) nor forfeited a mining bond or similar security deposited in lieu of a bond. Neither the applicant, affiliates, members or managers or persons controlled by or under common control with the applicant has received a violation during the last three year period. Compliance information on Ungurean's operations and the Coal Hollow Mine is attached at Appendix 1-10.

114 RIGHT OF ENTRY INFORMATION

Applicant bases its right to enter and begin coal mining activities in the permit area and the consent of the surface owner to extract coal by surface mining methods upon the following documents:

Lessor:	*Lessee:*
C. Burton Pugh	Alton Coal Development, LLC

Surface and Mineral Lease, dated 9/10/04; originally recorded 5/25/06

Lessor:	*Lessee:*
Roger M. Pugh	Alton Coal Development, LLC

Mineral Lease, dated 9/11/08; recorded 9/11/08

Lessor:	*Lessee:*
Margaret and Mark Moyers	Alton Coal Development, LLC

Mineral Lease, dated 6/26/08; recorded 7/21/08

Lessor:	*Lessee:*
Alecia Swapp Dame Trust	Alton Coal Development, LLC

Surface and Mineral Lease, dated 4/29/05; recorded 5/17/06
Mineral Lease, dated 10/23/13; recorded 10/23/13

Lessor:	*Lessee:*
Heaton Brothers, LLC	Alton Coal Development, LLC

Surface and Mineral Lease, dated 3/15/07
Surface and Mineral Lease, dated 10/22/14
Surface and Mineral Lease, dated 12/31/14

Lessor:	*Lessee:*
G. Ferril & Dorothy M. Heaton	Alton Coal Development, LLC

Surface Lease, dated 5/4/07
Surface Lease, dated 5/4/07
Surface Lease, dated 5/4/07
Surface Lease, dated 5/4/07

Lessor:	*Lessee:*
Delbert R. Palmer	Alton Coal Development, LLC

Mineral Lease, dated 7/2/14

Lessor:	*Lessee:*
Elgin R. Palmer	Alton Coal Development, LLC

Mineral Lease, dated 7/8/14

Lessor:	*Lessee:*
Dean R. Heaton	Alton Coal Development, LLC

Surface and Mineral Lease, dated 5/4/07
Surface and Mineral Lease, dated 5/4/07
Surface and Mineral Lease, dated 12/15/14

Lessor:	*Lessee:*
Orval & Greta Palmer	Alton Coal Development, LLC

Surface and Mineral Lease, dated 6/30/14

Copies of these lease assignments are included in Appendix 1-2 located in the Volume 9, Confidential binder.

115 STATUS OF UNSUITABILITY CLAIMS

115.100 The permit area is not within an area or under study as an area designated as unsuitable for mining under R645-103-400, nor has any petitions been filed with the UDOGM under R645-103-420 that could affect the proposed permit area. The Coal Hollow Project is located on private lands adjacent to federal lands, which after careful consideration were declared suitable for mining in 1980 by then Secretary of Interior Andrus. Secretary's Decision, Petition to Designate Certain Federal Lands In Southern Utah Unsuitable for Surface Coal Mining, OSM Ref No. 79-5-001, dated December 16, 1980, copy attached at Appendix 1-3.

This petition was filed under the provisions of section 522(c) of the federal Surface Mining Control and Reclamation Act ("SMCRA"). OSM Notice, Receipt of a Complete Petition for Designation of Lands as Unsuitable for Surface Coal Mining Operations, 45 fed. Reg. 3398, Jan. 17, 1980, attached at Appendix 1-3.

Those federal lands in the Petition area found suitable for mining include lands adjacent to the private lands which the Project has included in a federal lease by application and located in Kane County, Utah within Township 39 South, Ranges 5 and 6 West, SLM. Secretarial Decision at Paragraph 4. The Secretarial Decision was based on an extensive Administrative Record, including the Petition filed under Section 533 of SMCRA, 30 U.S.C. Section 1272, public hearings, a combined petition evaluation document and environmental impact statement published in two volumes on November 26, 1980 as, "Southern Utah Petition Evaluation Document" and the "Southern Utah Petition Evaluation Document - Comments and Responses." The Secretarial Decision was further supported by a 52 page Statement of Reasons, dated January 13, 1981, attached at Appendix 1-3.

The Secretarial Decision was upheld by the federal court in *Utah International, Inc. v. Watt*, 553 F. Supp. 872 (D. Utah 1982).

115.300 Coal mining and reclamation activities at the Coal Hollow Project are not planned within 300 feet, measured horizontally, of an occupied dwelling or 100 feet of a public road. Drawing 1-5 shows the proximity of the Swapp Ranch to the planned operations. With the alternate highwall method, coal will be recovered by highwall mining beneath the Swapp Ranch. Engineering has been completed and incorporated into the plan such that subsidence does not occur to the surface.

116 PERMIT TERM

116.100 There are 6 mining phases or areas associated with this permit term. Three phases contained within the Coal Hollow Mine Permit boundary, and three permit areas contained within the North Private Lease boundary. The first phase of mining at the Coal Hollow Mine began on November 10, 2010. Phase 3 for the Coal Hollow Mine is anticipated to conclude in year 2017. The first area of mining for the North Private Lease began on February 22, 2016. Area 3 for the North Private Lease is anticipated to conclude in year 2023.

116.101 *Coal Hollow Acres of disturbance per Mining Phase*

Phase 1 250 acres

Phase 2 54 acres

Phase 3 68.5 acres

116.102 *North Private Lease Acres of disturbance per Mining Phase*

Area 1 69.79 acres

Area 2 97.84 acres

Area 3 57.2 acres

116.200 Permit Term

The Coal Hollow Mine Project is proposed for a 5-year term under the Permanent Regulatory Program for 5 years

117 INSURANCE, PROOF OF PUBLICATION

Proof of publication pursuant to R645-303-322 is included in Appendix 1-5.

117.100 Certificate of Liability Insurance

A copy of the Certificate of Liability Insurance is found in Appendix 1-4.

118 PERMIT FILING FEE

A copy of this permit is on file with the Utah Division of Oil, Gas and Mining (UDOGM), P.O. Box 145801, Salt lake City, Utah 84114-5801. A filing fee of $5.00 accompanied permit submittal.

120 PERMIT APPLICATION FORMAT AND CONTENTS

This permit application contains information and will comply with R645-301-120. A notarized statement attesting to the accuracy of this information is set forth at Appendix 1-6.

130 REPORTING OF TECHNICAL DATA

All technical data submitted in the permit application will be accompanied by the name or organization responsible for the collection and analysis of data, dates of collection and descriptions of methodology used. Technical analyses will be planned by or under the direction of a qualified professional in the subject to be analyzed.

The following assisted or were consulted in the preparation of this permit application:

State of Utah, Department of Natural Resources
Division of Oil, Gas and Mining
Salt Lake City, Utah

Department of the Interior, Bureau of Land Management
District and Regional Office
Kanab and Salt Lake City, Utah

United States Geological Survey, Utah Region
Salt Lake City, Utah

United States Department of Agriculture
Natural Resources Conservation Service
Salt Lake City, Richfield and Cedar City, Utah

State of Utah, Department of Natural Resources
Division of Wildlife Resources (DWR)
Salt Lake City, Price and Cedar City, Utah

Dr. Patrick D. Collins
Mt. Nebo Scientific Research & Consulting
Springville, UT

Erik Petersen, P.G.
Petersen Hydrologic, LLC
Lehi, UT

John T. Boyd Company
James Boyd
Mining & Geological Consulting
Canonsburg, PA

John T. Boyd Company

Dr. James E. Nelson
Brigham Young University
Provo, UT

Talon Resources, Inc
Huntington, UT

C. Burton Pugh
Lindon, UT

Richard Dame
Boulder City, NV

University of Miami

Rich Bate
Mining & Geological Consulting
Denver, CO

Miami, FL

Keith Montgomery
Montgomery Archaeological
Moab, UT

Geochron Laboratories
Cambridge, MA

Dr. Stephen Petersen
Elk Ridge, UT

Energy Labs
Billings, MT

Larry Hayden-Wing
Hayden-Wing Associates, LLC
Laramie, WY

Taylor Geo-Engineering
Alan O. Taylor
Lehi, UT

Mark Page
Water Rights Consultant
Price, UT

Long Resource Consultants
Robert E. Long
Morgan, UT

D.A. Smith Drilling
Loma, CO

JBR Environmental, Inc.
Dawn Whaley
Sandy, UT

Kane County
76 North Main
Kanab, UT

Bruce Chesler
Escalante, UT

Heaton Livestock
PO Box 100773
Alton, UT

A.H. Hamblin
Paleontogical Consulting
Cedar City, UT

Patricia Stavish
Montgomery Archeological
Moab, UT

Mike Shurtz, C.E.T
AGEC
Cedar City, UT

Byron Caton
SGS North America, Inc
Denver, CO

Inter-Mountain Laboratories
Karen Secor
1673 Terra Avenue
Sheridan, WY

Glenn Grossman
Will Spitzenberg, P.E.

Tom Campbell

Boss Engineering
Pleasant Grove, UT

TerraTek
Salt Lake City, UT

GEM Engineering, Inc.
Cedar City, UT

Dan Guy
Mining & Engineering Consultant
St. George, UT

David Newman, PhD P.E.
Appalachian Mining & Engineering, Inc.
Lexington, Kentucky

Dale Gourley
Bighorn Archaeological Consultants
3706 Nicholas Drive
Santa Clara, Utah 84765

Brown Consulting Engineers
163 West 1600 South #5
St. George, UT 84770

Southwest Energy LLC
Orica Mining Service
Tucson, AZ 85705

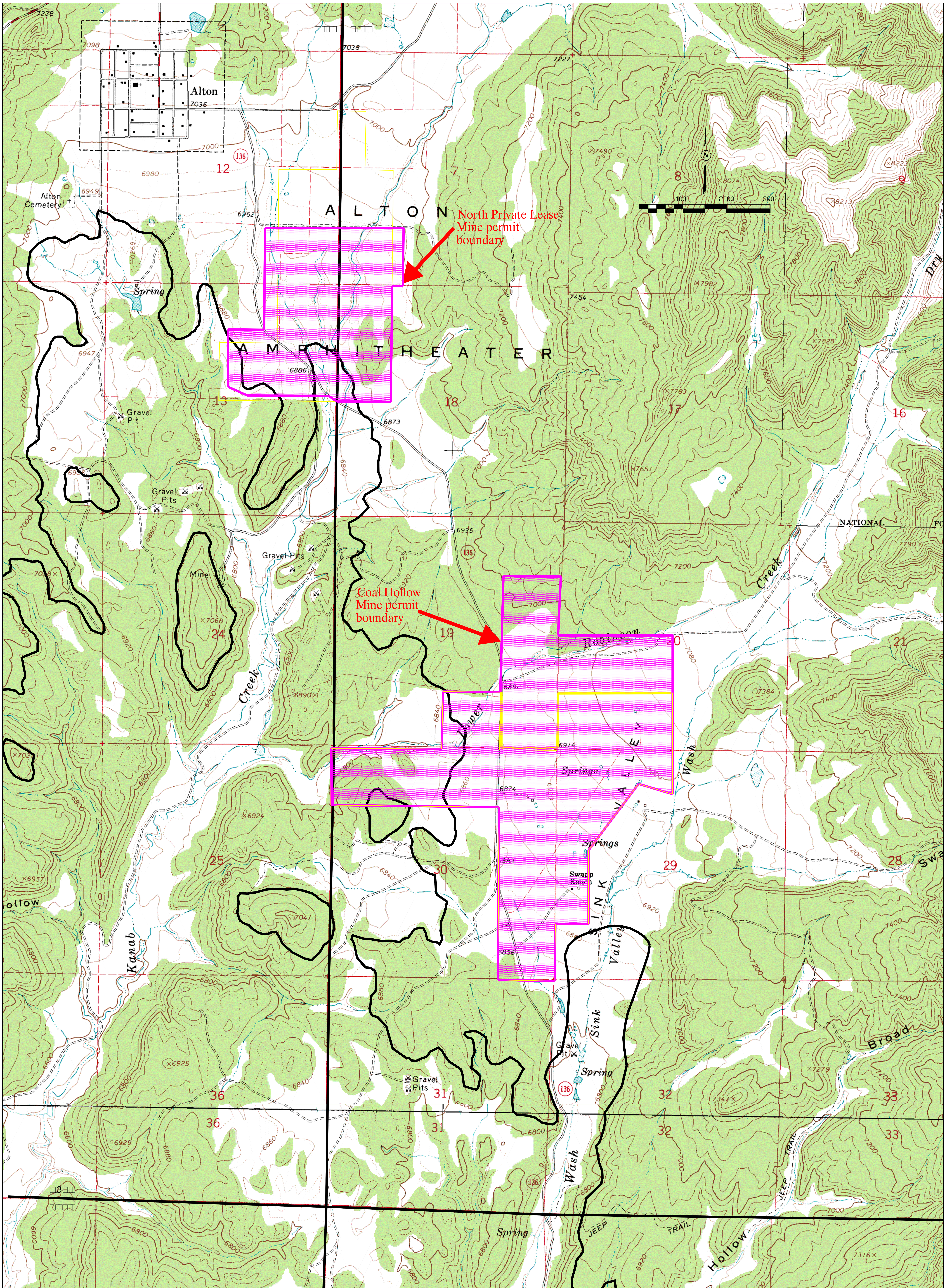
Jay S. Adams, RLS
Adams Surveying Inc.
Cedar City, Utah 84721

140 DRAWING AND PLANS

The Drawing and plans in the Mining and Reclamation Plan are submitted consistent with the requirement of R645-301-140.

150 COMPLETENESS

Alton Coal Development, LLC represents that the information contained in the Coal Hollow Mining and Reclamation Plan permit application to be complete and correct.



LEGEND:

PERMIT AREA

PRIVATE COAL

COAL LINE BOUNDARY

COUNTY ROAD

DRAWN BY:	CHECKED BY:
N. BUTKOVICH	APC
DRAWING: 1-1	DATE: 8/16/04
	SCALE: 1" = 1000'
JOB NUMBER: 1400	SHEET

REVISIONS

DATE:	BY:
[illegible]	CRM
[illegible]	[illegible]N
[illegible]	[illegible]N
[illegible]	[illegible]N
[illegible]	[illegible]N
[illegible]	[illegible]N

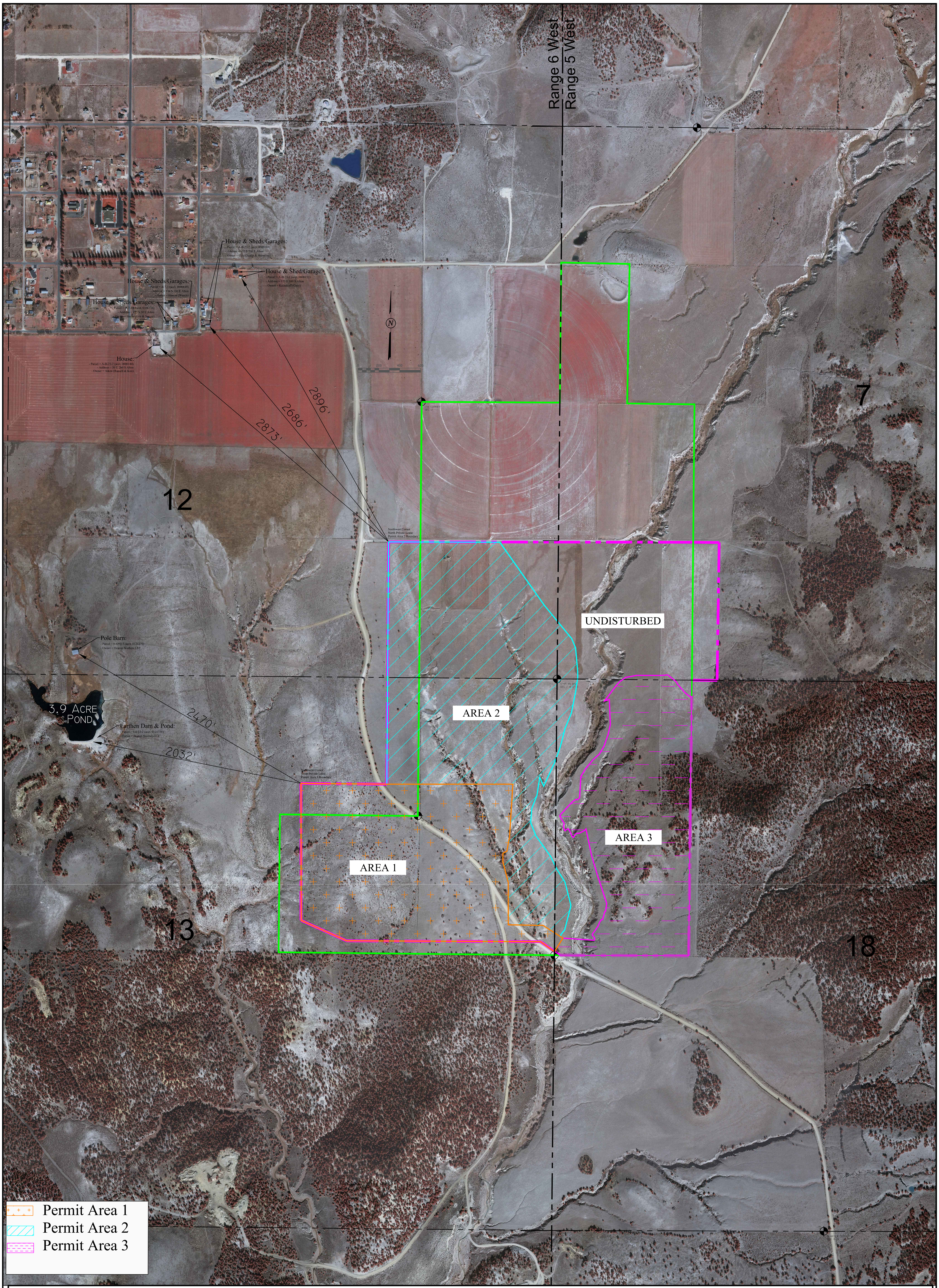
PERMIT AREA

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: [illegible]

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project



LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY: K. NICHOLES
CHECKED BY: DWG
DRAWING: 1-7
DATE: 12/10/15
SCALE: 1" = 400'
JOB NUMBER: 0001
SHEET

REVISIONS	
DATE:	BY:
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
11/23/16	AC
2/2/17	AC
5/4/17	AC

Permit Boundary and Nearest Alton Town Buildings

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 1-7

UTAH REGISTERED PROFESSIONAL ENGINEER
#154168
DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

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R645-301-200. SOILS

210. INTRODUCTION

211. Soil Removal

In this section, the Alton Coal Project will present a description of the pre-mining soil resources as specified under R645-301-221. Topsoil and subsoil to be saved under R645-301-232 will be separately removed and segregated from other materials.

212. Soil Redistribution

After removal, topsoil will be immediately redistributed in accordance with R645-301-242 and stockpiled pending redistribution under R645-301-234. For details refer to Section 5 of Appendix 2-1.

220. ENVIRONMENTAL DESCRIPTION

221. Prime Farmland Investigation

The Natural Resource Conservation Service conducted a prime farmland assessment in October 2006 and determined that "No Prime Farmland or Soils of Statewide Importance were found within the study area (Coal Hollow Mine area), per criteria outlined in the National Survey Handbook Part 622 and Exhibit UT603-1, respectively (C. Meier, 2006)." The assessment stated that the soils "..could classify as Soils of Statewide Importance, if irrigated.."

"An available and reliable source of moisture to sustain crops common to the area is the primary limiting factor that excludes the observed soils from classifying as Prime Farmland or SSI (C. Meier, 2006)."

"In addition to a lack of a reliable source of water, soils did not classify as Prime Farmland due to high pH, high electrical conductivity, excessive erosion potential on steep slopes and slow permeability (C. Meier, 2006)."

On January 28, 2014, the Natural Resource Conservation Service provided a prime farmland assessment for the Dame Lease IBC. It was determined that "About 80 acres of the area of interest meets the definition of "Statewide Important Farmland, if irrigated" . It is in map unit "1103- Sili-Sidshow- Gypsic Haplustepts complex, 2 to 15 percent slopes" .

A copy of the NRCS Prime Farmland Determination for both the 2006 (Coal Hollow Mine) and the 2014 (Dame Lease IBC) is included in Section 1 of Appendix 2-1.

The Natural Resource Conservation Service (NRCS) conducted a Prime Farmland assessment in December 2012 and determined that soil map unit 1111 is considered Prime Farmland, if irrigated." NRCS soil map unit 1111 is Naplene-Termote-Arboles Oxyaquic Ustifluvent complex, 2 to 8 percent slopes. The NRCS determined that there is "...approximately 292 of soil map unit 1111" which is irrigated and "...will be converted." The NRCS Prime Farmland assessment can be seen in Appendix A of Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil*

Survey for the North Private Lease Expansion of the Coal Hollow Mine (November 2014).

The NRCS Prime Farmland assessment is based on a broad Order 2 and Order 3, Soil Survey of Kane County, Utah.

An evaluation of potential Prime Farmland areas within the North Private Lease was conducted using field and lab data collected for the soil survey. The results found a difference between the soils mapped as part of the Kane County Area, Utah Soil Survey and those identified by the more intensive North Private Lease soil survey. The project specific evaluation of potential *Prime Farmland* map units was conducted using field and laboratory analysis data from the North Private Lease area and the criteria set forth in the *Code of Federal Regulations Title 7, Part 657.5 Identification of important farmlands*. The results of this evaluation can be seen in Section 4 of Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

The results of this evaluation found that there is approximately 121 acres of Prime Farmland soil map units that are irrigated and approximately 130 acres of Farmland of Statewide Importance within the North Private Lease soil survey area. This total area of 251 acres is equivalent to the sum of all land that is currently under irrigation or has the potential of being irrigated with existing water rights. Handling procedures of Prime Farmland soils found in Area 2 of the NPL can be found in MRP, Chapter 9, Section R302-316 through R302-317.

222. Soil Survey

An order 2 soils survey has been completed in 2007 at the Coal Hollow Project. Appendix 2-1 contains a report that provides the details for this survey. Utilizing existing soils data, the soil map units were extended to include the Dame Lease IBC. Appendix 2-3 contains a report that provides details for this survey. The survey area is on private lands leased by Alton Coal Development (ACD) and adjacent lands. These soil surveys were prepared so that ACD could: 1) identify suitable sources of subsoil and topsoil; 2) determine topsoil and subsoil salvage depths and quantities; and, 3) develop a post mining reclamation plan using salvaged soil materials. These soil surveys cover approximately 716 acres.

An Order 2 soil survey was completed in the North Private Lease area in 2014. This soil survey report can be found in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014). The survey is on private lands leased by Alton Coal Development (ACD) and adjacent lands. This soil survey was prepared so that ACD could: 1) identify suitable sources of subsoil and topsoil; 2) determine topsoil and subsoil salvage depths and quantities; and, 3) develop a post mining reclamation plan using salvaged soil materials. These soil surveys cover approximately 428 acres.

A soil survey update was completed for approximately 27.9 acres of undisturbed soils in the Pit 10 Borrow Area. This update is described Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*.

222.100. Soils Map

A map with soil map unit delineations is shown on Drawing 2-1.

A map with soil map unit delineations for the North Private Lease is shown on Soils Map 2 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

An updated soil map for the Pit 10 Borrow Area was produced based on the July 26 and 27, 2016 field evaluation and subsequent laboratory analysis. This updated soil map is shown as Figure 2-4.1 in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*.

222.200. Soil Identification

Soils in the Coal Hollow project soil survey area have been grouped into thirteen soil map units based on taxonomic classification, depth to parent material, and slope. The composition of these map units is described in table 2-1. Detailed descriptions of each soil map unit are included in Appendix 2-1. The soil survey map is Drawing 2-1.

Table 2-1. Soil map unit composition for the Coal Hollow project area.

Map Unit	**Pct**	**Soil Type[1]**	**Taxonomic Classification[2]**	**Modal Pedon[3]**
1		**A Family – Wapiti Family complex, 3 to 8 percent slopes**		
	65	A Family	fine, mixed, superactive, mesic Aridic Calciustept	1
	15	Wapiti Family	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	32
	10	D	fine, mixed, superactive, mesic Aridic Calciustoll	33
	5	Manzanst Family	fine, mixed, superactive, mesic Aridic Haplustalf	48
	5	N Family	fine, mixed, superactive, frigid Aquic Calciustoll	26
2		**M Family - Calendar Family – D Family complex, 3 to 8 percent slopes**		
	60	M Family	fine, mixed, superactive, mesic Aridic Calciustepts	3
	25	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	4
	15	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	2
3		**Cibeque Family – Wapiti Familiy complex, 3 to 8 percent slopes**		
	60	Cibeque Family	fine-loamy, mixed, superactive, mesic Aridic Calciustept	6
	30	Wapiti Family	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	31
	5	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
	5	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
4		**Jonale Family - Graystone Cobbly Substratum Family - Wapiti Family complex, 3 to 8 percent slopes**		
	50	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	17
	25	Graystone cobbly substratum Family	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	39
	15	Wapiti Family	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	19

Map Unit	Pct	Soil Type[1]	Taxonomic Classification[2]	Modal Pedon[3]
	5	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	
	5	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
5		**Calendar Family - M Family – Drififty Family complex, 8 to 25 percent slopes**		
	40	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	24
	30	M Family	fine, mixed, superactive, mesic Aridic Calciustept	25
	20	Drififty Family	loamy, mixed, superactive, calcareous, mesic Aridic Lithic Ustorthent	49
	10	Zigzag	Clayey, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthent	
6		**Graystone - Cookcan – Jonale Family complex, 1 to 5 percent slopes**		
	45	Graystone	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	15
	20	Cookcan	coarse-loamy, mixed, superactive, frigid Typic Calciaquoll	9B
	20	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	16
	15	I Family	fine-loamy, mixed, superactive, frigid Aquic Calciustept	14
7		**Happyhollow Family - Alamosa complex, 1 to 5 percent slopes**		
	55	Happyhollow Family	fine, mixed, superactive frigid Aeric Epiaquept	38
	20	Alamosa	fine-loamy, mixed, superactive, frigid Typic Argiaquoll	18A
	10	Jicarilla Family	fine, mixed, superactive, frigid Typic Argiaquoll	43
	10	Tetonview Family	fine-loamy, mixed, superactive frigid Aeric Calciaquoll	40
	3	Brumley	fine-loamy, mixed, superactive, mesic Calcidic Haplustalf	
	2	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	
8		**Brumley – Graystone - Snilloc complex, 3 to 8 percent slopes**		
	40	Brumley	fine-loamy, mixed, superactive, mesic Calcidic Haplustalf	22
	30	Graystone Cobbly Substratum Family	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	20
	20	Snilloc	coarse-loamy, mixed, superactive, mesic Aridic Calciustept	21
	10	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	
9		**D Family - Deacon complex, 5 to 30 percent slopes**		
	55	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	41
	30	Deacon	fine-loamy, mixed, superactive, mesic Aridic Haplustoll	42
	10	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
	5		Creek bottom	
10		**Zigzag clay, 8 to 25 percent slopes**		
	85	Zigzag	Clayey, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthent	50

Map Unit	Pct	Soil Type[1]	Taxonomic Classification[2]	Modal Pedon[3]
	10	Drififty Family	loamy, mixed, superactive, calcareous, mesic Aridic Lithic Ustorthent	
	5	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
11		**A family clay, 8 to 25 percent slopes**		
	85	A Family	fine, mixed, superactive, mesic Aridic Calciustept	28
	10	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
	5	Zigzag	Clayey, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthent	
12		**Manzanst Taxadjunct Family clay, 3 to 12 percent slopes**		
	85	Manzanst Family	very fine, mixed, superactive, mesic Aridic Haplustalf	48
	10	Manzanst Family Deep	very fine, mixed, superactive, mesic Aridic Haplustalf	60
	5	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
13		**A Family – Happyhollow Family complex, 1 to 5 percent slopes**		
	80	A Family	fine, mixed, superactive, mesic Aridic Calciustept	59
	15	Happyhollow Family	fine, mixed, superactive frigid Aeric Epiaquept	45
	5	I Family	fine-loamy, mixed, superactive, frigid Aquic Calciustept	52

Soils in the North Private Lease soil survey area were delineated with 12 soil map units and 1 miscellaneous land form. The composition of the soil map units is described in Table 6 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014). Detailed descriptions of the soil map units can be seen in Section Three in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

222.300 Soil Descriptions

Based on the order 2 soils survey that was completed on 2007, the following soil map unit descriptions and productivities apply. Additional information describing each soil map unit is contained in Appendix 2-1.

1 A Family – Wapiti Family complex, 3 to 8 percent slopes

General Description

Map unit 1 is dominated by clayey soils with very slow hydraulic conductivity rates of less than 0.04 inches per hour based on the silty clay soil texture (p. 91, Renard, 1997). The depth to Tropic shale is greater than 40 inches in the major soils (A and Wapiti soil families), but minor inclusions with Tropic shale from 20 to 40 inches deep occur. The map unit is dominated by big sagebrush and grasses.

This map unit occurs at the north end of the map unit where the Coal Hollow project proposes to build facilities and establish topsoil and subsoil stockpiles.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
65	A Family	fine, mixed, superactive, mesic Aridic Calciustept	1*
20	Wapiti Family	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	32
10	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	33
5	M	fine, mixed, superactive, mesic Aridic Haplustepts	26
* Lab analysis of typifying soil pedon for map unit.			

Map unit 1 description is continued on page 2-5.

Typifying Soil Pedon Descriptions

Soil colors are for dry soil unless specified otherwise.

The typifying soil pedon for A family soils in map unit 1 is soil pedon 1. The surface is a grayish brown clay loam 12 inches thick, dark grayish brown (moist). The subsoil (calcic) consists of light brownish gray silty clay, light olive brown (moist). Decomposing Tropic shale occurs at 42 inches below the surface.

The typifying soil pedon for the Wapiti family soils in map unit 1 is soil pedon 32. The mollic surface is a brown loam 8 inches thick, very dark grayish brown (moist). The subsurface (argillic) is a pale brown clay loam and silty clay, brown (moist). The subsoil (calcic) is pink loam to 6 feet, brown (moist). The underlying soil to nearly 12 feet is light yellowish brown silty clay over pink coarse sands with 10 percent faint strong brown mottles.

Supporting Soil Pedons

Soil family A is also represented by soil pits 27 and 30 in map unit A. Soil pit 27 does not have Tropic shale within 140 inches of the surface. Soil pit 30 has decomposing Tropic shale at 105 inches below the surface.

Laboratory Analysis

Analysis of soil samples from soil pit 1 had a poor soil pH (8.7) from 24 to 42 inches and fair lime percents (22.6 to 28.3 percent) throughout the soil profile. The silty clay texture at 24 inches is in the poor category for texture. SAR increases gradually with depth to 4.02 in the 24 to 42 inch horizon and then reaches 12.3 in the tropic shale below 42 inches.

Soil Inclusions

Small inclusions of D Family and N Family soils occur within map unit 1. D Family soils are similar to the A Family soils, but have a mollic epipedon (dark surface). The N family soils are very deep, similar to the D Family soil, but have aquic soil conditions below 20 inches and are located in concave depressions within map unit 1.

2 M Family – Calendar Family - D Family complex, 3 to 8 percent slopes

General Description

This map unit is dominated by soils with Tropic shale parent material at 20 to 72 inches below the surface. The map unit is dominated by big sagebrush and grasses with some pinyon pine and Utah juniper encroaching along edges of the map unit near map unit 5. This map unit is dominated by clayey soils with very slow hydraulic conductivity rates of less than 0.04 inches per hour based on the silty clay soil texture (p. 91, Renard, 1997).

This map unit occurs at the north end of the map unit where the Coal Hollow project proposes to build facilities. A second small delineation of map unit 2 occurs along the south boundary of the proposed year 1 mining area west of the county road.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
60	M Family	fine, mixed, superactive, mesic Aridic Calciustepts	3*
25	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	4*
15	D family	fine, mixed, superactive, mesic Aridic Calciustoll	2*

* Lab analysis of typifying soil pedon for map unit.

Typifying Soil Pedon Descriptions

The typifying soil pedon for M family soils in map unit 2 is soil pedon 3. The surface is a brown loam 4 inches thick, dark brown (moist). The subsurface (cambic) is a grayish brown clay loam and silty clay loam 15 inches thick, brown (moist). The underlying subsoil to 33 inches is light brownish gray silty clay, light olive brown (moist). Tropic shale parent material occurs at 33 inches below the surface.

The typifying soil pedon for Calendar family soils in map unit 2 is pedon 4. The surface is pale brown silty clay 4 inches thick, dark grayish brown (moist). The subsurface (cambic) is light brownish gray silty clay moderate to strong structure, dark grayish brown (moist) to 31 inches. Tropic shale parent material occurs at 31 inches.

The typifying soil pedon for D family soils in map unit 2 is pedon 2. The surface (mollic) is brown clay loam 12 inches thick, very dark grayish brown (moist). The subsurface (cambic and calcic) is pale brown silty clay and clay to 48 inches deep, brown (moist). The subsoil is white silty clay to 72 inches, brown (moist). Tropic shale parent material occurs at 72 inches below the surface.

Supporting Soil Pedons

Soil pedon 12 is representative of soil type M and is located in the delineation of map unit 2 along the south boundary of the year 1 mining area. The depth to Tropic shale in pedon 12 is 26 inches.

Laboratory Analysis

The main limiting feature of soils in map unit 2 is an increase of conductivity and SAR into the fair range as the soil depth reaches the interface with Tropic shale. The percent lime in the soil ranges from 18.6 to 27.5 above the Tropic shale. The saturation percentage increases with the percent clay, but remains in the fair range even with the clay and silty clay.

3 Cibeque Family - Wapiti Family complex, 3 to 8 percent slopes

General Description

Map unit 3 is characterized by very deep soils that show some indication of alluvial deposition most likely from the large alluvial fan that formed this portion of Sink Valley. Recent soil deposition from nearby Robinson Creek is indicated in pedon 6 by an increase of organic matter at 12 inches below the soil surface.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
60	Cibeque	fine-loamy, mixed, superactive, mesic Aridic Calciustept	6*
30	Wapiti	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	31
5	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
5	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for Cibeque family soils in map unit 3 is soil pedon 6. The surface is brown loamy sand 12 inches thick, dark yellowish brown (moist). The subsoil (calcic) is pale brown loam and sandy loam to 34 inches deep, brown (moist). The underlying soil to 60 inches is light grayish brown silty clay, brown (moist).

The typifying soil pedon for Wapiti family in map unit 3 is soil pedon 31. The surface (mollic) is dark grayish brown loam 7 inches thick, dark brown (moist). The subsurface (argillic) is light yellowish brown clay loam to 17 inches, dark yellowish brown (moist). The subsoil (lower argillic and calcic) is light brownish gray and brown clay loam and loam to 52 inches, grayish brown and brown (moist). The underlying soil to 110 inches is very pale brown sandy loam and loamy sand, brown and yellowish brown (moist).

Supporting Soil Pedons

Soil pedon 13 is representative of Cibeque family in map unit 3.

Laboratory Analysis

Soil pH increases to the fair category (8.3 to 8.5) at 6 inches below the surface in pedon 6. The soil pH is consistent with percent lime in fair category (18.4 to 29.2). The loamy sand surface has a fair water holding capacity. Organic matter has an irregular increase at 12 inches from 0.7 in the A2 horizon to 2.6 in the upper Bk horizon.

Soil Inclusions

Small inclusions of A and Calendar soil families occur in map unit 3. A family soils are similar to Cibeque soils, but have a higher percentage of clay in the control section (10 to 40 inches). Calendar soils are very deep but do not have either an argillic horizon (increase in illuvial clays) or a calcic horizon within 40 inches of the soil surface.

4 Jonale Family – Graystone cobbly substratum Family - Wapiti Family complex, 3 to 8 percent slopes

General Description

Map unit 4 is characterized by very deep fine-loamy and coarse-loamy soils with mollic epipedons and calcic horizons. Lime accumulations below 12 to 22 inches are common in these soils. Soil pH is strongly alkaline below 22 inches in some soils. Vegetation in this map unit is big sagebrush and grasses.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
50	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	17*
25	Graystone cobbly substratum family	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	39*
15	Wapiti Family	fine-loamy, mixed, superactive, mesic Calcidic Argiustoll	19*
5	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	7*
5	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for Jonale family in map unit 4 is soil pedon 17. The surface (mollic) is a brown clay loam 9 inches thick, dark brown (moist). The subsurface (cambic) is a pale brown clay loam to 18 inches, brown (moist). The lower subsurface (Bwk) to 45 inches is light yellowish brown loam and clay loam, dark yellowish brown (moist). The underlying subsoil (calcic) is very pale brown clay loam and silty clay to 80 inches, yellowish brown (moist).

The typifying soil pedon for Graystone cobbly substratum family in map unit 4 is soil pedon 39. The surface is brown clay loam 12 inches thick, dark brown (moist). The subsurface (calcic) is a very pale brown to light yellowish brown sandy loam to 36 inches deep, yellowish brown (moist) with 0 to 15 percent gravels and cobbles. The underlying subsoil is very pale brown very cobbly loamy sand to 75 inches, brown (moist).

The typifying soil pedon for Wapiti family in map unit 4 is soil pedon 19. The surface (mollic) is a grayish brown loam 6 inches thick, very dark grayish brown (moist). The subsurface (upper argillic) is a brown and pale brown clay loam to 24 inches deep, dark grayish brown and yellowish brown (moist). The lower subsurface (lower argillic and upper calcic, Btk) is a pale brown loam to 37 inches deep, brown (moist). The underlying subsoil (calcic) is a pale brown and light yellowish brown sandy loam to 90 inches deep, yellowish brown (moist).

Supporting Soil Pedons

Jonale family is represented by soil pedons 5, 8, 10, 18B, 23, 34, and 35. Soil family H is represented by soil pedons 11, 36, and 37.

Laboratory Analysis

Jonale soil family is characterized by soil pH in the poor range of 8.6 to 9.0 (Utah DOGM, 2005) at depths below 22 to 40 inches. This strongly alkaline soil pH corresponds to lime percentages of greater than 30 in this same portion of the soil profile.

Graystone cobbly substratum soil family is dominated by sandy loam and loamy sand textures with some clay loam. Lime accumulation occurs below 12 to 16 inches, but percentages are lower relative to the fine-loamy type C soils. Soil pH becomes strongly alkaline at depths of 48 inches in some pedons. There is 15 to 45 percent gravels and cobbles below 36 inches.

Wapiti soil family has fair levels of carbonates throughout the soil profile. Soil pH was measured as poor below 68” in soil pedon 19.

Soil Inclusions

Soil family D is represented by pedon 7 in map unit 4. There are also small inclusions of soil family A where map unit 4 borders map units 1 and 11.

5 Calendar Family - M Family – Drifity Family complex, 8 to 25 percent slopes

General Description

These soils are moderately deep (20 to 40 inches) to shallow (less than 20 inches to Tropic shale. The moderately deep soils have clayey textures, while the shallow soils are loamy. Vegetation is pinyon pine, Utah juniper, black sage and grasses.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
45	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	24*
30	M family	fine, mixed, superactive, mesic Aridic Calciustept	25*
20	Drififty Family	loamy, mixed, superactive, calcareous, mesic Aridic Lithic Ustorthent	49*
5	Zigzag	Clayey, mixed, superactive, calcareous, mesic, shallow Aridic Ustorthent	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for Calendar family in map unit 5 is soil pedon 24. The surface is olive brown clay 5 inches thick, dark grayish brown (moist). The subsurface (cambic) is dark grayish brown and olive clay with moderate to strong blocky structure to 32 inches. Tropic shale parent material is at 32 inches.

The typifying soil pedon for M family in map unit 5 is soil pedon 25. The surface is covered with a half inch of decomposing needles and twigs. The soil surface is light brown clay 5 inches thick, brown (moist). The subsurface (calcic) is brown and strong brown clay with lime accumulations, dark brown (moist). Tropic shale parent material is at 32 inches.

The typifying soil pedon for Drififty family in map unit 5 is soil pedon 49. The surface light yellowish brown silty clay loam 3 inches thick, light olive brown (moist). The subsoil is a light olive brown loam to 10 inches, olive brown (moist). Interbeded sandstone and Tropic shale are at 10 inches.

Laboratory Analysis

Calendar soil family is characterized by percent clay of 44 to 47 with correspondingly high saturation percentages of 73.6 to 91.2. Conductivity increases to 7.8 at 17 inches below the surface.
Soil type M is characterized by percent clay of 40 to 47 with correspondingly high saturation percentages of 58.5 to 80.6 in the upper 20 inches of the soil profile. The percent clay decreases to 33 percent below 20 inches. Lime percentage is greater than 30 in the 5 to 20 inch depth, but less than 5 above and below this zone.

Drififty soil family is characterized by pH of 8.1 to 8.4, lime percentage of 18, and SAR of less than 0.1.

Soil Inclusions

There are some inclusions of Zigzag soils that are shallow (less than 20 inches) to Tropic shale. Zigzag soils are clayey.

6 Graystone – Cookcan – Jonale Family complex, 1 to 5 percent slopes

General Description

These medium to coarse textured soils are very deep. Wet soil conditions are present at varying depths in all of the map unit soils. The depth to wet soil conditions varies from 14 to 58 inches. This map unit is not a good source of subsoil. It is estimated that these soils are slower to warm up in the spring due to the wet soil conditions. Vegetation is grasses, sedges, and forbs.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
45	Graystone	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	15*
20	Cookcan	coarse-loamy, mixed, superactive, frigid Typic Calciaquoll	9B*
20	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	16*
15	I Family	fine-loamy, mixed, superactive, frigid Aquic Calciustept	14*
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for Graystone soils in map unit 6 is soil pedon 15. There is a dense root mat 1 inch thick on the surface. The surface is brown sandy loam 8 inches thick, dark brown (moist). The subsurface (cambic) is pale brown loam with moderate structure, dark yellowish brown (moist) to 20 inches. The subsoil (calcic) is very pale brown loam to 58 inches deep, yellowish brown (moist). The underlying soil is yellow and brownish yellow sandy loam with common prominent mottles to 96 inches, yellowish brown (moist).

The typifying soil pedon for Cookcan soils in map unit 6 is soil pedon 9B. The surface is dark grayish brown loam 6 inches thick, very dark grayish brown (moist). The lower surface is grayish brown sandy clay loam to 14 inches with few faint mottles, dark grayish brown (moist). The subsurface is light brownish gray sandy loam with common prominent mottles, dark gray (moist). The subsoil is light gray sandy loam with many prominent mottles, grayish brown (moist). The soil was wet below 48 inches.

The typifying soil pedon for Jonale soil family in map unit 6 is soil pedon 16. There is a dense root mat 1 ½ inch thick on the surface. The surface is dark grayish brown silty clay loam 8 inches thick, very dark grayish brown (moist). The subsurface (cambic) is pale brown silty clay to 18 inches, strong brown (moist). The subsoil is pink clay loam to 36 inches, brown (moist). The lower subsoil is pink silty clay loam and loam with few faint strong brown mottles to 68 inches, brown (moist). The underlying soil is light brownish gray clay loam with common prominent yellowish red mottles, grayish brown (moist).

Supporting Soil Pedons

Soil pedon 9A is similar to Graystone soils, but it has carbonates throughout the soil profile without any zone of accumulation.

Laboratory Analysis

Strongly alkaline soil pH (8.6 to 9.0) within 12 to 20 inches of the soil surface is the main limiting feature of the soils in map unit 6. Soil pedon 9A has very strongly alkaline pH (greater than 9.0) below 12 inches of the surface.

Lime percentage exceeds 30 in 3 of 5 pedons within 12 to 20 inches of the surface. Lime percentage ranges from 15 to 26 in the other two pedons from the surface to 48 inches.

Soil Inclusions

Soil pedon 14 is representative of I family soils within map unit 6 that do not have a mollic epipedon (dark surface) and have aquic (wet) soil conditions within 30 inches of the surface. These soils have a calcic horizon.

7 Happyhollow Family – Alamosa complex, 1 to 5 percent slopes

General Description

This soil map unit is located on a Tropic shale structural bench on the east side of the Sink Valley fault. Soils are characterized by clay and a high water table that is perched on top of the heavy clay soils. The high water table is at or within a foot of the soil surface during the wet period of the year. It is estimated that these soils are slower to warm up in the spring due to the wet soil conditions. Vegetation is sedges and forbs.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
55	Happyhollow Family	fine, mixed, superactive frigid Aeric Epiaquept	38*
20	Alamosa	fine-loamy, mixed, superactive, frigid Typic Argiaquoll	18A*
10	Jicarilla Family	fine, mixed, superactive, frigid Typic Argiaquoll	43
10	Tetonview Family	fine-loamy, mixed, superactive frigid Aeric Calciaquoll	40*
3	Brumley	fine-loamy, mixed, superactive, mesic Calcidic Haplustalf	
2	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for Happyhollow family soils in map unit 7 is soil pedon 38. The surface is dark grayish brown (moist) silty clay 6 inches thick. The subsurface is a yellowish brown (moist) silty clay 6 inches thick. The calcic horizon begins at 12 inches below the surface and is a light yellowish brown (moist) to very pale brown (moist) silty clay. The calcic horizon continues to 48 inches or deeper. The water table was at 29 inches when the pit was described in March 2007. Mottles and gleyed soil were observed below 12 inches. Vegetation is grasses, sedges, widely scattered Wyoming big sagebrush, and wild rose.

The typifying soil pedon for Alamosa soils in map unit 7 is soil pedon 18A. The mollic surface is a very dark grayish brown (moist) loam to 7 inches. The cambic horizon is a brown (moist) loam to 15 inches deep. The calcic horizon is a light olive brown (moist) sandy loam to 30 inches. The underlying soil is grayish brown (moist) clay loam and sandy clay loam to 60 inches deep. Mottles were observed below 7 inches. The water table was at 51 inches when the described in September 2006.

Supporting Soil Pedons

Happyhollow family soil type was observed in pedon 45 within map unit 7 and a similar clayey soil in pedon 44. The Alamoss soil was also observed in pit 46.

Laboratory Analysis

The Happyhollow family soil is characterized by silty clay from the surface down to 24 inches or greater. Soil pH is 8.3 to 8.5 in the 12 to 24” horizon. Saturation percentage ranges from 69.9 to 81.8 in the upper 24 inches. The calcium carbonate equivalent ranges from 17.8 to 28.3 in the upper 20 inches and then increases to 44.5 below 20 inches. This soil pit was not sampled below 24 inches, because of the high water table.

Alamosa soil is characterized by medium textured soils (loam, clay loam, and sandy clay loam) in the upper 60 inches. The calcium carbonate equivalent ranges increases from 20.2 percent in the upper 7 inches to 29.3 percent in the 30 to 45 inch horizon.

Soil Inclusions

A soil similar to Alamosa soils, but with more clay in the control section is in localized areas. Soil mottles were observed and water was flowing into pit 43 when it was described in April 2007. The water table appeared to be perched on top of the underlying clay horizon at 54 inches.

Tetonview family soils were identified in soil pit 40. Mottles were observed below 6 inches and a water table at 23 inches when the pit was described in March 2007. This soil has a dark surface (mollic) and a calcic horizon.

Dry soil profiles occur on small isolated mounds within map unit 7. These non-hydric soils include Brumley and Jonale family soils. Both are very deep soils with a calcic horizon. Jonale family soils have a dark surface (mollic).

8 Brumley – Graystone Cobbly - Snilloc complex, 3 to 8 percent slopes

General Description

These soils developed in very deep alluvium on the east side of the Coal Hollow project area. They are medium to coarse textured. Evidence of a fluctuating water table was observed in most soils below 48 to 60 inches, depending on location and physiographic setting. This map unit would be a good source of cover material, but most of the planned disturbance in this area will be limited to cover soil stockpiles.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
40	Brumley	fine-loamy, mixed, superactive, mesic Calcidic Haplustalf	22*
30	Graystone	coarse-loamy, mixed, superactive, mesic Aridic Calciustoll	20*
20	Snilloc	coarse-loamy, mixed, superactive, mesic Aridic Calciustept	21*
10	Jonale Family	fine-loamy, mixed, superactive, mesic Aridic Calciustoll	

* Lab analysis of typifying soil pedon for map unit.

Typifying Soil Pedon Descriptions

Colors are for dry soil unless otherwise noted.

The typifying soil pedon for the Brumley soils in map unit 8 is soil pedon 22. The surface is pale brown sandy loam to 6 inches. The argillic and upper calcic horizon is a light yellowish brown silty clay loam and sandy clay loam to 28 inches. The underlying soil is very pale brown sandy loam to 84 inches. Mottles increase significantly below 48 inches indicating that there is fluctuating water table during wet years. This soil supports Gamble oak, snowberry, grasses, and forbs.

The typifying soil pedon for the Graystone soil in map unit 8 is soil pedon 20. The surface is brown loam to 6 inches. The cambic horizon is light yellowish brown clay loam to 13 inches. The calcic horizon is very pale brown to light yellowish brown sandy loam and loamy sand to 54 inches. The underlying soil is a light yellowish brown loam to

72 inches and loamy sand to 96 inches. This soil supports Pinyon pine, Utah Juniper, Gamble oak, and snowberry.

The typifying soil pedon for Snilloc soils in map unit 8 is soil pedon 21. The surface is a light yellowish brown sandy clay loam to 8 inches. The calcic horizon is a pale brown sandy clay loam to 18 inches. The underlying soil is a pale brown strongly alkaline sandy loam to 96 inches. This soil was described in an opening of Wyoming big sagebrush within a larger area of Gamble oak.

Supporting Soil Pedons

A moist phase of the Brumley soil was observed in pit 47 in big sagebrush in map unit 8. A few faint mottles were observed below 24 inches. The amount of soil mottling increased significantly below 44 inches. This soil is on a low mound surrounded on three sides by wet soils in map unit 7. A water table was not observed when the pit was described in April 2007, but the mottles indicate that it is common for the water to rise within 44 inches of the surface in most years, and 24 inches in wet year.

Laboratory Analysis

The Brumley soil has calcium carbonate equivalents ranging from 17.5 to 23.8 percent.

The Graystone soil has a low saturation percentage in the 13 to 28 inch horizon (calcic). Calcium carbonate equivalents range from 16.5 to 25.4 percent. Available water capacity is 0.08 in layers of loamy sands below 28 inches.

The Snilloc family soil is characterized by strongly alkaline soil pH (8.7) below 36 inches. Calcium carbonate equivalents range from 16.8 to 29.8 percent.

Soil Inclusions

The Jonale family soils occur within this map unit. These soils are similar to Brumley soils, but have a dark surface (mollic).

9 D Family - Deacon complex, 5 to 30 percent slopes

General Description

These clayey soils are very deep and dominated by clayey textures. They have a dark surface (mollic epipedon). The D family soil has an increase in lime at 6 to 12 inches below the surface, while the Deacon soil has similar levels of lime throughout the soil profile. Soils in this map unit appear to have developed from the large alluvial fan that covers most of Sink Valley. The map unit is delineated along Robinson Creek and in an area south of the creek that could be the remnants of a historic channel. Vegetation is dominantly big sagebrush, rabbitbrush, and grasses with pinyon pine and Utah juniper encroaching from adjacent areas.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
55	D Family	fine, mixed, superactive, mesic Aridic Calciustoll	41*
30	Deacon	fine-loamy, mixed, superactive, mesic Aridic Haplustoll	42*
10	A Family	fine, mixed, superactive, mesic Aridic Calciustept	
5		Creek bottom	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for the D family soil in map unit 9 is soil pedon 41. The surface is brown sandy clay loam to 6 inches, dark brown (moist). The lower surface is brown clay to 12 inches, dark brown (moist). The subsurface (cambic) is pale brown silty clay to 36 inches, brown (moist). The subsoil (calcic) is very pale brown silty clay loam and sandy loam to 80 inches, yellowish brown (moist).

The typifying soil pedon for Deacon soils in map unit 9 is soil pedon 42. The surface is brown loam 9 inches thick, very dark grayish brown (moist). The subsurface (cambic) is pale brown silty clay to 24 inches, brown (moist). The upper subsoil (lower cambic) is pale brown sandy clay loam to 36 inches, brown (moist). The lower subsoil is light yellowish brown loam to 48 inches, yellowish brown (moist).

Supporting Soil Pedons

Soil pedon 29 is representative of the D family soil in map unit 9.

Laboratory Analysis

Poor soil pH at depth and clayey horizons characterize soils in map unit 9. Soil pH is poor below 64 inches in the D family soil (pit 41) and below 36 inches in the Deacon soil. Horizons of silty clay and clay occur in the D family soil (pit 41) between 6 and 36 inches. The clayey horizon in the Deacon soil is between 9 and 24 inches.

Soil Inclusions

The channel area of Robinson Creek comprises a small portion of this map unit. The creek bottom is not vegetated.

10 Zigzag clay, 8 to 25 percent slopes

General Description

These clayey soils are shallow to Tropic shale and formed along the Sink Valley escarpment. Vegetation is pinyon pine, Utah juniper, black sage, and Indian ricegrass.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
85	Zigzag	clayey, mixed, superactive, nonacid, mesic, shallow Aridic Ustorthent	50*
10	Drififty Family	loamy, mixed, superactive, nonacid, mesic Aridic Lithic Ustorthent	
5	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Description

The typifying soil pedon for the Zigzag soil in map unit 10 is soil pedon 50. The surface is light brownish gray clay to 4 inches, dark grayish brown (moist). The subsurface is light brownish gray clay to 19 inches, dark grayish brown and olive brown (moist). Tropic shale is at 19 inches.

Laboratory Analysis

Clayey soil texture is the main limiting feature to the Zigzag soil in map unit 10. Lime percentage is between 18 and 19 throughout the soil profile. SAR is less than 1. Soil pH is in the good to fair range (8.1 to 8.4).

Soil Inclusions

The Drififty family soil occurs along ridges where the Tropic shale is interbeded with sandstone. These soils are loamy and less than 20 inches deep.
Calendar family soil occur in concave toeslope areas. These soils are clayey and moderately deep (20 to 40 inches) to Tropic shale.

11 A Family clay, 8 to 25 percent slopes

General Description

These soils are very deep and are on the footslope and backslope of the Sink Valley fault escarpment. Vegetation is grasses, rabbitbrush, and big sagebrush.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
85	A Family	fine, mixed, superactive, mesic Aridic Calciustept	28*
10	Calendar Family	fine, mixed, superactive, mesic Aridic Haplustepts	
5	Zigzag	Clayey, mixed, superactive, nonacid, mesic, shallow Aridic Ustorthent	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Description

The typifying soil pedon for the A family soil in map unit 11 is soil pedon 28. The surface is grayish brown clay to 8 inches, dark grayish brown (moist). The subsurface (cambic) is gray clay with moderate blocky structure to 24 inches, grayish brown (moist). The upper subsoil (calcic, Bwk) is gray clay with common fine soft calcium carbonate masses to 48 inches, grayish brown (moist). The lower subsoil (calcic, Bk) is light grayish brown clay with common fine and medium soft calcium carbonate masses to 102 inches, grayish brown (moist).

Laboratory Analysis

Clay texture is the primary limiting feature with the A family soil in map unit 11. SAR and conductivity increase significantly in the 24 to 48 inch horizon, but both are still within the fair range (Utah DOGM, 2005). Lime percentage ranges from 17 to 19. Samples were not available for analysis for the 48 to 102 inch zone.

Soil Inclusions

Inclusions of the Calendar family soil occur along shoulders of hills and ridges. These soils are clayey and moderately deep (20 to 40 inches) to Tropic shale.

Small inclusions of the Zigzag soil occur on the summits of ridges and hills. These soils are clayey and shallow (less than 20 inches) to Tropic shale.

12 Manzanst Taxadjunct Family clay, 3 to 12 percent slopes

General Description

These clayey soils are deep to very deep to Tropic shale and formed on gently sloping to moderately steep slopes along the west side of Sink Valley. Vegetation is pinyon pine, Utah juniper, black sage, and Indian ricegrass. The very deep phase is on the backslopes and footslopes. The deep phase (40 to 60 inches to Tropic shale) of Manzanst family soil occurs on the shoulders of the hill sideslopes.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
85	Manzanst taxadjunct, very deep phase	very fine, mixed, superactive, nonacid, mesic, Aridic Ustorthent	48*
10	Manzanst taxadjunct, deep phase	very fine, mixed, superactive, nonacid, mesic, Aridic Ustorthent	60
5	A Family	fine, mixed, superactive, mesic Aridic Calciustepts	
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Description

The typifying soil pedon for the Manzanst taxadjunct soil in map unit 10 is soil pedon 48. The surface is grayish brown clay (moist) 3 inches, very dark grayish brown (moist). The subsurface is light brownish gray clay to 30 inches, dark grayish brown (moist). The substratum is light brownish gray clay with 3 to 10 percent very fine and fine calcium carbonate masses to 84 inches, dark grayish brown (moist).

The typifying pedon for the Manzanst taxadjunct deep phase is pedon 60. It is similar to pedon 48. Tropic shale is at 48 inches.

Laboratory Analysis

Clayey soil texture and SAR are the main limiting features of the Manzanst soil family in map unit 12. The SAR ranges from 10.80 to 12.70 below 12 inches.

Soil Inclusions

The A family soil occurs on the toeslopes and in swales where alluvium has accumulated. These soils are clayey and very deep (greater than 60 inches). They have an accumulation of carbonates in the subsoil.

13 A Family – Happyhollow Family complex, 1 to 5 percent slopes

General Description

These clayey soils are very deep to Tropic shale and formed on nearly level to gently sloping slopes in the south central portion of Sink Valley. Vegetation is grasses. The very deep phase is on the backslopes and footslopes. The deep phase (40 to 60 inches to Tropic shale) of Manzanst family soil occurs on the shoulders of the hill sideslopes.

Taxonomic Soil Classifications

Percent of Map Unit	Soil Series Family	Taxonomic Family	Typifying Soil Pedon
80	A Family	fine, mixed, superactive, mesic Aridic Calciustepts	59
15	Happyhollow Family	fine, mixed, superactive frigid Aeric Epiaquept	45
5	I Family	fine-loamy, mixed, superactive, frigid Aquic Calciustept	52
* Lab analysis of typifying soil pedon for map unit.			

Typifying Soil Pedon Descriptions

The typifying soil pedon for the A family soil in map unit 13 is soil pedon 59. The surface is light yellowish brown clay loam to 10 inches, dark grayish brown (moist). The subsurface is light yellowish brown and very pale brown clay loam to 45 inches, yellowish brown and pale brown (moist). The substratum is very pale brown and pale yellow sandy clay loam to 76 inches. Reddish yellow medium and coarse mottles were observed below 62 inches.

The typifying soil pedon for the Happyhollow family soil is soil pedon 45. The surface is light brownish gray loam to 12 inches, dark grayish brown (moist). The subsurface is light gray and very pale brown sandy clay loam to 48 inches, gray and light yellowish brown (moist). The substratum is very pale brown sandy clay loam to 84 inches, light yellowish brown (moist). The lower substratum is light gray silty clay to 100 inches, gray (moist). Yellow and brownish yellow medium and coarse mottles were observed below 5 inches.

Laboratory Analysis

Field conductivity (ECe) measurements for soil pit 59 ranged from 0.39 to 1.30 mmhos/cm.

Lab analysis of soil pit 28 is representative of the A family soil in map unit 13. Clay texture is the primary limiting feature with the A family soil in map unit 13. SAR and conductivity increase significantly in the 24 to 48 inch horizon (pedon 28), but both are still within the fair range (Utah DOGM, 2005). Lime percentage ranges from 17 to 19. Samples were not available for analysis for the 48 to 102 inch zone.

Soil Inclusions

The I family soils are similar to the A family soil, but they have aquic conditions below 20 inches. Reddish yellow fine mottles were observed in soil pedon 52 below 24 inches.

Soil map unit descriptions for the North Private Lease soil survey area are in Section Three in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

Soils in the Pit 10 Borrow were examined on July 26 and 27, 2016. Soil mapping in the southwest portion of the area was updated based on additional soil descriptions and laboratory analysis. The results of this field examination and laboratory analysis are described in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in* *the Pit 10 Borrow Area*.

222.400 Present and Potential Productivity of Existing Soils

Soils in the Coal Hollow project area support big sagebrush, grasses (native and introduced species), pinyon pine, Utah juniper, and Gambel oak. Detailed descriptions of the present and potential productivity of the soils are detailed in Chapter 3, Section 321.200.

Soils in the northern portion of the North Private Lease area are in agricultural production of alfalfa and small grains, while soils in the southern portion support big sagebrush, rabbitbrush, grasses (native and introduced species), pinyon pine, Utah juniper, Russian olive, and Gambel oak. Detailed descriptions of the present and potential productivity are detailed in Chapter 3, Section 321.200.

223. Soil Characterization

This soil survey was made in accordance with the guidelines for an order 2 soil survey as detailed in the Soil Survey manual (USDA 1993). Soils were classified using the Keys to Soil Taxonomy, Ninth Edition (USDA 2003). Soils for the New Dame Lease IBC were classified using the Keys to Soil Taxonomy, Eleventh Edition (NRCS 2010). Representative soil samples were submitted for laboratory analysis of the parameters outlined by the Utah Division of Oil Gas and Mining's *Guidelines for Management of Topsoil and Overburden* (2005).

The North Private Lease soil survey was made in accordance with the guideline for an order 2 soil survey as detailed in the Soil Survey manual (USDA NRCS 1993). Soils were classified using the Keys to Soil Taxonomy, Twelfth Edition (USDA NRCS 2014d). Representative soil samples were submitted for laboratory analysis of the parameters outlined by the Utah Division of Oil Gas and Mining's *Guidelines for Management of Topsoil and Overburden* (2005).

The Pit10 Borrow Area soil survey update was made in accordance with the guidelines for an order 2 soil survey as detailed in the Soil Survey manual (USDA NRCS 1993). Soils were classified using the Keys to Soil Taxonomy, Twelfth Edition (USDA NRCS 2014d). Representative soil samples were submitted for laboratory analysis of the parameters outlined by the Utah Division of Oil Gas and Mining's *Guidelines for Management of Topsoil and Overburden* (2008).

224. Substitute Topsoil

Based on the 2006-2007 order 2 soil survey, sufficient quantities of suitable topsoil and subsoil are available for reclamation within the project area. The Coal Hollow Project does not plan to use substitute material for topsoil at the time of reclamation. However, if in the future the Coal Hollow mine plan proposes to use selected overburden materials as a supplement or substitute for topsoil, an application will be provided to the DOGM that includes results of analyses, trials, and tests as described under R645-301-232.100 through R645-301-232.600, R645-301-234, R645-301-242, and R645-301-243. DOGM may also require the results of field-site trials or greenhouse tests as required under R645-301-233.

Based on the 2014 order 2 soil survey for the North Private Lease, sufficient quantities of suitable topsoil and subsoil are available for reclamation within the project area. The Coal Hollow mine does not plan to use substitute material for topsoil at the time of reclamation of North Private Lease expansion. However, if in the future the Coal Hollow mine plan proposes to use selected overburden materials as a supplement or substitute for topsoil, an application will be provided to the DOGM that includes results of analyses, trials, and tests as described under R645-301-232.100 through R645-301-232.600, R645-301-234, R645-301-242, and R645-301-243. DOGM may also require the results of field-site trials or greenhouse tests as required under R645-301-233.

A source of substitute subsoil was evaluated as part of the Pit 10 Borrow Area field evaluation on July 26, 2016 and subsequent laboratory analysis. This source of substitute subsoil is located on the interim reclamation slope at the top of the pit 10 highwall. The results of this evaluation and analysis are described in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*. There are no plans to use this material as substitute subsoil at this time due to Poor soil pH in some areas, but will remain a source of substitute subsoil until Pit 10 is reclaimed. Additional sampling and analysis will be conducted prior to moving forward with any plans to use the material as substitute subsoil.

230. Operation Plan

231. General Requirements

231.100. Methods for Removing and Storing Subsoil and Topsoil

The methods for removing and storing topsoil, subsoil, and other materials will be to first remove the woody plants from the area and place them in piles for later placement in pit backfills. Next, dozers or scrapers will remove the topsoil layer to a depth determined by the soil survey. The topsoil will be stockpiled and protected from wind and water erosion. Stockpiles that will be in place for less than 1 year will be planted with "Quick Guard" at the recommended rate of 10 lbs. /acre~~coated with a tackifier at the manufacturer's suggested rate for dust control applications~~. Those stockpiles that will be in place for at least one year will be seeded and covered with mulch during the appropriate season. Side slopes of stockpiles will be sloped to 3h:1v: The suitable subsoil will then be removed and stockpiled separately from the topsoil. The depth of topsoil and subsoil salvage will be determined by the aforementioned soil survey and in the field during mining by the Coal Hollow environmental technician in consultation with a certified professional soil scientist. Quality control of topsoil salvage depth will be accomplished by leaving pedestals (small islands of topsoil left to verify soil removal depth). Stockpiling of topsoil and subsoil will only occur when direct placement (or live hauling) is not operationally practical. Drawing 2-2 shows planned topsoil stockpiles and topsoil removal plans. Drawing 2-4 shows planned topsoil stockpiles and topsoil removal plans in the North Private Lease.

For the North Private Lease prior to mining Pit 1 the following steps will be followed:

1. The A horizon (topsoil) will be salvaged along with B horizon (subsoil) to a depth of 14 inches (1.2 feet) from all active mining areas (pits, ponds, roadways, haul roads, storage and repair yards, etc.). The only exception is that topsoil can remain under topsoil storage piles.

2. For the area inside the excavation perimeter of Pit 1, Pond 5 and Pond 6, the remaining subsoil (the B & C horizon above lithic contact, approximately 2.6 feet) will also be removed and stockpiled in a subsoil stockpile. This means that roadways and the subsoil and spoil piles depicted in Drawing 2-4 will be placed on top of native subsoil. This native subsoil will be protected in place beneath the spoil stockpile by using a marker fence to delineate the subsoil surface on 100 ft. centers and by using a gps survey grid of the topography of the subsoil surface layer. The native subsoil will be protected in place on any roadway receiving surface treatment (ie. Gravel, additional fill) by placing marker fence along the roadway centerline. The native subsoil will then be recovered as part of the subsequent mining sequence and placed directly over regraded backfill to the cover depth required in section 232.

4. A soil scientist will monitor the topsoil and subsoil removal and placement of geo-marker.

5.A surveyor will map the surface elevation of the subsoil being protected in place.

Area 1 expanded increases Area 1 by 17.89 acres, all topsoil and subsoil will be salvaged and stockpiled as mining of Pits 7, 8 and 9 progress. Stockpile locations are shown and volumes tabulated for on Drawing 2-4. These stockpiles will remain and be utilized for final reclamation of the last pits mined.

As with the Coal Hollow Mine, topsoil and subsoil will be removed with dozers and/or scrapers to a depth determined by the soil scientist.

Topsoil and subsoil in Pit B1 will be removed with dozers and/or scrapers to a depth determined by the soil scientist.

231.200. Suitable Substitute Topsoil

The use of substitute topsoil is not planned for the Coal Hollow based on the 2007 soil survey information. Demonstration studies of the suitability of topsoil substitutes or supplements will be submitted to the DOGM if the use of topsoil substitutes becomes necessary for future reclamation and revegetation.

Subsoil will be used as interim reclamation cover for the Pit 10 Borrow Area. Organic mulches will be incorporated to improve fertility and soil quality, as detailed in R645-301-244.200. This improved subsoil will be salvaged and stockpiled as cultivated topsoil at the end of the interim reclamation phase of the Pit 10 Borrow Area project. Cultivated topsoil will be used as topsoil during reclamation of the Pit 10 Borrow Area. This operation is described in more detail in

Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*. Salvage and stockpiling of the cultivated topsoil will be monitored by a Certified Professional Soil Scientist.

The use of substitute topsoil is not planned for the North Private Lease based on the 2014 soil survey information. Demonstration studies of the suitability of topsoil substitutes or supplements will be submitted to the DOGM if the use of topsoil substitutes becomes necessary for future reclamation and revegetation.

231.300. Soil Testing for Reclamation

The final seedbed of the reclaimed areas will be prepared by first replacing the subsoil and topsoil in the same order it existed prior to removal by the mining activities. Next, a basic topsoil (top 8 inches of reclamation profile) sampling regime will be implemented prior to seeding that should identify fertility problems and will provide a basis for determining necessary soil amendments. The parameters analyzed will be:

Available phosphorus (P)
Soluble Potassium (K)
Nitrate-Nitrogen

One composite sample will be collected from approximately every 2 to 5 acres based on soil types and variability. Each composite will be comprised of at least 4 sub-samples.

Pre-testing of the soils has been conducted as part of the soils survey. Results from the pre-testing of topsoil and subsoil can be viewed in Table C-1 of Appendix 2-1 (native topsoil and subsoil) and Table C-2 (samples from core hole/overburden pits) of Appendix 2-1.

Pre-testing of the soils has been conducted as part of the North Private Lease soils survey. Results from the pre-testing of topsoil and subsoil can be viewed in Appendix C of Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

Pre-testing of soils in the Pit 10 Borrow Area as part of the Order 2 Soil Survey of the Coal Hollow Mine Disturbance (2009) and as part of the July 26 and 27, 2016 evaluation of the Pit 10 Borrow Area as described in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*.

Additional sampling and testing of the subsoil used for interim reclamation will be done prior to its salvage as cultivated topsoil at the end of the interim reclamation phase. Samples will be collected on the basis of approximately one sample per 2.5 acres. Sampling depth will be to 4 feet. This testing will include all parameters listed in Tables 3 and 7 in *Guidelines for Management of Topsoil and Overburden* (DOGM January 2008). Suitability will be evaluated based on the laboratory analysis and parameter limits listed in Tables 4 and 8 in *Guidelines for Management of Topsoil and Overburden*

(DOGM January 2008).

Soil pH will be monitored in all subsoil salvaged below 58 inches (147 cm or 4.8 feet) in map unit G. Subsoil with pH greater than 8.8 will not be salvaged, stockpiled, or used for subsoil in the reclamation soil profile. Placement of subsoil within a pH range of 8.6 to 8.8 will be only be placed in the bottom foot (3 to 4 foot depth) of the reclamation soil profile.

231.400. Topsoil Handling

The topsoil will be removed from the mine area and either live hauled to a reclamation area or stored separately. All soil stockpiles piles will be seeded with an appropriate interim seed mix to prevent loss and deterioration by wind and water erosion. Soil stockpiles will have side slopes graded to a maximum 3h:1v. Piles will be bermed or otherwise treated to prevent the transport of sediments away from the pile. Details about soil horizons and zones planned for use as subsoil are detailed in Appendix 2-1. A detailed map showing stockpile designs/locations and soil removal are shown on Drawing 2-2.

Details about soils horizons and zones planned for use as subsoil in the North Private lease are shown on Drawing 2-4 and detailed in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

232. Topsoil and Subsoil Removal

232.100. Separate Layers
All soil materials will be removed in separate layers from the area to be disturbed, and segregated.
Based on soil map units, average depths have been estimated and will be used as a guide and monitored in the field. Refer to Table 4-2 in Appendix 2-1. Soil will be salvaged and directly placed or stockpiled as either topsoil or subsoil.

Based on soil map unit, average depths have been estimated and will be used as a guide and monitored in the field. Quality control of topsoil salvage depth will be accomplished by leaving pedestals (small islands of topsoil left to verify soil removal depth). Refer to Tables 13 and 14 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

The estimated topsoil, subsoil, and substitute subsoil salvage and replacement depths for each mine area are shown in the following table.

Mining Area	Average Estimated	Average Estimated	Salvage of Upper	Reclamation Soil Profile	Notes

	Topsoil Salvage	Subsoil Salvage	Shale	Depth	
	inches	inches	inches	inches	
1	18	26	0	44	a
1extended	13	33	0	46	a
2	11	37	0	48	b
3	12	37	0	49	c

a. Salvage topsoil; salvage subsoil to depth of Tropic shale; follow sampling protocol for substitute subsoil in Section R645-301-232.720 for reclamation profile.
b. Salvage topsoil; salvage subsoil to 48 inches deep.
c. Salvage topsoil; salvage subsoil to 96 inches deep or bedrock.

Estimated topsoil and subsoil salvage depths were developed for the pit 10 Borrow Area and are detailed in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*. Estimated depths of topsoil and subsoil available for salvage by soil map unit and area are detailed in Table 2-4.12. Soil will be salvaged and directly placed or stockpiled as either topsoil or subsoil.

The following table details the estimated topsoil and subsoil salvage depths by map unit in Area 1 Expanded. These salvage estimates were updated based on additional soil profile evaluations done in Area 1 during March 2016 (Appendix 2-5). The subsoil salvage depth was increased to 4.8 feet in order to provide adequate subsoil for a total reclamation soil profile depth of 48 inches.

Estimated topsoil and subsoil salvage depths by soil map unit in *Area 1 Expanded*.

Map Unit	Estimated Topsoil Salvage Depth[1]	Estimated Subsoil Salvage Depth2	Map Unit Area[3]	Estimated Topsoil Salvage Volume	Estimated Subsoil Salvage Volume
	inches	inches	acres	cubic yards	cubic yards
A1	11	36	10.98	16,238	53,143
A2	11	36	30.46	45,047	147,426
A3	11	36	17.96	26,561	86,926
D	14	31	0.02	38	83
E	13	35	0.46	804	2,165
F	19	29	1.21	3,091	4,718

G	11	37	3.18	4,703	24,797
H	12	36	0.31	500	1,500
J	7	41	0.08	75	441
K	12	34	1.84	2,969	8,411
Total			66.5	100,025	329,611
			Inches	Feet	
Reclamation Depths		Topsoil	11.2	0.9	
		Subsoil	36.9	3.1	
		Profile	48.1	4.0	

1. Estimated topsoil salvage depths for map units A1, A2, and A3 are based on the average for soil profiles examined in March 2016 (Long 2016 in Appendix 2-5) and profiles within *Area 1 Expanded* which were examined during the *Order 2 Soil Survey of the North Private Lease* (Supplemental Volume 11). Estimated topsoil salvage depths for map units D thru K are based on estimated depths in Table 14 in the *Order 2 Soil Survey of the North Private Lease* (Supplemental Volume 11).
2. Estimated subsoil salvage depths for map units A1, A2, and A3 are based on the average for soil profiles examined in March 2016 (Long 2016 in Appendix 2-5) and profiles within *Area 1 Expanded* which were examined during the *Order 2 Soil Survey of the North Private Lease* (Supplemental Volume 11) . Estimated topsoil salvage depths for map units D thru K are based on estimated depths in Table 14 in the Order 2 Soil Survey of the North Private Lease (Supplemental Volume 11).
3. Measured map unit acres within Area 1 Expanded boundary.

232.200. Topsoil of Insufficient Quantity or Quality

Where the topsoil is of insufficient quantity or poor quality for sustaining vegetation, other materials approved by the DOGM in accordance with R645-301-233.100 will be removed as a separate layer from the area to be disturbed, and segregated.

Based on the Soil Survey, there should be sufficient quantities of topsoil to place an average of eight inches of topsoil across all reclaimed areas.

Based on the 2014 Soil Survey of the North Private Lease, there should be sufficient quantities of topsoil to place an average of 13 inches of topsoil across all reclaimed areas. The estimated replacement topsoil depths for each mining area are 18 inches in Mine Area 1, 11 inches in Mine Area 2, and 12 inches in Mine Area 3 (based on soil profiles examined within each mine area).

Appendix 2-4 details that the amount of undisturbed topsoil that will be salvaged in the Pit 10 Borrow Area and available for final reclamation will provide an approximate depth of 3.5 inches. In order to increase the volume of topsoil available for final reclamation, organic mulches will be incorporated into subsoil used for interim reclamation to develop it into cultivated topsoil when it is salvaged at the end of the interim reclamation phase. These operations are detailed in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*.

The estimated salvage depths listed for topsoil and subsoil in *Area 1 Expanded* will provide an estimated 11.2 inches (0.9 feet) of topsoil and 36.9 inches (3.1 feet) of subsoil for a total estimated reclamation soil profile of 48.1 inches (4.0 feet).

Soil pH will be monitored in all subsoil salvaged below 58 inches (147 cm or 4.8 feet) in map unit G. Subsoil with pH greater than 8.8 will not be salvaged, stockpiled, or used for subsoil in the reclamation soil profile. Placement of subsoil within a pH range of 8.6 to 8.8 will be only be placed in the bottom foot (3 to 4 foot depth) of the reclamation soil profile.

232.300. <u>Shallow Topsoil Handling</u>

If topsoil is less than six inches thick, the operator may remove the topsoil and the unconsolidated materials immediately below the topsoil and treat the mixture as topsoil.

Sufficient quantities of topsoil are estimated to be available for replacement of an average eight inches of topsoil across reclamation, with a minimum of six inches. Therefore, mixing of topsoil with subsoil is not anticipated to be necessary.

Localized areas of the Vessilla family soil in map unit C of the North Private Lease may be less than 6 inches thick. Topsoil and subsoil will be stockpiled together as topsoil. Mixing of topsoil with subsoil is not anticipated to be necessary in other areas of the North Private Lease area.

The estimated topsoil salvage and replacement depths for each mine area are shown in the table in Section R-645-301-232.100.

Localized areas of Vessilla clayey taxadjunct in map unit L and Zigzag in map unit 10 may be less than 6 inches thick in the Pit 10 Borrow Area. Topsoil and subsoil will be stockpiled together as topsoil. Mixing of topsoil with subsoil is not anticipated to be necessary in other areas of the Pit 10 Borrow Area.

232.400 - 232.420. <u>Topsoil Removal Exceptions</u>

UDOGM will not require the removal of topsoil for minor disturbances which occur at the site of small structures, such as power poles, signs, or fence lines. Removal of topsoil will not be required when the disturbances will not destroy the existing vegetation and will not cause erosion.

232.500. <u>Subsoil Segregation</u>

The Coal Hollow Project plans to remove soils as either topsoil or subsoil based on the completed soil survey. DOGM may require that the B horizon, C horizon, or other underlying strata, or portions thereof, be removed and segregated, stockpiled, and *redistributed as subsoil in accordance with the requirements of R645-301-234 and R645-301-242 if it finds that such subsoil layers are necessary to comply with the revegetation requirements of R645-301-353 through R645-301-357.*

Refer to Table 4-2 in Appendix 2-1, which contains estimated subsoil salvage depths. In addition, substitute subsoil has been identified in the layers between the identified topsoil layer and the Tropic Shale. Sufficient quantities of this material are available to live haul most of the subsoil with the exception of one stockpile that will be constructed from the initial mining area and reserved for reclamation of the final mining area and one temporary stockpile that will be constructed from removal of the NW/4, NE/4, Section 30. All substitute subsoil materials will be sampled and tested for pH, conductivity, SAR, percent lime, and texture, prior to salvage and stockpiling.

Refer to Appendix 2-4 for a summary of the amount of available subsoil, salvage depths, replacement, potential substitute subsoil needs, and potential sources of substitute subsoil in the Pit 10 Borrow Area. Sampling of the final graded overburden surface and the substitute subsoil source is described in Appendix 2-4. Table 2-4.14 summarizes the estimated amount of subsoil available for reclamation of the Pit 10 Borrow Area.

Refer to Table 14 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) for subsoil salvage depths. The estimated average subsoil salvage and replacement depths for each mine area is listed in the table in Section R-645-301-232.100.

The majority of the soils in the North Private lease were sampled to 8 feet or bedrock. The soil analysis results can be seen in Appendix C of Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014). Additional testing of substitute subsoil materials will be completed at the time of final reclamation by following the procedure outlined in R645-301-232.700. Analysis of substitute subsoil will include parameters listed in Tables 3 and 7 in the *Guidelines for Management of Topsoil and Overburden.*

The following soil sampling program will be conducted during the initial mining process in the Coal Hollow Mine and does not apply to the North Primate Lease area:

- Topsoil: Sampling will occur every 2 to 4 acres or approximately every 2,500 to 5,000 bank cubic yards.
- Subsoil: Sampling will occur every 2 to 3 acres or approximately every 10,000 to 15,000 bank cubic yards.

These samples are anticipated to be composites of individual samples taken throughout the week during the time frames that topsoil and subsoil are being salvaged. These individual samples would be taken five days a week and composited to a single sample representing the material moved each week. The parameters that will be analyzed for topsoil are found in Table 4-1 of Appendix 2-1.

Following the initial mining process (approximately 1 year), the sampling program was reviewed to determine the appropriate level of sampling necessary to ensure adequacy of topsoil and subsoil used in reclamation for all subsequent mining. It was determined that areas that exhibited an accumulation of salts after being placed, should at minimum be tested for elevated SAR ratio.

232.600. Timing

All material to be removed under R645-301-232 will be removed after the vegetative cover that would interfere with its salvage is cleared from the area to be disturbed, but before any drilling, blasting, mining, or other surface disturbance takes place. Drawing 2-2 shows the anticipated topsoil removal sequence and stockpiling.

Drawing 2-4 shows the anticipated topsoil removal sequence and stockpiling for the North Private Lease. Estimated average topsoil and subsoil salvage depths in the North Private Lease are detained in Soils map 10 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

Figure 2-4.1 in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area* details topsoil and subsoil salvage areas for the Pit 10 Borrow Area.

232.700. Topsoil & Subsoil Removal Under Adverse Conditions

An exception to the requirements of R645-301-232 to remove topsoil or subsoils in a separate layer from an area to be disturbed by surface operations may be granted by UDOGM where the operator can demonstrate;

232.710. Unsafe Conditions

The removal of soils in a separate layer from the area by the use of conventional machines would be unsafe or impractical because of the slope or other conditions of the terrain or because of the rockiness or limited depth of the soils.

These conditions are not anticipated in the Coal Hollow project area.

232.720. Lack of On-Site Material Available

If the requirements of R645-301-233 have been or will be fulfilled with regard to the use of substitute soil materials unless no available substitute material can be made suitable for achieving the revegetation standards of R645-301-356, then the operator will, as a condition of the permit, be required to import soil material of the quality and quantity necessary to achieve such revegetation standards.

The soil survey indicates that there are sufficient quantities of topsoil and subsoil to adequately reclaim the mined area with 48 inches of combined cover. If additional materials are needed, then Alton Coal Development (ACD) will salvage suitable overburden for use as substitute subsoil material from the zone below the topsoil layer (8 inches thick average) to a maximum depth of 30 feet, excluding any Tropic shale materials. ACD will do additional sampling to identify the zones in which suitable materials occur for maximum salvage potential of substitute subsoil. Representative overburden samples will be analyzed for pH, conductivity, SAR, percent lime, and texture. A detailed description of subsoil sampling is provided in Section 232.500.

The estimated combined salvage depths for each soil map unit are listed in Table 14 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014). The table in Section R-645-301-232.100 details the estimated average depths of topsoil, subsoil, and substitute subsoil that will be salvaged and replaced in each mine area.

There are sufficient sources of native subsoil in adjacent soil map units to provide adequate amounts of native subsoil to cover mined areas 2 and 3 of the North Private Lease with a minimum 48 inches of combined cover.

Mine Area 1 may require an additional 4 inches and Mine Area 1 extended an additional 2 inches of substitute subsoil in order to achieve suitable material within the root zone. Also, for Mine Area 2 and 3 that will see more live haul, to ensure all areas achieve suitable material within the root zone, the following procedure will be followed. ~~Therefore a~~After backfill of the overburden has been complete, the upper 8 inches of Tropic Shale will be sampled on a basis of one sample per 2.5 acres as depicted in Drawing 5-76A. Sample locations will be recorded with a GPS. Tropic Shale samples will be analyzed for the parameters listed in Tables 3 and 7 in the *Guidelines for Management of Topsoil and Subsoil* (Utah DOGM). Should a sample analysis indicate backfilled Tropic Shale are poor or unacceptable, samples will be taken half the distance between the unsuitable sample and the surrounding samples to delineate the extent of the unsuitable soil. Additional suitable subsoil or subsoil substitute will be placed over the delineated area to provide 48” of reclamation soil profile, as needed.

Subsoil will be used as interim reclamation cover for the Pit 10 Borrow Area. Organic mulches will be incorporated to improve fertility and soil quality, as detailed in R645-301-244.200. This improved subsoil will be salvaged and stockpiled as cultivated topsoil at the end of the interim reclamation phase of the Pit 10 Borrow Area project. Cultivated topsoil will be used as topsoil during reclamation of the Pit 10 Borrow Area. This operation is described in more detail in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*. Salvage and stockpiling of the cultivated topsoil will be monitored by a Certified Professional Soil Scientist.

233.100 - 400 Topsoil Substitutes and Supplements.

Based on the Soil Survey contained in Appendix 2-1, topsoil substitutes and supplements are not anticipated to be necessary. This survey estimates that nine inches of topsoil can be replaced across the reclamation area.

Based on the Soil Survey, topsoil substitutes and supplements are not anticipated to be necessary. The North Private Lease soil survey estimates that thirteen inches of topsoil can be place over the entire mined area. Table 14 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) details the estimated depth of topsoil that can be salvaged from each soil map unit. The estimated average topsoil depth for soil map units C and J are 7 inches or less. However, the overall survey area estimated average topsoil salvage depth of approximately 13 inches. The estimated replacement topsoil depths for each mining area are 18 inches in Mine Area 1, 11 inches in Mine Area 2, and 12 inches in Mine Area 3 (based on soil profiles examined within each mine area).

Subsoil will be used as interim reclamation cover for the Pit 10 Borrow Area. Organic mulches will be incorporated to improve fertility and soil quality, as detailed in R645-301-244.200. This improved subsoil will be salvaged and stockpiled as cultivated topsoil at the end of the interim reclamation phase of the Pit 10 Borrow Area project. Cultivated topsoil will be used as topsoil during reclamation of the Pit 10 Borrow Area. This operation is described in more detail in Appendix 2-4 called: *Topsoil and Subsoil Sources and Substitute Sources in the Pit 10 Borrow Area*. Salvage and stockpiling of the cultivated topsoil will be monitored by a Certified Professional Soil Scientist.

The cultivated topsoil will be sampled and tested prior to salvage. Samples will be collected on the basis of approximately one sample per 2.5 acres. Sampling depth will be to 4 feet. This testing will include all parameters listed in Tables 3 and 7 in *Guidelines for Management of Topsoil and Overburden* (DOGM January 2008). Suitability will be evaluated based on the laboratory analysis and parameter limits listed in Tables 4 and 8 in *Guidelines for Management of Topsoil and Overburden* (DOGM January 2008).

The following intermediate seed mix will be used to establish vegetation on the intermediate reclamation area in the Pit 10 Borrow where cultivated topsoil will be developed from subsoil. The Sweetpea milkvetch and alfalfa are legumes included for nitrogen fixation.

Intermediate Reclamation Seed Mix for Topsoil Cultivation Area			
		Seeds/Ft^2	Rate (PLS/Acre)
Astragalus cicer	Sweetpea milkvetch	9.99	3.00
Bromus carinatus	Mountain Brome	11.48	5.00
Elymus lanceolatus	Thickspike wheatgrass	10.61	3.00
Elymus smithii	Western wheatgrass	11.57	4.00

Elymus spicatus	Bluebunch wheatgrass	12.86	4.00
Medicago sativa	Alfalfa	14.46	3.00
Poa pratensis	Kentucky bluegrass	14.99	0.30
TOTAL		**85.96**	**22.30**

234. Topsoil Storage

234.100. Stockpiles

Materials removed under R645-301-232.100, R645-301-232.200, and R645-301-232.300 will be segregated and stockpiled when it is impractical to redistribute such materials promptly on regraded areas. Drawing 2-2 shows the planned stockpile areas, anticipated storage time, quantities and size.

Drawing 2-4 shows the planned stockpile areas, anticipated storage time, quantities and size for the North Private Lease.

Planned stockpile areas and quantities for the Pit 10 Borrow Area are shown on Drawing 2-2.

234.200. Requirements of Stockpiles

Stockpiled materials will be subject to the following conditions.

234.210. (a) They will be selectively placed on a stable site within the permit area. Areas are shown on Drawing 2-2.

Stockpile areas in the North Private Lease are shown on Drawing 2-4.

Stockpile areas for topsoil and subsoil salvaged from Pit B1 are shown on Drawing 2-2.

234.220. (b) They will be protected from contaminants and unnecessary compaction that would interfere with revegetation.

234.230. (c) They will be protected from wind and water erosion through prompt establishment and maintenance of an effective, quick growing vegetative cover. The side slopes will be graded to a maximum 3h:1v. Drawing 2-2 shows the planned stockpile areas, anticipated storage time, quantities and size. Drawing 2-4 shows the planned stockpile areas, anticipated storage time, quantities and size for the North Private Lease. Drawing 2-2 shows the planned stockpile areas, anticipated storage time, quantities and size for the Pit 10 Borrow Area. The interim seed mix for all the stockpiles is the following:

Stockpile Interim Seed Mix		
		Rate (PLS/Acre)
Bromus carinatus	Mountain Brome	6
Elymus lanceolatus	Thickspike wheatgrass	4
Elymus smithii	Western wheatgrass	5
Elymus spicatus	Bluebunch wheatgrass	6
Poa pratensis	Kentucky bluegrass	0.4
Total		**21.40**

Partially utilized stockpiles of topsoil, subsoil, and substitute subsoil will be reshaped and bermed within a reasonable time period following the end of use. The disturbance will be seeded during the next appropriate seeding period or by November 30th of that year. If the season is not appropriate for seeding after reshaping, the stockpile will then be coated with a tackifier at the manufacturer's suggested rate for dust control applications.

The following example balance sheet will be used to track salvage, stockpiling, and placement of topsoil, subsoil, and substitute subsoil in each mine area. Tracking of topsoil, subsoil, and substitute subsoil will be done for each Mine Area separately. The depth of topsoil and subsoil salvage will be determined by the soil survey and in the field during mining by the Coal Hollow environmental technician in consultation with a certified professional soil scientist.

NPL AREA 1	Topsoil Stockpile	Subsoil Stockpile
Starting Stockpile Volume	74,953	41,378

BRP 1-10 = 12.21 ACRES

Source	NL Topsoil	Livehaul Topsoil*	Total Topsoil	NL Subsoil	Livehaul Subsoil	Total Subsoil	
	CY	CY	CY	CY	CY	CY	CY
Stockpile volume utilized	18,784	0	18,784	14,071	8,459	22,530	
Suitable spoil**							33,283
Remaining stockpile volume	56,169			27,307			

*Livehaul source: Area 1

**Suitable Spoil: Surface two feet of 9.38 acres represented by Soil Sample Pits 1, 2, and 3.5N

***Average topsoil cover depth 1.08 ft.

****Subsoil redistribution depth as shown on Drawing 5-76a

	~~Topsoil~~	~~Subsoil~~	~~Substitute Subsoil~~
~~Acres~~			
~~Average Depth of Removal (feet)~~			
~~Estimate of Salvageable Material (yd^3)~~			
~~Volume Actually Salvaged (yd^3)~~			
~~Proposed Placement Depth (feet)~~			
~~Volume Required for Reclamation (yd^3)~~			
~~Surplus or Deficit (yd^3)~~			

For the purpose of tracking soil balance in the Coal Hollow Mine, Figure 1with the addition of ~~Figure~~ Table 1 of Appendix 2-2 has been revised to show soil placed in reclamation, topsoil sampled for fertility and includes a table indicating the soil remaining/planned in stockpiles including new stockpile address in Appendix 2-4 (Pit 10 Borrow amendment). As sampling and placement of soils progresses with reclamation, Figure 1 and Table 1of Appendix 2-2 will be updated with new information.

234.240. (d) They will not be moved until required for redistribution unless approved by the UDOGM. Anticipated storage time for each stockpile is shown on Drawing 2-2.

Drawing 2-4 shows the anticipated storage time for each stockpile in the North Private Lease. A portion of the topsoil stockpile in Area 1 will be relocated prior to mining Pit 11, ACD will notify the Division of the volume of stored topsoil to be moved and the timing for this movement.

Drawing 2-2 shows the anticipated storage time for each stockpile in the Pit 10 Borrow Area.

234.300. Long-Term Disturbance & Stockpiling

When long-term disturbed areas will result from facilities and preparation plants and when stockpiling of materials removed under 8645-301-232.100 would be detrimental to the quality or quantity of those materials, DOGM may approve the temporary distribution of the soil materials removed to an approved site within the permit area to enhance the current use of that site until later when needed for reclamation, provided that the following conditions occur.

234.310. Such action will not permanently diminish the capability of the topsoil of the host site.

234.320. The material will be retained in a condition more suitable for redistribution than if stockpiled.

240. Reclamation Plan (General Requirements)

A detailed Order 2 soil survey has been completed in 2006 and 2007 and extended to include the New Dame Lease IBC in 2014. This information provides detail for onsite soil suitability, salvage depths, and volumes available for reclamation of the mine site. Dozers or Scrapers will replace the subsoil and topsoil. The topsoil is estimated to average 8 inches and the subsoil will be approximately 39 inches in thickness. The total profile of topsoil and subsoil is estimated to average 48 inches.

A detailed Order 2 soil survey of the North Private Lease was completed in 2014 and is detailed in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014). This information provides detail for onsite soil suitability, salvage depths, and volumes available for reclamation of the mine site. Dozers or Scrapers will replace the subsoil and topsoil. The topsoil is estimated to average 13 inches and the subsoil will be approximately 31 inches in thickness. The total profile of topsoil and subsoil is estimated to average 44 inches.

A detailed Order 2 soil survey of the Pit 10 Borrow Area was completed in 2016 and is detailed in Appendix 2-4: *Topsoil and Subsoil Sources and Substitute Subsoil source in the Pit 10 Borrow Area* (September 2016). This information provides details for onsite soil suitability, salvage depths, and volumes available for reclamation of the mine site. Dozers or Scrapers will replace the subsoil and topsoil. The minimum final cover depths in the Pit 10 Borrow Area will be approximately 0.9 feet of topsoil and 3.1 feet of subsoil. The total reclamation profile of topsoil and subsoil is estimated to average 4.0 feet.

241. General Requirements
Refer to R-645-301-242 for redistribution of soils, R-645-301-243 for soil nutrients and amendments, and R-645-301-244 for mulch use and application.

242. Soil Redistribution

242.100. Topsoil materials removed under R645-301-232.100, R645-301-232.200, and R645-301-232.300 and stored under R645-30I-234 will be redistributed in a manner that meets the following conditions.

242.110. (a) The material achieves an approximately uniform, stable thickness consistent with the approved postmining land use, contours, and surface-water drainage systems. All slopes will be appropriately graded and leveled prior to placement of topsoil and subsoil layers. Soil layer thicknesses will be regularly checked using a high precision GPS system and spot checking by the ACD environmental technician.

242.120. (b) Reduced material handling of the soil resource prevents excess compaction. Material handling will be minimized by direct hauling and placing materials when operationally practical rather than stockpiling. Materials will be spread by a dozer or scrapers and spread only as much as necessary to obtain the required uniform thickness. Traffic from rubber tired equipment across topsoil and subsoil will be minimized.

If heavy equipment operation results in excessive soil compaction at the surface of the reclaimed areas, they will then be ripped, disked, and harrowed to loosen the seedbed prior to seeding. Excessive compaction that could impact seeding success will be determined by observation and judgment of an environmental professional. In other areas where less compaction has occurred, the areas will be disked and harrowed. The disking and harrowing of all areas will be done parallel with the contour wherever possible to decrease the potential for water erosion downslope. In other areas where compaction is not a problem, dozer tracking can be used to roughen the surface, and to trap seed, fertilizer, mulch, and other amendments as well as decrease erosion by wind and water. In such cases seeding will be done immediately after this treatment, whereas soil amendments, where required, would be applied over the surface during seedbed preparations. Seeding will mainly occur in the early spring and late fall. Seeding will be accomplished by the seed drilling method followed by mulching as described in Section 244.200. Seed mixtures and rates can be viewed in Tables 3-37 through 3-42 in Chapter 3, Volume 2.

242.130. (c) Handling procedures will be implemented to protect the materials from wind and water erosion before and after seeding and planting. Reclamation will be graded to the planned slope angles, not to exceed 3h:1v. Soil layers will be sloped as the material is relocated to the reclaim areas. Once soil is placed, seeding will occur at the earliest appropriate season suitable to planting conditions. If the season is not appropriate for seeding at the time of topsoil placement, the topsoil will then be coated with a tackifier at the manufacturer's suggested rate for dust control applications. Mulching will be implemented on all reclamation to control erosion following seeding.

242.200. Treatments of Material to be Redistributed

Before redistribution of the materials removed under R645-301-232, the regraded land will be treated if necessary to reduce potential slippage of the redistributed material and to promote root penetration. If no harm will be caused to the redistributed material and reestablished vegetation, such treatment may be conducted after the material is replaced. Potential for slippage is anticipated to be minimal based on the planned slope angles for reclamation.

In the North Private Lease, areas exceeding 3:1 slope, will have the underlying spoil ripped to a depth of 18" prior to placement of subsoil and the placed subsoil will be also be ripped to a depth of 18" prior to placement of topsoil. In all areas where the subsoil has become compacted, the subsoil will be ripped to a depth of 18" prior to placement of the topsoil.

When subsoil placement is not immediately followed by topsoil placement (within a month), the graded subsoil will be treated with mulch or tackifier (per Section 244.200) to prevent erosion in the interim; and the subsoil will be ripped to a depth of 18 inches prior to topsoil placement.

242.300. <u>Soil Redistribution on Impoundments & Roads</u>

DOGM may not require the redistribution of topsoil or topsoil substitutes on the approved postmining embankments of permanent impoundments or roads if it determines the following.

242.310. (a) Placement of topsoil or topsoil substitutes on such embankments is inconsistent with the requirement to use the best technology currently available to prevent sedimentation.

242.320. (b) Such embankments will be otherwise stabilized.

243. <u>Soil Nutrients & Amendments</u>

Nutrients and soil amendments will be applied to the redistributed material when necessary to establish the vegetative cover. The final seedbed of the reclaimed areas will be prepared by first replacing the subsoil and topsoil. Next, a basic topsoil (top 8 inches of reclamation profile) sampling regime will be implemented prior to seeding that should identify fertility problems and will provide a basis for determining necessary soil amendments. The parameters analyzed will be:

Available phosphorus (P)
Soluble Potassium (K)
Nitrate-Nitrogen

One composite sample will be collected from approximately every 2 acres based on soil types and variability. Each composite will be comprised of at least 4 sub-samples. This sampling will be completed within three months of topsoil placement.

Pre-testing of the soils has been conducted as part of the soils survey. Results from the pre-testing of topsoil and subsoil can be viewed in Table C-1 of Appendix 2-1 (native topsoil and subsoil) and Table C-2 (samples from core hole/overburden pits) of Appendix 2-1.

Results from the pre-testing of topsoil and subsoil can be seen in the laboratory analysis reports in Appendix C in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).

Results from the pre-testing of topsoil and subsoil in the Pit 10 Borrow Area are in the laboratory analysis reports in Appendix 2-4: *Topsoil and Subsoil Sources and Substitute Subsoil source in the Pit 10 Borrow Area* (September 2016).

244. Soil Stabilization

244.100. Erosion Protection from Wind & Water

All exposed surface areas will be protected and stabilized to effectively control erosion and air pollution attendant to erosion. Reclamation will be regraded to the planned slope angles, not to exceed 3h:1v. Soil layers will be sloped as the material is relocated to the reclaim areas. Once soil is placed, seeding will occur at the earliest appropriate season suitable to planting conditions. Grass matting, mulching and/or cross ditches will be implemented as necessary to control erosion. Surfaces of stockpiles will be roughened by pocking, gouging or ripping. Soil stockpiles will be seeded with the temporary seed mix provided in Section 234.230 and mulched by one of the methods described in Section 244.200.

Stockpiles of topsoil, subsoil, and substitute subsoil will be shaped, roughened, and bermed immediately following construction. The disturbance will be seeded during the next appropriate seeding period as described in the reclamation time table in Chapter 3 section 341.100. If the season is not appropriate for seeding the stockpile will be coated with a tackifier at the manufacturer’s suggested rate for dust control applications.

The sideslopes of the temporary spoil pile will be roughened and coated with a tackifier at the manufacturer's recommended rate as the pile rises.

244.200. Mulch

Suitable mulch and other soil stabilizing practices will be used on all areas that have been regraded and covered by topsoil or topsoil substitutes. DOGM may waive this requirement if seasonal, soil, or slope factors result in a condition where mulch and other soil stabilizing practices are not necessary to control erosion and to promptly establish an effective vegetative cover.

Mulch will be placed on the seedbed surface once soil amendments have been incorporated. In most cases seeding will be accomplished after straw mulch has been placed to ensure seed is placed at the proper depth, exceptions would be for safety on steep slopes. Mulching treatments will occur by one or more of the following methods:

- Certified noxious weed free straw applied at a rate of 1 ton/acre anchored by crimping or a chemical binder.

- Wood fiber hydromulch at a rate of ¾ ton per acre for slopes flatter than 3:1 and 1 ton per acre for slopes at 3:1 which is the steepest slope planned at the project. This hydromulch would be anchored with a chemical binder at the manufacturer’s suggested rate.

- Live mulch by use of quick growing sterile nurse crop such as “Quick Guard” with recommended rates of 5-10 lbs. /acre.

- The use of Nutri-Mulch® or equivalent product as an organic matter amendment and fertilizer. Application rate will be as recommended by the manufacturer.

The mulch should control erosion by wind and water, decrease evaporation and seed predation, and increase survivability of the seeded species. Since there is only one post mining land use, mulching will follow one of the above described methods for all reclaim areas. Although live mulch (“Quick Gard”) has performed the best at the Coal Hollow Mine, other methods or combinations of the above listed methods will be used based on slope, climatic trends, soil moisture, soil texture, etc. and will be determined at the time of planting for each area.

244.300. Rills & Gullies

Rills and gullies that form in areas that have been regraded and topsoiled that cause the following conditions will have the topsoil replaced followed by reseeding or replanting if the following occurs.

244.310. (a) If they disrupt the approved postmining land use or the reestablishment of the vegetative cover.

244.320. (b) If they cause or contribute to a violation of water quality standards for receiving streams will be filled, regraded, or otherwise stabilized; topsoil will be replaced; and the areas will be reseeded or planted.

250. PERFORMANCE STANDARDS

251. Topsoil & Subsoil Removed

All topsoil, subsoil and topsoil substitutes or supplements will be removed, maintained and redistributed according to the plan given under R645-301-230 and R645-301-240.

252. Topsoil & Subsoil Stockpiled

All stockpiled topsoil, subsoil and topsoil substitutes or supplements will be located, maintained and redistributed according to plans given under R645-301-230 and R645-301-240.

~~R645-302-316 Issuance of Permit~~

~~A permit to conduct coal mining and reclamation operations that include mining and reclamation on designated special areas of prime farmland may be granted by the Division, if it first finds, in writing, upon the basis of a complete application, that:~~

~~316.100. The approved proposed postmining land use of these prime farmlands will be cropland;~~

~~The planned post mining land use for all prime farmlands disturbed during mining will be for the same agricultural use as prior to mining.~~

~~316.200. The permit incorporates as specific conditions the contents of the plan submitted under R645-302-314, after consideration of any revisions to that plan suggested by the State Conservationist under R645-302-315.300;~~

~~316.300. The applicant has the technological capability to restore the prime farmland, within a reasonable time, to equivalent or higher levels of yield as nonmined prime farmland in the surrounding area under equivalent levels of management; and~~

~~316.400. The proposed coal mining and reclamation operations will be conducted in compliance with the requirements of R645-302-317 and other environmental protection performance and reclamation standards for mining and reclamation of prime farmland of the State Program.~~

~~316.500. The aggregate total prime farmland acreage shall not be decreased from that which existed prior to mining. Water bodies, if any, to be constructed during mining and reclamation operations must be located within the post-reclamation non-prime farmland portions of the permit area. The creation of any such water bodies must be approved by the Division and the consent of all affected property owners within the permit area must be obtained.~~

~~All planned water bodies will be constructed during or following mining in non-prime farmland portions of the permit area.~~

~~R645-302-317 Prime Farmland Performance Standards~~

~~317.100 Scope and Purpose~~

~~317.200 Responsible Agencies~~

~~The Natural Resources Conservation Service and UDOGM will consult with ACD on Prime Farmland areas within the North Private Lease mine permit area.~~

~~R645-302-315 makes clear that the authority with regard to prime farmland soils is the Secretary of Agriculture through the Utah NRCS State Soil Conservationist. The Division has initiated consultation with the State Conservationist per R645-301-315.100 and R645-301-315.200. Prior to approval, the State Conservationist is required to review and comment on the details of the proposed plan.~~

~~317.210 Prime Farmland Specifications~~

~~The NRCS within Utah will establish specifications for prime farmland soil removal, storage, replacement, and reconstruction.~~

~~The Division is in consultation with the NRCS State Conservationist to determine the preferred Prime Farmland soil reconstruction. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.220 Implementation of Prime Farmland Specifications~~

~~UDOGM will use the soil-reconstruction specifications established by the NRCS to carry out its responsibilities in accordance with R645-302-310 through R645-302-311 316 and R645-302-316 and R645-301-800.~~

~~317.300 Applicability~~

~~The requirements of the R645-302-317 will not apply to prime farmland that has been excluded in accordance with R645-302-311 and R645-302-312.~~

~~The current Coal Hollow mine was permitted after August 3, 1977.~~

~~317.400 Soil Removal and Stockpiling~~

~~Soil will be removed from Prime Farmland areas by horizon (A, B, and C) and stockpiled separately by landowner. Estimated salvage depths for the A, B, and C horizons for soil map units in the Prime Farmland areas can be found in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).~~

~~Soil samples will be collected from the Prime Farmland areas prior to salvaging to a depth of 48 inches and analyzed for by horizons depth, for pH, density, sodium adsorption ration (SAR), conductivity (ECe), texture, and available water capacity. Sample locations will be approximately one per 2 acres. Horizon samples will be limited to depths of approximately 12 inches. Additional analysis parameters may be included after consultation with UDOGM and the NRCS.~~

~~317.410 Timing~~

~~Prime farmland soils will be removed from the areas to be disturbed before drilling, blasting, or mining.~~

~~317.420 Salvage Depth of Prime Farmland Soils~~

~~The minimum depth of soil and substitute soil material to be reconstructed will be 48 inches, or a lesser depth equal to the depth to a subsurface horizon in the natural soil that inhibits or prevents root penetration, or a greater depth if determined necessary to restore~~

~~the original soil productive capacity.~~

~~Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) details the estimated total salvage depths for Prime Farmland soil map unit. It is anticipated that the salvage depths of B an C horizons in adjacent Prime Farmland soil map units can be increased in order to achieve a minimum final reclamation soil profile depth of 48 inches. The estimated average soil depth that can be salvaged from soil map units A1, A2, N and D is limited by the depth to Tropic shale.~~

~~317.430 <u>Soil Removal and Stockpiling</u>~~

~~Soil removal and stockpiling will be conducted to:~~

~~317.431 <u>Separate Removal and Stockpiling of Topsoil</u>~~

~~The A horizon or topsoil in Prime Farmland areas will be removed and stockpiled separately by landowner in a manner that will create a final soil having a greater productive value than prior to mining. It is anticipated that the duration of stockpiling Prime Farmland topsoil will be of short duration, since the Prime Farmland areas are at the north end of the proposed mining sequence. Estimated average salvage depths of the A horizon or topsoil in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).~~

~~317.432 <u>Separate Removal and Stockpiling of B and C horizons</u>~~

~~Removal and stockpiling of all Prime Farmland soil horizons will be directly monitored by a Certified Professional Soil Scientist.~~

~~The B and C horizons will be removed and stockpiled separately by landowner in a manner that will create a final soil having a greater productive value than prior to mining. It is anticipated that the duration of stockpiling Prime Farmland B and C soil horizons will be of short duration, since the Prime Farmland areas are at the north end of the proposed mining sequence. Estimated average salvage depths of the B and C horizons in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).~~

~~The C horizon will be stockpiled and stockpiled as B horizon soil, if the depth of C horizon soil to be stockpiled is less than 6 inches. It is anticipated that this consolidation of materials will not diminish the quality of the B horizon.~~

~~C horizon materials will primarily consist of soils with pH greater than 8.5.~~

~~317.440 <u>Protection of Prime Farmland Stockpiles</u>~~

~~Stockpiles of salvaged soil from the A, B, and C horizons will be placed at locations within the permit area where they will not be disturbed or be subject to excessive erosion. If left in place for more than 30 days, stockpiles will meet the requirements of R645-301-232, R645-301-233.100, R645-301-234, R645-301-242, and R645-301-243.~~

~~Stockpiled Prime Farmland materials will be subject to the following conditions within 30 days of stockpiling.~~

~~(a) They will be selectively placed on a stable site within the permit area. Prime Farmland soils will be stockpiled by horizon and by landowner. Stockpile areas in the North Private Lease are shown on Drawing 2-4~~

~~(b) They will be protected from contaminants and unnecessary compaction that would interfere with revegetation.~~

~~(c) They will be protected from wind and water erosion through prompt establishment and maintenance of an effective, quick growing vegetative cover or through other measures approved by the UDOGM. The side slopes will be graded to a maximum 3h:1v. Drawing 2-4 shows the planned stockpile areas, anticipated storage time, quantities and size for the North Private Lease. The interim seed mix for the Prime Farmland stockpiles is the following:~~

~~**Stockpile Interim Seed Mix**~~		
		~~Rate (PLS/Acre)~~
~~Bromus carinatus~~	~~Mountain Brome~~	~~6~~
~~Elymus lanceolatus~~	~~Thickspike wheatgrass~~	~~4~~
~~Elymus amithii~~	~~Western wheatgrass~~	~~5~~
~~Elymus spicatus~~	~~Bluebunch wheatgrass~~	~~6~~
~~Poa pratensis~~	~~Kentucky bluegrass~~	~~0.4~~
~~**Total**~~		~~**21.40**~~

~~(d) They will not be moved until required for redistribution unless approved by the UDOGM. Drawing 2-4 shows the anticipated storage time for each stockpile in the North Private Lease.~~

~~317.500 Soil Replacement~~

~~317.510 Soil Profile Reconstruction~~

~~Prime Farmland topsoil and subsoil will be replaced by horizons in the order that they existed prior to removal with the A horizon being on top, the B horizon in the middle, and the C horizon on the bottom of the reconstructed soil profile. Soil samples will be collected from the final graded surface in the Prime Farmland areas on a basis of approximately one sample per two acres on a random statistical grid. The soil samples will be analyzed for horizon depth, pH, density, sodium adsorption ration (SAR), conductivity (ECe), texture, and available water capacity. Horizon samples will be~~

~~limited to depths of approximately 12 inches.~~

~~317.520 Depth of Reconstructed Soil Profile~~

~~The combined depth of the reconstructed A, B, and C horizons will be a minimum of 48 inches. Substitute subsoil from adjacent soil map units will be incorporated as either B or C horizon material in areas where the soil depth was less than 48 inches prior to mining. Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014) details the estimated soil profiles for each of the Prime Farmland soil map units.~~

~~317.530 Soil Compaction Monitoring~~

~~Soil compaction or density will be monitored during replacement of the A, B, and C horizons. The soil will be ripped or disked as needed to achieve soil densities similar to those documented in the Prime Farmland soils prior to removal and stockpiling as detailed in R645-302-317.400. The overlying soil horizon will not be reconstructed until the desired soil density has been achieved in the underlying soil horizon.~~

~~317.540 Replacement of B and C horizons~~

~~The combined depth of the B and C horizons will be sufficient to achieve a total minimum depth of 48 inches when the A horizon is included as part of the depth. Substitute subsoil will be used as C horizon soil in areas where the combined original depth was less than 48 inches prior to mining.~~

~~317.550 Replacement of A horizon~~

~~The A horizon or topsoil will be replaced in Prime Farmland areas as the final soil surface layer. This surface soil layer will equal or exceed the thickness of the original surface soil layer. The thickness of the average original soil surface layer in Prime Farmland areas is detailed in Table 13 in Volume 11: Supplemental Report section of the MRP in the report called: *Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine* (November 2014).~~

~~317.600 Revegetation and Restoration of Soil Productivity~~

~~317.610 Vegetation Establishment~~

~~Following prime farmland soil replacement, the soil surface will be stabilized with a vegetative cover or other means that effectively controls soil loss by wind and water erosion. Vegetation will be planted in consultation with the landowner following reconstruction and seedbed preparation of Prime Farmland areas.~~

~~317.620 Restoration of Prime Farmland Productivity~~

~~317.621 Measurement of Prime Farmland Productivity~~

~~Productivity of the reconstructed Prime Farmland areas will be measured implementing a monitoring program developed in consultation with UDOGM and the NRCS.~~

~~317.622 Productivity Monitoring Program~~

~~The productivity of the reconstructed Prime Farmland areas will be measured with a statistically valid program with 90 percent or greater confidence developed in consultation with UDOGM and the NRCS.~~

~~The Division is in consultation with the NRCS State Conservationist to determine the preferred productivity monitoring program for the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.623 Monitoring Period~~

~~The measurement period for determining average annual crop production will be a minimum of three years prior to release of the performance bond.~~

~~317.624 Management Level~~

~~The level of management applied to the reconstructed Prime Farmland during the measurement period will be equal to the management level on non mined similar adjacent areas.~~

~~317.625 Restoration of Soil Productivity~~

~~Restoration of soil productivity will be considered achieved when the average yield during the measurement period equals or exceeds the average yield of the reference crop established for the same period for non-mined soils of the same or similar texture or slope phase of the soil series in the surrounding area under equivalent management practices.~~

~~317.626 Reference Crop~~

~~The reference crop on which restoration of soil productivity is proven will be selected from the crops most commonly produced on the surrounding prime farmland. Where row crops are the dominant crops grown on prime farmland in the area, the row crop requiring the greatest rooting depth will be chosen as one of the reference crops.~~

~~317.6327 Reference Crop Yields~~

~~Reference crop yields for the selected reference crop will be determined from, either:~~

~~317.627.1 Yield Records~~

~~The current yield records of representative local farms in the surrounding area, with concurrence by the NRCS; or~~

~~The Division is in consultation with the NRCS State Conservationist for the yield records of representative local farms in the surrounding area for the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.627.2 Average County Yields~~

~~The average county yields recognized by the U.S. Department of Agriculture, which have been adjusted by the NRCS for local yield variation within the county that is associated with differences between non-mined prime farmland soil and all other soils that produce the reference crop; and~~

~~The Division is in consultation with the NRCS State Conservationist for the average county yields for the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.628 Adjustment of Reference Yields~~

~~Average reference crop yields in R645-302-317.627 may be adjusted, with concurrence of the NRCS, for:~~

~~The Division is in consultation with the NRCS State Conservationist to determine if the average reference yields should be adjusted for the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.628.1 Environmental Impacts~~

~~Disease, pest, and weather-related seasonal variations; or~~

~~The Division will be in consultation with the NRCS State Conservationist for the to determine if an environmental impacts should be taken into account as part of the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

~~317.628.2 Management Practices~~

~~Differences in specific management practices where the overall management practices of the crops being compared are equivalent.~~

~~The Division will be in consultation with the NRCS State Conservationist for the to determine if differences in management practices should be taken into account as part of the post mining land use evaluation. That coordinated review is ongoing and the recommendations made by the NRCS will be incorporated into the mining plan.~~

APPENDIX 2-2

Soils Analysis

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1103042001

Project: Topsoil Stockpile
Date Received: 3/1/2011

Date Reported: 3/25/2011
Work Order: S1103042

Lab ID	Sample ID	pH	Saturation	Electrical Conductivity	Field Capacity	Wilt Point	Organic Matter	PE Calcium	PE Magnesium	PE Sodium	SAR
		s.u.	%	dS/m	%	%	%	meq/L	meq/L	meq/L	
S1103042-001	Topsoil Week 1	7.3	55.6	0.41	36.9	19.2	4.0	2.66	0.91	0.83	0.62
S1103042-002	Topsoil Week 2	7.4	51.1	0.50	31.9	14.8	4.2	3.87	1.66	0.72	0.43
S1103042-003	Topsoil Week 3	7.7	50.2	0.50	35.4	15.4	4.0	2.03	0.94	2.45	2.01
S1103042-004	Topsoil Week 4	7.4	54.7	0.28	32.8	21.9	5.5	1.69	0.62	0.38	0.36

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

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1103042001

Project: Topsoil Stockpile
Date Received: 3/1/2011

Date Reported: 3/25/2011
Work Order: S1103042

Lab ID	Sample ID	Sand	Silt	Clay	Texture	Very Fine Sand	CO3	Total Carbon	TOC
		%	%	%		%	%	%	%
S1103042-001	Topsoil Week 1	21.0	41.0	38.0	Clay Loam	10.0	22.2	3.8	1.2
S1103042-002	Topsoil Week 2	42.0	31.0	27.0	Clay Loam	6.6	20.1	3.6	1.2
S1103042-003	Topsoil Week 3	36.0	32.0	32.0	Clay Loam	8.3	18.8	3.2	1.0
S1103042-004	Topsoil Week 4	30.0	37.0	33.0	Clay Loam	8.7	21.2	4.0	1.6

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-Mounta... ..abs, Inc
1673 Terra Ave, Sheridan, Wyoming, 82801
(307) 672-8945

Soil Analysis Report

Alton Coal Development

463 North 100 West, Suite 100
Cedar City, UT 84721

Project ID: Topsoil Stockpile
Date Received: 3/1/2011

Report ID: S1103042001
Date Reported: 3/25/2011
Work Order: S1103042

Lab ID	Sample ID	Organic Matter	Sand	Silt	Clay	Very Fine Sand	Texture	K-factor	Structure	Permeability	M	Description
		%	%	%	%	%		(t.ac.h/100acft.tf.in)	s	p		
S1103042-001	Topsoil Week 1	4	21.0	41.0	38.0	10	Clay Loam	0.22	3	4	3162.0	
S1103042-002	Topsoil Week 2	4.2	42.0	31.0	27.0	6.6	Clay Loam	0.16	2	4	2744.8	
S1103042-003	Topsoil Week 3	4	36.0	32.0	32.0	8.3	Clay Loam	0.16	2	4	2740.4	
S1103042-004	Topsoil Week 4	5.5	30.0	37.0	33.0	8.7	Clay Loam	0.15	2	4	3061.9	

These Results apply only to the samples tested

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

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1105140001

Project: Coal Hollow Mine
Date Received: 5/9/2011

Date Reported: 6/1/2011
Work Order: S1105140

Lab ID	Sample ID	pH	Saturation	Electrical Conductivity	Field Capacity	Wilt Point	Organic Matter	PE Calcium	PE Magnesium	PE Sodium	SAR
		s.u.	%	dS/m	%	%	%	meq/L	meq/L	meq/L	
S1105140-001	Topsoil Week of 4/4/11	7.8	45.1	1.15	29.9	15.2	3.7	8.14	5.49	2.62	1.00
S1105140-002	Subsoil Stockpile 2 Week of 4/18/11	7.9	36.9	1.21	25.8	9.2	1.4	7.53	6.26	4.65	1.77
S1105140-003	Subsoil Stockpile 1 Week of 4/25/11	7.8	34.7	0.51	25.5	9.3	2.3	3.51	1.82	0.34	0.21

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

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1105140001

Project: Coal Hollow Mine
Date Received: 5/9/2011

Date Reported: 6/1/2011
Work Order: S1105140

Lab ID	Sample ID	Sand	Silt	Clay	Texture	Very Fine Sand	CO3	Total Carbon	TOC
		%	%	%		%	%	%	%
S1105140-001	Topsoil Week of 4/4/11	46.0	28.0	26.0	Loam	9.9	12.3	2.7	1.3
S1105140-002	Subsoil Stockpile 2 Week of 4/18/11	62.0	20.0	18.0	Sandy Loam	14.3	18.5	2.5	0.3
S1105140-003	Subsoil Stockpile 1 Week of 4/25/11	66.0	18.0	16.0	Sandy Loam	14.9	13.3	2.4	0.8

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

Soil Analysis Report
Alton Coal Development
463 North 100 West, Suite 100
Cedar City, UT 84721

Project ID: Coal Hollow Mine
Date Received: 5/9/2011

Report ID: S1105140001
Date Reported: 6/1/2011
Work Order: S1105140

Lab ID	Sample ID	Organic Matter	Sand	Silt	Clay	Very Fine Sand	Texture	K-factor	Structure	Permeability	M	Description
		%	%	%	%	%		(t.ac.h/100acft.tf.in)	s	p		
S1105140-001	Topsoil Week of 4/4/11	3.7	46.0	28.0	26.0	9.9	Loam	0.15	2	3	2804.6	
S1105140-002	Subsoil Stockpile 2 Week of 4/18/11	1.4	62.0	20.0	18.0	14.3	Sandy Loam	0.20	3	2	2812.6	
S1105140-003	Subsoil Stockpile 1 Week of 4/25/11	2.3	66.0	18.0	16.0	14.9	Sandy Loam	0.18	3	2	2763.6	

These Results apply only to the samples tested

Reviewed by Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monit[illegible]g Partner

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1212072001

Project: Topsoil Stockpile #4
Date Received: 12/5/2012

Date Reported: 1/25/2013
Work Order: S1212072

Lab ID	Sample ID	pH	Saturation	Electrical Conductivity	Field Capacity	Wilt Point	Organic Matter	PE Calcium	PE Magnesium	PE Sodium	SAR
		s.u.	%	dS/m	%	%	%	meq/L	meq/L	meq/L	
S1212072-001	Topsoil Pit 8&9	7.6	42.8	0.64	21.9	14.6	3.2	4.08	1.92	0.25	0.15

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

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1212072001

Project: Topsoil Stockpile #4
Date Received: 12/5/2012

Date Reported: 1/25/2013
Work Order: S1212072

Lab ID	Sample ID	Sand	Silt	Clay	Texture	Very Fine Sand	CO3	Total Carbon	TOC
		%	%	%		%	%	%	%
S1212072-001	Topsoil Pit 8&9	41.0	30.0	29.0	Clay Loam	7.4	10.6	3.0	1.7

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

Soil Analysis Report
Alton Coal Development
463 North 100 West, Suite 1
Cedar City, UT 84721

Project ID: Topsoil Stockpile #4
Date Received: 12/5/2012

Report ID: S1212072001
Date Reported: 1/25/2013
Work Order: S1212072

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	Description
S1212072-001	Topsoil Pit 8&9	3.2	41.0	30.0	29.0	7.4	Clay Loam	0.14	1	4	2655.4	

These Results apply only to the samples tested.

Reviewed by: Karen Secor
Karen Secor, Soil Lab Supervisor

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1308185002
(Replaces S1308185001)
Date Reported: 10/9/2013
Work Order: S1308185

Project: Coal Hollow Mine
Date Received: 8/13/2013

Live hauled to 2013 Reclamation N.W.

Lab ID	Sample ID	pH	Saturation	Electrical Conductivity	Field Capacity	Wilt Point	Organic Matter	PE Calcium	PE Magnesium	PE Sodium	SAR
		s.u.	%	dS/m	%	%	%	meq/L	meq/L	meq/L	
S1308185-001	Topsoil Pit 27&28 (7/6/13)	7.7	58.5	0.61	40.0	29.1	2.9	3.06	1.25	2.00	1.36
S1308185-002	Topsoil Pit 27&28 (7/27/13)	7.9	48.7	0.85	32.9	21.2	3.5	1.98	5.01	1.61	0.86

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

Your Environmental Monit_ _g Partner

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1308185002
(Replaces S1308185001)
Date Reported: 10/9/2013
Work Order: S1308185

Project: Coal Hollow Mine
Date Received: 8/13/2013

Lab ID	Sample ID	Sand	Silt	Clay	Texture	Very Fine Sand	Nitrate (as N)	CO3	Available Phosphorus	Available Potassium
		%	%	%		%	ppm	%	ppm	ppm
S1308185-001	Topsoil Pit 27&28 (7/6/13)	20.0	35.0	45.0	Clay	1.0	1.2	9.6	5.6	299
S1308185-002	Topsoil Pit 27&28 (7/27/13)	25.0	38.8	36.3	Clay Loam	10.7	<0.1	22.3	6.6	272

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

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1308185002
(Replaces S1308185001)
Date Reported: 10/9/2013
Work Order: S1308185

Project: Coal Hollow Mine
Date Received: 8/13/2013

Lab ID	Sample ID	Total Carbon %	TOC %
S1308185-001	Topsoil Pit 27&28 (7/6/13)	1.7	0.6
S1308185-002	Topsoil Pit 27&28 (7/27/13)	3.4	0.7

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

Appendix 2-2

2015 Soil Analytical Results

Inter-Mountain Labs

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 1/6/2016

CLIENT: Alton Coal Development, LLC
Project: Coal Hollow Mine
Lab Order: S1512061

CASE NARRATIVE

Report ID: S1512061001

Samples 15TS-17, 15TS-18, 15TS-19, 15TS-20, 15TS-21, 15TS-22, 15TS-23, 15TS-24, 15TS-25, 15TS-26, 15TS-27, and 15TS-28 were received on December 3, 2015.

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

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1512061001

Project: Coal Hollow Mine

Date Received: 12/3/2015

Date Reported: 1/6/2016

Work Order: S1512061

Lab ID	Sample ID	pH s.u.	Electrical Conductivity dS/m	CO3 %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1512061-001	15TS-17	7.6	2.06	14.5	10.4	7.43	5.07	1.70
S1512061-002	15TS-18	7.6	2.03	13.6	10.3	7.65	3.94	1.31
S1512061-003	15TS-19	7.9	1.72	29.0	4.82	6.14	6.51	2.78
S1512061-004	15TS-20	7.8	2.49	16.7	7.95	8.44	9.85	3.44
S1512061-005	15TS-21	7.7	2.60	17.9	10.5	9.11	9.13	2.92
S1512061-006	15TS-22	7.7	1.91	14.9	9.80	7.28	3.87	1.32
S1512061-007	15TS-23	7.8	2.14	16.0	9.15	7.25	6.54	2.28
S1512061-008	15TS-24	7.9	1.89	23.4	6.14	9.50	4.08	1.46
S1512061-009	15TS-25	8.3	0.49	19.9	2.16	2.96	1.64	1.02
S1512061-010	15TS-26	8.1	0.52	21.3	1.80	1.81	1.36	1.01
S1512061-011	15TS-27	8.0	1.62	19.3	6.13	6.90	2.98	1.17
S1512061-012	15TS-28	8.1	0.52	12.5	2.38	1.73	1.63	1.14

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

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1512061001

Project: Coal Hollow Mine
Date Received: 12/3/2015

Date Reported: 1/6/2016
Work Order: S1512061

Lab ID	Sample ID	Sand %	Silt %	Clay %	Texture	Potassium ppm	Phosphorus ppm	Nitrate(as N) ppm
S1512061-001	15TS-17	38.0	30.0	32.0	Clay Loam	293	14	6.3
S1512061-002	15TS-18	38.0	30.0	32.0	Clay Loam	295	13	14.4
S1512061-003	15TS-19	28.0	38.0	34.0	Clay Loam	232	10	4.9
S1512061-004	15TS-20	36.0	34.0	30.0	Clay Loam	280	8	3.2
S1512061-005	15TS-21	40.0	31.0	29.0	Clay Loam	242	10	8.5
S1512061-006	15TS-22	36.0	32.0	32.0	Clay Loam	299	9	9.7
S1512061-007	15TS-23	34.0	32.0	34.0	Clay Loam	294	8	10.8
S1512061-008	15TS-24	28.0	39.0	33.0	Clay Loam	255	15	5.4
S1512061-009	15TS-25	28.0	35.0	37.0	Clay Loam	285	9	0.8
S1512061-010	15TS-26	30.0	32.0	38.0	Clay Loam	256	8	1.2
S1512061-011	15TS-27	32.0	32.0	36.0	Clay Loam	269	10	0.8
S1512061-012	15TS-28	16.0	32.0	52.0	Clay	342	12	1.4

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

Date: 9/22/2015

CLIENT: Alton Coal Development, LLC
Project: Coal Hollow Mine
Lab Order: S1508166

CASE NARRATIVE

Report ID: S1508166001

Samples 15TS-1, 15TS-10, 15TS-11, 15TS-12, 15TS-13, 15TS-14, 15TS-15, 15TS-16, 15TS-2, 15TS-3, 15TS-4, 15TS-5, 15TS-6, 15TS-8, and 15TS-9 were received on August 11, 2015.

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

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1508166001

Project: Coal Hollow Mine

Date Received: 8/11/2015

Date Reported: 9/22/2015

Work Order: S1508166

Lab ID	Sample ID	pH s.u.	Electrical Conductivity dS/m	CO3 %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1508166-001	15TS-1	7.9	0.80	21.8	2.66	4.51	2.17	1.15
S1508166-002	15TS-2	7.9	0.89	19.6	3.14	4.08	1.93	1.01
S1508166-003	15TS-3	7.9	1.07	18.8	4.42	4.07	3.09	1.50
S1508166-004	15TS-4	8.1	2.02	22.4	6.76	11.8	7.91	2.60
S1508166-005	15TS-5	8.1	2.05	25.0	11.2	16.1	4.37	1.18
S1508166-006	15TS-6	7.9	0.77	15.7	3.62	3.01	1.95	1.07
S1508166-007	15TS-8	7.8	1.36	19.8	8.03	6.61	2.34	0.86
S1508166-008	15TS-9	7.9	2.13	25.6	12.8	12.7	5.82	1.63
S1508166-009	15TS-10	7.9	1.78	16.6	9.22	9.81	7.18	2.33
S1508166-010	15TS-11	8.0	1.28	22.5	4.12	6.00	4.90	2.18
S1508166-011	15TS-12	7.9	1.57	20.0	7.06	7.57	5.61	2.08
S1508166-012	15TS-13	7.8	0.61	13.6	3.21	2.94	1.21	0.69
S1508166-013	15TS-14	8.0	1.65	27.5	6.93	8.20	5.92	2.15
S1508166-014	15TS-15	8.0	2.34	23.6	9.44	9.94	12.3	3.96
S1508166-015	15TS-16	8.0	0.84	14.5	4.59	3.19	2.93	1.48

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

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1508166001

Project: Coal Hollow Mine

Date Received: 8/11/2015

Date Reported: 9/22/2015

Work Order: S1508166

Lab ID	Sample ID	Sand %	Silt %	Clay %	Texture	Phosphorus ppm	Available Potassium ppm	Nitrate(as N) ppm
S1508166-001	15TS-1	20.0	43.0	37.0	Clay Loam	20	331	5.2
S1508166-002	15TS-2	22.0	39.0	39.0	Clay Loam	18	467	9.0
S1508166-003	15TS-3	25.0	40.0	35.0	Clay Loam	24	337	4.3
S1508166-004	15TS-4	23.0	40.0	37.0	Clay Loam	22	377	6.8
S1508166-005	15TS-5	21.0	39.0	40.0	Clay	18	314	17.3
S1508166-006	15TS-6	37.0	33.0	30.0	Clay Loam	31	369	5.9
S1508166-007	15TS-8	20.0	39.0	41.0	Clay	52	474	5.2
S1508166-008	15TS-9	23.0	38.0	39.0	Clay Loam	32	333	9.8
S1508166-009	15TS-10	17.0	42.0	41.0	Silty Clay	24	463	18.7
S1508166-010	15TS-11	24.0	39.0	37.0	Clay Loam	48	421	9.6
S1508166-011	15TS-12	12.0	45.0	43.0	Silty Clay	47	553	7.3
S1508166-012	15TS-13	16.0	40.0	44.0	Silty Clay	24	469	3.2
S1508166-013	15TS-14	13.0	47.0	40.0	Silty Clay	47	385	11.5
S1508166-014	15TS-15	23.0	39.0	38.0	Clay Loam	25	368	14.8
S1508166-015	15TS-16	22.0	36.0	42.0	Clay	28	421	4.9

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

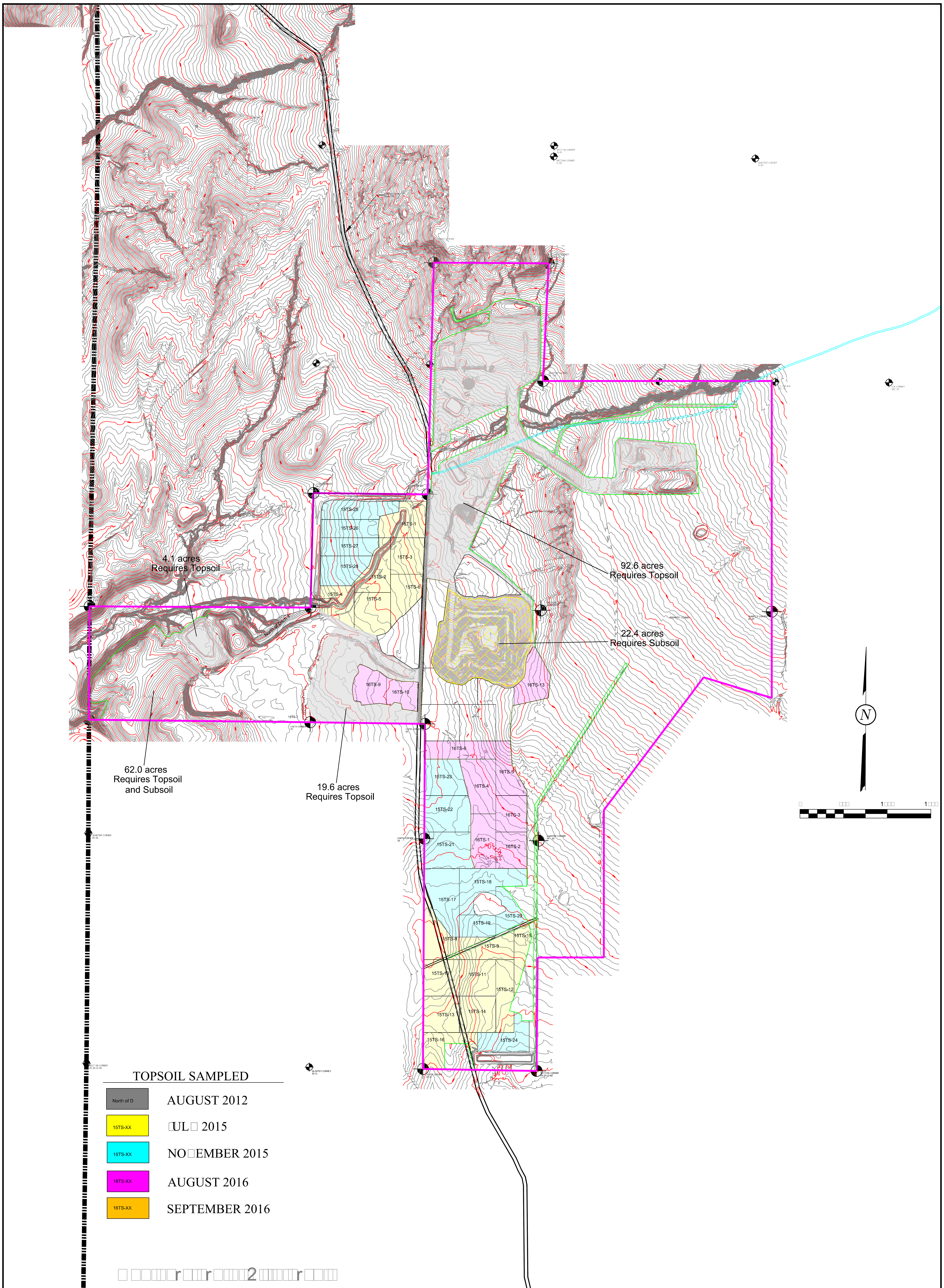
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Soil Sample Locations
and
Soil Balance



LEGEND:	DRAWN BY: K NICHOLES	CHECKED BY: LWJ	REVISIONS		TOPSOIL SAMPLING LOCATIONS
PERMIT BOUNDARY	DRAWING:	DATE: 10/17/2015	DATE:	BY:	
PRIVATE COAL OWNERSHIP	FIGURE 1	SCALE: 1" = 500' Printed on 24"x 36"	□□3□□	□N	COAL HOLLOW PROJECT ALTON, UTAH
SECTION LINE	JOB NUMBER: 1400	SHEET	□3□3□7	□N	□IGURE □
FOUND SECTION CORNER					
FOUND PROPERTY CORNER					
BONDED AREA					

Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

Topsoil and Subsoil Balance Sheet for the Coal Hollow Mine

Topsoil Balance 8/16/2016 Current Foot Print - Borrow Foot Print						
	Placed in Reclamation				Available Stockpiled	
	sqft	depth	cuyds	acres	Topsoil	cuyds
East CRoad	4249568	0.67	104,928	97.56	#1	25,289
West CRoad	1083408	0.67	26,751	24.9	#2	137,021
Pond 3	180435	0.67	4,455	4.1		
			136,134			**162,310**
					Surplus/Deficit	**26,176**

Subsoil Balance 8/16/2016 -Borrow Foot Print						
	Placed in Reclamation				Available Stockpiled	
	sqft	depth	cuyds	acres	Subsoil	cuyds
Facilities	0	3.3	-	0.0	#1	23,011
pit 10	975430	3.3	119,219	22.4	#2	87,397
spoil	0	3.3	-	0.0		
			119,219			**110,408**
					Surplus/Deficit	**(8,811)**

Topsoil Balance 8/16/2016 Pit 10 Borrow Area						
	Placed in Reclamation				Available Stockpiled	
	sqft	depth	cuyds	acres	Topsoil	cuyds
Pit 10 Borrow	2700115	0.67	66,670	62.0	#6	73,446
			66,670			**73,446**
					Surplus/Deficit	**6,776**
					Topsoil Grand Total Surplus/Deficit	**32,953**

Subsoil Balance 8/16/2016 Pit 10 Borrow Area						
	Placed in Reclamation				Available Stockpiled	
	sqft	depth	cuyds	acres	Subsoil	cuyds
Pit 10 Borrow	2700115	3.3	330,014	62.0	#4	374,627
			330,014			**374,627**
					Surplus/Deficit	**44,613**
					Subsoil Grand Total Surplus/Deficit	**35,802**

Table 1

APPENDIX 2-6

North Private Lease
NRCS Concurrence with Prime Farmland Designation

USDA
United States Department of Agriculture

December 7, 2016

Ms. Priscilla Burton, MS, CPSSc
Environmental Scientist III
Utah Division of Oil, Gas & Mining
Price Field Office
319 North Carbonville Road #C
Price, Utah 84501-2351

Reference: North Private Lease Soil Survey

Dear Ms. Burton:

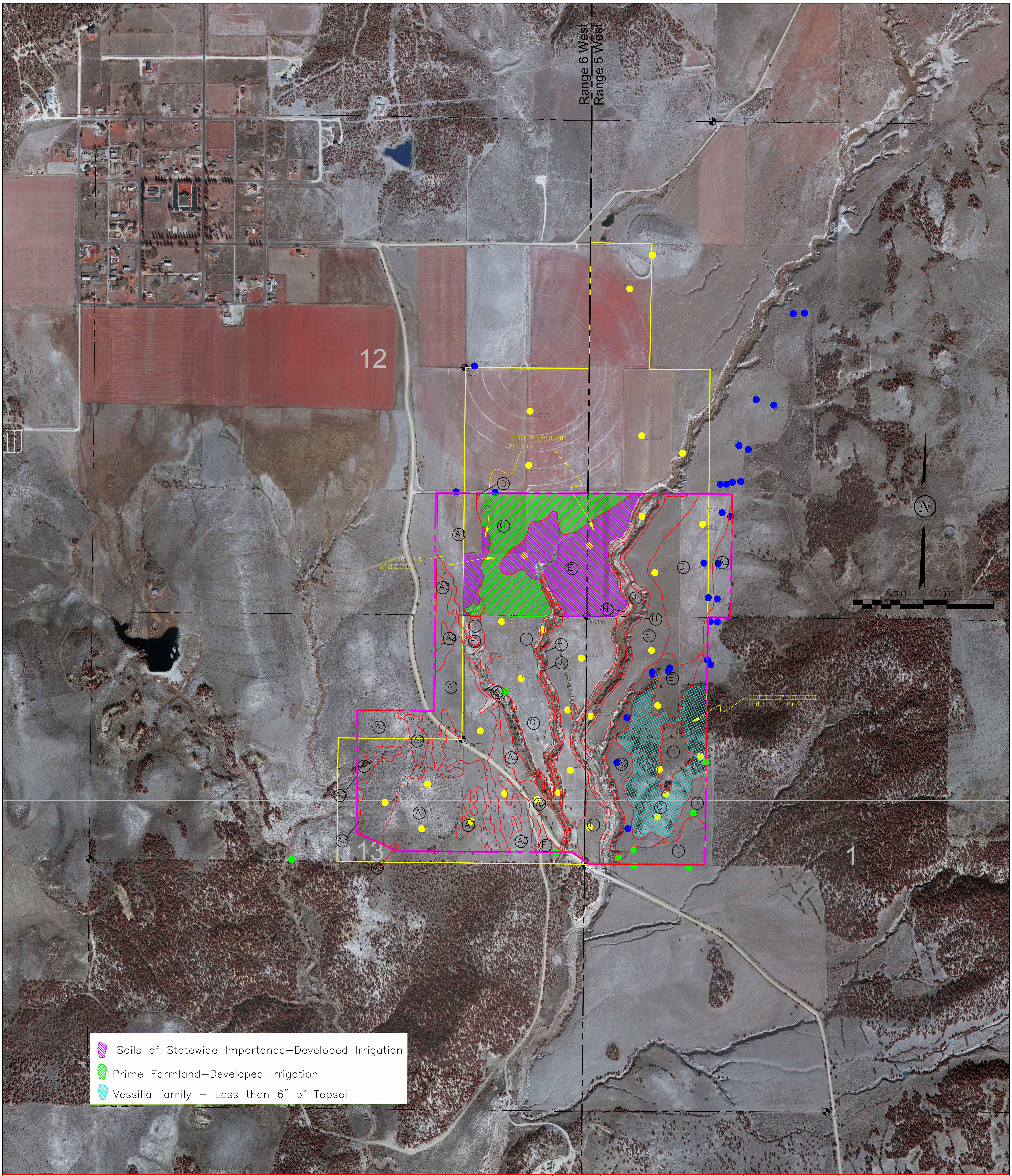
This letter is in response to your request regarding the use of the Long Resource Consultants soil survey for determining the extent of Prime Farmlands in the North Private Lease Expansion. The Long Resource Consultants soil survey is more detailed than the draft NRCS soil survey. It would be appropriate to use the "Order 2 Soil Survey of the North Private Lease Expansion of the Coal Hollow Mine" provided by Long Resource Consultants, Inc.

Sincerely,

Michael Domeier

MICHAEL DOMEIER
State Soil Scientist

Natural Resources Conservation Service
125 South State St., Room 4010, Salt Lake City, UT 84138
Voice 801 524-4550 Fax 1-844-715-4928



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[illegible]	[illegible]	1[illegible]	2[illegible]		
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[illegible]	[illegible]		1[illegible]		
[illegible]	[illegible]	12	3[illegible]	[illegible]	
[illegible]	[illegible]				

LEGEND:

PERMIT BOUNDARY

PRIVATE COAL OWNERSHIP

SECTION LINE

FOUND SECTION CORNER

SOILS PIT

DP HOLES 2012

NOVEMBER 2013

2012 & 2014 SOIL PITS

DRAWN BY:	CHECKED BY:
K. NICHOLES	B. LONG
DRAWING: 2-3	DATE: 7/30/14
	SCALE: 1" = 500' Printed on 24" x 36"
JOB NUMBER: 0001	SHEET

REVISIONS	
DATE:	BY:
[illegible]	[illegible]N
[illegible]	[illegible]N
[illegible]	[illegible]N
[illegible]	[illegible]N

SOIL SURVEY MAP

NORTH COAL HOLLOW PROJECT ALTON, UTAH

DRAWING: [illegible]-3

Alton Coal Development
Coal Hollow Project

North Private Lease Areas 1, 2 & 3 Subsoil & Topsoil Salvage Quantities

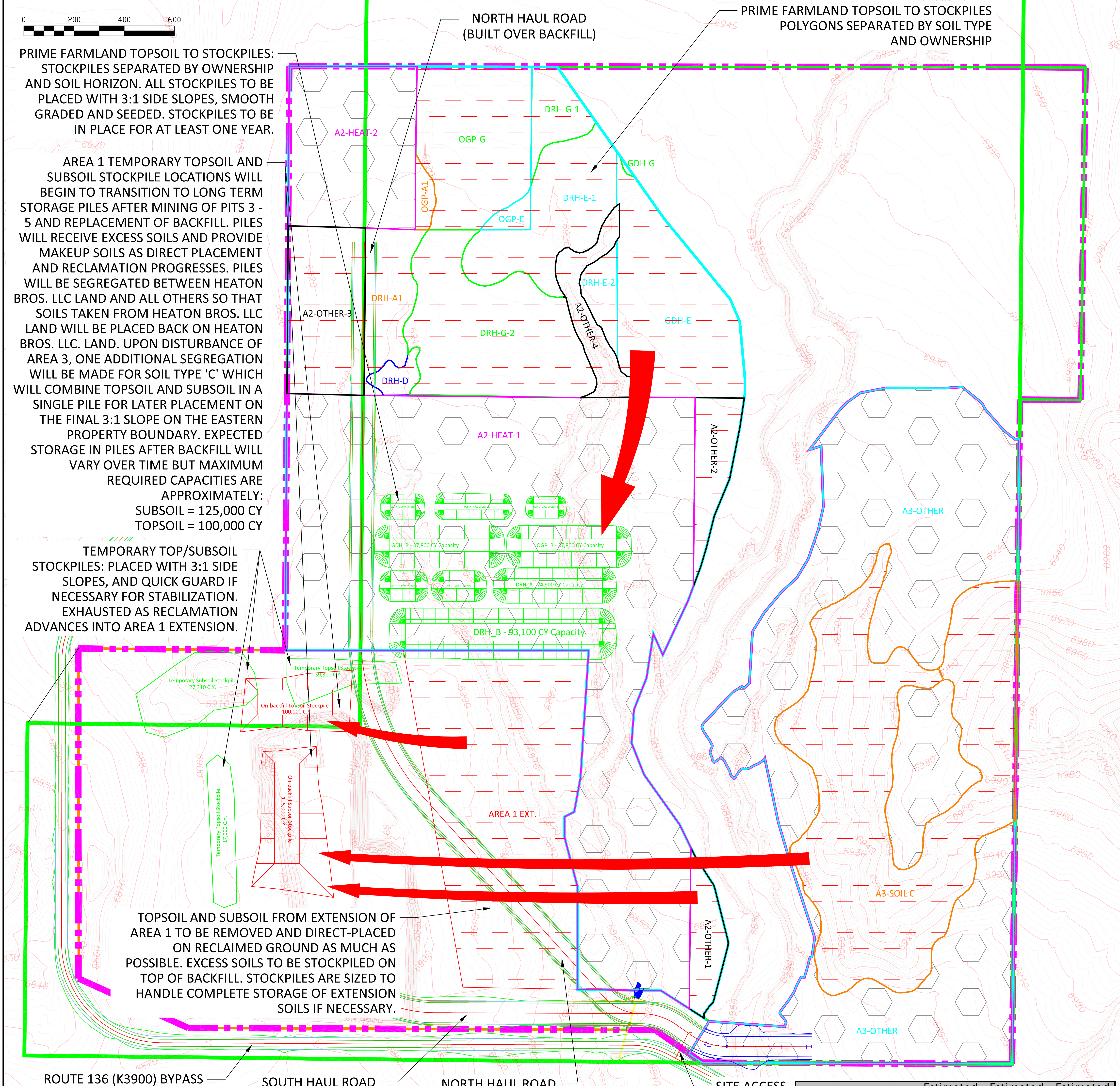
Polygon	Area (sq. ft)	Area (Acres)	Topsoil Salvage Depth (ft)*	Subsoil Salvage Depth (ft)*	Topsoil Salvage Volume (CY)	Subsoil Salvage Volume (CY)	Movement Designation
A1-Extension (Heaton Soils)	777,984	17.86	1.08	2.73	31,119	78,663	Heaton Piles
A2-HEAT-1	2,111,728	48.48	1.03	2.88	80,167	225,512	Direct Haul
A2-HEAT-2	325,574	7.47	1.15	2.61	13,867	31,452	Direct Haul
A2-OTHER-1	68,089	1.56	1.55	2.45	3,909	6,178	Other Piles
A2-OTHER-2	83,480	1.92	1.08	2.92	3,350	9,018	Other Piles
A2-OTHER-3	205,461	4.72	1.14	2.61	8,688	19,849	Other Piles
A2-OTHER-4	79,152	1.82	0.97	3.03	2,834	8,892	Other Piles
A3-SOIL C	916,106	21.03	0.18	1.46	6,107	49,538	'C' Pile
A3-OTHER	1,576,899	36.20	0.94	1.96	54,997	114,374	Direct Haul

* Weighted average salvage depth from soil types composite within Area/Ownership polygons - See Dwg 2-3

North Private Lease Areas 1, 2 & 3 Soil Movement Quantities

Soil Destination	Topsoil Storage/Haul Volume (CY)	Subsoil Salvage/Haul Volume (CY)
Area 1 - Stockpiles Req'd Volume	31,119	78,663
Area 2 - HEAT Direct Haul Volume	94,034	256,964
Area 2 - OTHER Stockpiles Req'd Volume	18,780	43,937
Area 3 - 'C' Stockpile Req'd Volume^	55,645	
Area 3 - OTHER Direct Haul Volume	54,997	114,374

^ Topsoil and Subsoil combined as discussed in MRP Chapter 2



Contour Interval = 2'

Permit Area 1 Disturbance	=	69.8 Acres
Permit Area 2 Disturbance	=	97.8 Acres
Permit Area 3 Disturbance	=	57.2 Acres
Total Disturbance	=	224.8 Acres
Undisturbed Area	=	70.8 Acres
Total Lease Area	=	295.6 Acres

Top/Subsoil Direct Placed for Reclaim
Top/Subsoil placed in Stockpile

Owner	Prime Farmland Area	Estimated A Horizon Salvage Quantity[1]	Estimated B Horizon Salvage Quantity[1]	Estimated C Horizon Salvage Quantity[1]
	acres	yds^3	yds^3	yds^3
DRH	17.9	17,700	88,889	6,840
GDH	7.2	5,798	36,666	3,852
OGP	6.9	7,265	34,027	2,055
Total	31.9	30,762	159,582	12,747

1. Estimated salvage volumes based on estimated horizon salvage depths listed in Table 13, Volume 11, Order 2 Soil Survey for the North Private Lease Expansion of the Coal Hollow Mine.

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 2-4
DATE: 4/10/15
SCALE: 1" = 200'
JOB NUMBER: 0001
SHEET

REVISIONS	
DATE:	BY:
10/3/16	AC
10/19/16	AC
11/23/16	AC
12/14/16	AC
2/2/17	AC
5/4/17	AC
6/19/17	AC

TOPSOIL HANDLING PLAN

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 2-4

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

APPENDIX 2-7

Bond Release Soil Accounting

SPL	Topsoil Stockpile #1	Topsoil Stockpile #2	Topsoil Stockpile #4	Topsoil Stockpile #6		Subsoil Stockpile #1	Subsoil Stockpile #2	Subsoil Stockpile #3	
Starting Stockpile Volume	25,289	82,905	50,916	0		73,077	211,207	0	

BRP 1-9 = 9.08 ACRES

Source	Topsoil Stockpile #1	Topsoil Stockpile #2	Topsoil Stockpile #4	Topsoil Stockpile #6	Total Topsoil	Subsoil Stockpile #1	Subsoil Stockpile #2	Subsoil Stockpile #3	Total Subsoil
		CY	CY	CY	CY	CY	CY	CY	CY
Stockpile volume utilized	0	0	9,761	0	9,761	0	48,806	0	48,806
Remaining stockpile volume	25,289	82,905	41,155	0		73,077	162,401	0	

Other Areas Soiled from 3/1/16 to 12/14/16

Source	Topsoil Stockpile #1	Topsoil Stockpile #2	Topsoil Stockpile #4	Topsoil Stockpile #6	Total Topsoil	Subsoil Stockpile #1	Subsoil Stockpile #2	Subsoil Stockpile #3	Total Subsoil
		CY	CY	CY	CY	CY	CY	CY	CY
Stockpile used other areas*	0	9,728	41,155	0	50,883	0	60,886	0	60,886
Remaining stockpile volume	25,289	73,177	0	0		73,077	101,515		

*Topsoil and Subsoil placed in ROBINSON, SURF8 HAUL MAINT, PIT 4, PIT 7, PIT 8, PIT 9-B, HWT1-B, SURF-5, HWT 2-A and PIT20-B as shown on Drawing 5-19

NPL AREA 1	Topsoil Stockpile	Subsoil Stockpile
Starting Stockpile Volume	74,953	41,378

BRP 1-10 = 12.21 ACRES

Source	NL Topsoil	Livehaul Topsoil*	Total Topsoil	NL Subsoil	Livehaul Subsoil	Total Subsoil	
	CY	CY	CY	CY	CY	CY	CY
Stockpile volume utilized	18,784	0	18,784	14,071	8,459	22,530	
Suitable spoil**							33,283
Remaining stockpile volume	56,169			27,307			

*Livehaul source: Area 1

**Suitable Spoil: Surface two feet of 9.38 acres represented by Soil Sample Pits 1, 2, and 3.5N

***Average topsoil cover depth 1.08 ft.

****Subsoil redistribution depth as shown on Drawing 5-76a

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 9/15/2016

CLIENT: Alton Coal Development, LLC
Project: Coal Hollow Reclamation
Lab Order: S1608480

CASE NARRATIVE

Report ID: S1608480002
(Replaces S1608480001)

Samples NPL Reclaim Soil Pit #1, NPL Reclaim Soil Pit #2, NPL Reclaim Soil Pit #3, and Pond 3 Sludge were received on August 29, 2016.

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
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1608480002
(Replaces S1608480001)
Date Reported: 9/15/2016
Work Order: S1608480

Project: Coal Hollow Reclamation
Date Received: 8/29/2016

Lab ID	Sample ID	Depths Feet	pH s.u.	Saturation %	Electrical Conductivity dS/m	Field Capacity %	Wilting Point %	Organic Matter LOI %	CaCO3 %
S1608480-001	NPL Reclaim Soil Pit #1	0-1	7.7	106	5.26	48.6	31.1	4.2	5.1
S1608480-002	NPL Reclaim Soil Pit #1	1-2	7.7	87.7	5.67	49.6	34.7	2.5	4.1
S1608480-003	NPL Reclaim Soil Pit #1	2-3	7.7	94.5	6.36	48.4	34.8	2.2	2.6
S1608480-004	NPL Reclaim Soil Pit #2	0-1	7.5	65.4	4.21	38.6	25.2	2.7	13.3
S1608480-005	NPL Reclaim Soil Pit #2	1-2	7.7	68.7	3.96	37.7	25.2	2.4	13.9
S1608480-006	NPL Reclaim Soil Pit #2	2-3	8.0	108	5.66	39.5	32.5	2.6	6.1
S1608480-007	NPL Reclaim Soil Pit #3	0-1	7.8	110	6.18	52.2	38.8	2.6	1.6
S1608480-008	NPL Reclaim Soil Pit #3	1-2	7.8	120	6.70	53.9	36.7	2.0	3.1
S1608480-009	NPL Reclaim Soil Pit #3	2-3	7.9	114	7.05	57.2	37.4	1.8	2.2
S1608480-010	Pond 3 Sludge	0-0	7.9	51.5	2.82	34.8	17.9	5.8	11.2

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
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1608480002
(Replaces S1608480001)
Date Reported: 9/15/2016
Work Order: S1608480

Project: Coal Hollow Reclamation
Date Received: 8/29/2016

Lab ID	Sample ID	Depths Feet	Calcium PE meq/L	Magnesium PE meq/L	Potassium PE meq/L	Sodium PE meq/L	SAR
S1608480-001	NPL Reclaim Soil Pit #1	0-1	16.9	12.0	0.73	50.7	13.4
S1608480-002	NPL Reclaim Soil Pit #1	1-2	19.7	17.0	0.86	49.5	11.5
S1608480-003	NPL Reclaim Soil Pit #1	2-3	17.3	19.8	1.02	61.9	14.4
S1608480-004	NPL Reclaim Soil Pit #2	0-1	22.4	13.0	0.54	26.4	6.28
S1608480-005	NPL Reclaim Soil Pit #2	1-2	22.2	12.5	0.51	23.7	5.69
S1608480-006	NPL Reclaim Soil Pit #2	2-3	14.6	12.8	0.78	56.0	15.1
S1608480-007	NPL Reclaim Soil Pit #3	0-1	15.3	15.0	0.92	61.2	15.7
S1608480-008	NPL Reclaim Soil Pit #3	1-2	17.0	14.5	0.95	68.9	17.4
S1608480-009	NPL Reclaim Soil Pit #3	2-3	20.0	16.1	1.11	84.1	19.8
S1608480-010	Pond 3 Sludge	0-0	8.06	5.80	0.53	21.4	8.13

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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Your Environmental Monitoring Partner
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Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1608480002
(Replaces S1608480001)
Date Reported: 9/15/2016
Work Order: S1608480

Project: Coal Hollow Reclamation
Date Received: 8/29/2016

Lab ID	Sample ID	Depths Feet	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	Selenium ppm	Total Carbon %	TOC %
S1608480-001	NPL Reclaim Soil Pit #1	0-1	17.0	33.0	50.0	Clay	10.5	1.62	0.06	2.3	1.6
S1608480-002	NPL Reclaim Soil Pit #1	1-2	13.0	35.0	52.0	Clay	8.0	1.29	0.06	1.0	0.5
S1608480-003	NPL Reclaim Soil Pit #1	2-3	15.0	35.0	50.0	Clay	9.7	1.17	0.07	0.7	0.4
S1608480-004	NPL Reclaim Soil Pit #2	0-1	11.0	37.0	52.0	Clay	6.2	1.45	0.04	2.6	1.0
S1608480-005	NPL Reclaim Soil Pit #2	1-2	13.0	35.0	52.0	Clay	8.6	1.53	0.05	2.3	0.7
S1608480-006	NPL Reclaim Soil Pit #2	2-3	15.0	33.0	52.0	Clay	9.5	1.09	0.03	1.6	0.9
S1608480-007	NPL Reclaim Soil Pit #3	0-1	13.0	31.0	56.0	Silty Clay	8.5	0.84	0.09	0.9	0.7
S1608480-008	NPL Reclaim Soil Pit #3	1-2	13.0	33.0	54.0	Clay	8.2	0.88	0.05	0.7	0.3
S1608480-009	NPL Reclaim Soil Pit #3	2-3	13.0	35.0	52.0	Clay	8.0	0.92	0.07	0.5	0.2
S1608480-010	Pond 3 Sludge	0-0	37.0	31.0	32.0	Clay Loam	13.9	2.49	<0.02	5.1	3.7

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

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1608480002
(Replaces S1608480001)
Date Reported: 9/15/2016
Work Order: S1608480

Project: Coal Hollow Reclamation
Date Received: 8/29/2016

Lab ID	Sample ID	Depths Feet	Total Sulfur %	T.S. AB t/1000t	Neutral. Potential t/1000t	T.S. ABP t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	PyriticS AB t/1000t	PyriticS ABP t/1000t
S1608480-001	NPL Reclaim Soil Pit #1	0-1	0.55	17.2	51.3	34.1					
S1608480-002	NPL Reclaim Soil Pit #1	1-2	0.62	19.4	41.1	21.7					
S1608480-003	NPL Reclaim Soil Pit #1	2-3	0.86	27.0	26.0	-1.00	0.84	0.01	0.01	0.40	25.6
S1608480-004	NPL Reclaim Soil Pit #2	0-1	0.40	12.4	133	120					
S1608480-005	NPL Reclaim Soil Pit #2	1-2	0.29	8.89	139	130					
S1608480-006	NPL Reclaim Soil Pit #2	2-3	0.59	18.4	60.7	42.3					
S1608480-007	NPL Reclaim Soil Pit #3	0-1	0.51	15.8	15.8	0.04					
S1608480-008	NPL Reclaim Soil Pit #3	1-2	0.75	23.4	30.6	7.28					
S1608480-009	NPL Reclaim Soil Pit #3	2-3	0.41	12.8	21.6	8.78					
S1608480-010	Pond 3 Sludge	0-0	0.24	7.37	112	104					

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

Soil Analysis Report
Alton Coal Development
463 North 100 West, Suite 100
Cedar City, UT 84721

Project ID: Coal Hollow Reclamation
Date Received: 8/29/2016

Report ID: S1608480001
Date Reported: 9/12/2016
Work Order: S1608480

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	Description
S1608480-001	NPL #1 (0-1)	4.2	17.0	33.0	50.0	10.5	Clay	0.18	2	6	2175.0	
S1608480-002	NPL #1 (1-2)	2.5	13.0	35.0	52.0	8.0	Clay	0.19	2	6	2064.0	
S1608480-003	NPL #1 (2-3)	2.2	15.0	35.0	50.0	9.7	Clay	0.21	2	6	2235.0	
S1608480-004	NPL #2 (0-1)	2.7	11.0	37.0	52.0	6.2	Clay	0.19	2	6	2073.6	
S1608480-005	NPL #2 (1-2)	2.4	13.0	35.0	52.0	8.6	Clay	0.20	2	6	2092.8	
S1608480-006	NPL #2 (2-3)	2.5	15.0	33.0	52.0	9.5	Clay	0.19	2	6	2040.0	
S1608480-007	NPL #3 (0-1)	2.6	13.0	31.0	56.0	8.5	Silty Clay	0.17	2	6	1738.0	
S1608480-008	NPL #3 (1-2)	1.9	13.0	33.0	54.0	8.2	Clay	0.19	2	6	1895.2	
S1608480-009	NPL #3 (2-3)	1.8	13.0	35.0	52.0	8.0	Clay	0.20	2	6	2064.0	
S1608480-010	Pond 3 Sludge	5.8	37.0	31.0	32.0	13.9	Clay Loam	0.15	2	4	3053.2	

These Results apply only to the samples tested.

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

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This is a legal document: any misrepresentation may be construed as fraud.

Page 1 of 1

168150

Client Name: Alton Coal Development, LLC
Project Identification: Coal Hollow Reclamation
Sampler (Signature/Attestation of Authenticity): B. Kirk Nicholes
Telephone #: 435-691-1551
Report Address: 463 N 100 W Suite 1, Cedar City, Utah 84721
Contact Name: Kirk Nicholes
Email: knicholes@altoncoal.com
Phone: 435691-1551
Invoice Address: Same
Purchase Order #:
Quote #:

ANALYSES / PARAMETERS

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME	SAMPLE IDENTIFICATION	Matrix	# of Containers	Saturation %	pH	EC (ms/cm 25°C)	SAR	% CaCO3	Texture	Total Organic Carbon	Available Water Capacity	K-factor	Soluble Na, K, Mg, Ca	REMARKS
1	S1608480-001	8/24/16		NPL Reclaim Soil Pit #1 0'-1'	SL	1	X	X	X	X	X	X	X	X	X	X	
2	-002			" " " " #1 1'-2'		1	X	X	X	X	X	X	X	X	X	X	
3	-003			" " " " #1 2'-3'		1	X	X	X	X	X	X	X	X	X	X	
4	-004			" " " " #2 0'-1'		1	X	X	X	X	X	X	X	X	X	X	
5	-005			" " " " #2 1'-2'		1	X	X	X	X	X	X	X	X	X	X	
6	-006			" " " " #2 2'-3'		1	X	X	X	X	X	X	X	X	X	X	
7	-007			" " " " #3 0'-1'		1	X	X	X	X	X	X	X	X	X	X	
8	-008			" " " " #3 1'-2'		1	X	X	X	X	X	X	X	X	X	X	
9	-009			" " " " #3 2'-3'		1	X	X	X	X	X	X	X	X	X	X	
10	-010			Pond 3 Sludge		1	X	X	X	X	X	X	X	X	X	X	
11																	
12																	
13																	
14																	

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
	B. Kirk Nicholes / B. Kirk Nicholes	8/25/16	8:00am	Karen A Secor	8/29/16	0850

SHIPPING INFO
- ☒ UPS
- ☐ Fed Express
- ☐ US Mail
- ☐ Hand Carried
- ☐ Other ________

MATRIX CODES

Water	WT
Soil	SL
Solid	SD
Filter	FT
Other	OT

TURNAROUND TIMES
Check desired service
- ☒ Standard turnaround
- ☐ **RUSH - 5 Working Days**
- ☐ **URGENT - < 2 Working Days**

Rush & Urgent Surcharges will be applied

COMPLIANCE INFORMATION
Compliance Monitoring? Y / N
Program (SDWA, NPDES,...)
PWSID / Permit #
Chlorinated? Y / N
Sample Disposal: Lab Client

ADDITIONAL REMARKS

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 9/22/2016

CLIENT: Alton Coal Development, LLC
Project: Coal Hollow Reclamation
Lab Order: S1609242

CASE NARRATIVE

Report ID: S1609242001

Samples NPL Reclaim Soil Pit #3.5E, and NPL Reclaim Soil Pit #3.5N were received on September 15, 2016.

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
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1609242001
Date Reported: 9/22/2016
Work Order: S1609242

Project: Coal Hollow Reclamation
Date Received: 9/15/2016

Lab ID	Sample ID	Depths Feet	pH s.u.	Saturation %	Electrical Conductivity dS/m	Field Capacity %	Wilting Point %	Organic Matter LOI %	CaCO3 %
S1609242-001	NPL Reclaim Soil Pit #3.5N	0-1	7.7	89.9	3.67	33.1	27.2	1.9	12.9
S1609242-002	NPL Reclaim Soil Pit #3.5N	1-2	7.6	91.7	4.65	38.1	30.1	3.0	7.9
S1609242-003	NPL Reclaim Soil Pit #3.5N	2-3	7.7	85.2	4.20	40.4	29.3	2.4	10.0
S1609242-004	NPL Reclaim Soil Pit #3.5E	0-1	7.9	124	6.30	45.0	32.8	1.9	5.4
S1609242-005	NPL Reclaim Soil Pit #3.5E	1-2	7.8	126	5.65	42.4	30.4	2.5	5.7
S1609242-006	NPL Reclaim Soil Pit #3.5E	2-3	8.2	157	6.30	47.2	37.2	1.7	4.9

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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Your Environmental Monitoring Partner
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Soil Analysis Report

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1609242001
Date Reported: 9/22/2016
Work Order: S1609242

Project: Coal Hollow Reclamation
Date Received: 9/15/2016

Lab ID	Sample ID	Depths Feet	Calcium PE meq/L	Magnesium PE meq/L	Potassium PE meq/L	Sodium PE meq/L	SAR
S1609242-001	NPL Reclaim Soil Pit #3.5N	0-1	23.5	12.6	0.45	20.9	4.93
S1609242-002	NPL Reclaim Soil Pit #3.5N	1-2	22.8	16.3	0.65	35.9	8.11
S1609242-003	NPL Reclaim Soil Pit #3.5N	2-3	22.9	13.9	0.55	28.8	6.72
S1609242-004	NPL Reclaim Soil Pit #3.5E	0-1	19.4	11.4	0.84	68.5	17.4
S1609242-005	NPL Reclaim Soil Pit #3.5E	1-2	20.5	12.0	0.81	56.8	14.1
S1609242-006	NPL Reclaim Soil Pit #3.5E	2-3	16.8	9.05	0.80	70.0	19.5

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

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Karen Secor, Soil Lab Supervisor

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Soil Analysis Report

Alton Coal Development, LLC

463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1609242001

Project: Coal Hollow Reclamation

Date Received: 9/15/2016

Date Reported: 9/22/2016

Work Order: S1609242

Lab ID	Sample ID	Depths Feet	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	Boron ppm	Selenium ppm	Total Carbon %	TOC %
S1609242-001	NPL Reclaim Soil Pit #3.5N	0-1	12.0	38.0	50.0	Clay	7.9	1.33	0.04	2.2	0.7
S1609242-002	NPL Reclaim Soil Pit #3.5N	1-2	12.0	37.0	51.0	Clay	6.4	1.36	0.03	2.3	1.3
S1609242-003	NPL Reclaim Soil Pit #3.5N	2-3	14.0	36.0	50.0	Clay	9.5	1.02	0.04	2.1	0.9
S1609242-004	NPL Reclaim Soil Pit #3.5E	0-1	13.0	41.0	46.0	Silty Clay	7.6	1.04	0.03	1.6	0.9
S1609242-005	NPL Reclaim Soil Pit #3.5E	1-2	13.0	40.0	47.0	Silty Clay	7.3	1.23	0.03	1.9	1.3
S1609242-006	NPL Reclaim Soil Pit #3.5E	2-3	21.0	34.0	45.0	Clay	15.6	1.12	0.03	1.3	0.7

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

Alton Coal Development, LLC
463 North 100 West
Suite 1
Cedar City, UT 84721

Report ID: S1609242001
Date Reported: 9/22/2016
Work Order: S1609242

Project: Coal Hollow Reclamation
Date Received: 9/15/2016

Lab ID	Sample ID	Depths Feet	Total Sulfur %	T.S. AB t/1000t	Neutral. Potential t/1000t	T.S. ABP t/1000t
S1609242-001	NPL Reclaim Soil Pit #3.5N	0-1	0.12	3.82	129	125
S1609242-002	NPL Reclaim Soil Pit #3.5N	1-2	0.37	11.4	79.0	67.6
S1609242-003	NPL Reclaim Soil Pit #3.5N	2-3	0.22	6.93	100	93.2
S1609242-004	NPL Reclaim Soil Pit #3.5E	0-1	0.57	17.7	54.3	36.7
S1609242-005	NPL Reclaim Soil Pit #3.5E	1-2	0.45	14.0	57.1	43.1
S1609242-006	NPL Reclaim Soil Pit #3.5E	2-3	0.51	15.8	48.8	33.0

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

Soil Analysis Report
Alton Coal Development
463 North 100 West, Suite 100
Cedar City, UT 84721

Project ID: Coal Hollow Reclamation
Date Received: 9/15/2016

Report ID: S16092420001
Date Reported: 9/22/2016
Work Order: S1609242

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	Description
S1609242-001	NPL #3.5N (0-1)	1.9	12.0	38.0	50.0	7.9	Clay	0.25	3	6	2295.0	
S1609242-002	NPL #3.5N (1-2)	3.0	12.0	37.0	51.0	6.4	Clay	0.19	2	6	2126.6	
S1609242-003	NPL #3.5N (2-3)	2.4	14.0	36.0	50.0	9.5	Clay	0.21	2	6	2275.0	
S1609242-004	NPL #3.5E (0-1)	1.9	13.0	41.0	46.0	7.6	Silty Clay	0.21	1	6	2624.4	
S1609242-005	NPL #3.5E (1-2)	2.5	13.0	40.0	47.0	7.3	Silty Clay	0.22	2	6	2506.9	
S1609242-006	NPL #3.5E (2-3)	1.7	21.0	34.0	45.0	15.6	Clay	0.25	2	6	2728.0	

These Results apply only to the samples tested.

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Inter-Mountain Labs, Inc.
Sheridan, WY and Gillette, WY

INTER-MOUNTAIN LABS

- CHAIN OF COUSTODY RECORD -

All shaded fields must be completed.
This is a legal document; any misrepresentation may be construed as fraud.

\# WEB Alton 091516

Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #
Alton Coal Development, LLC	Coal Hollow Mine	B. Kirk Nichols	435-691-1551

Report Address: 463 N 100 W, Suite 1
Cedar City, Utah 84721

Contact Name and Email:
Voice
FAX

Invoice Address: Same

Purchase Order #:
Quote #:

ANALYSES / PARAMETERS

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	% Saturation	pH	EC	SAR	% CaCO3	Texture	Total Organic Carbon	Available Water	K-Factor	Soluble Na, K, Mg	Acid Base Potential	Soluble Selenium	Available Boron	REMARKS
1	S1609242	6-13-16	14:30	NPL Reclaim Soil Pit #3.5N 0'-1'	SL	1														
2				1'-2'		1														
3				2'-3'		1														
4				NPL Reclaim Soil Pit #3.5E 0'-1		1														
5				1'-2'		1														
6				2'-3		1														
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
	B. Kirk Nichols / B. Kirk Nichols	9/14/16	7:42am	Karen Secor	9/15/16	1025

SHIPPING INFO	MATRIX CODES		TURN AROUND TIMES	COMPLIANCE INFORMATION		ADDITIONAL REMARKS
☐ UPS	Water	WT	**Check desired service**	Compliance Monitoring ?	Y / N	
☒ Fed Express	Soil	SL	☐ Standard turnaround	Program (SDWA, NPDES, ...)		
☐ US Mail	Solid	SD	☐ **RUSH** - 5 Working Days	PWSID / Permit #		
☐ Hand Carried	Trip Blank	TB	☒ **URGENT** - < 2 Working Days	Chlorinated?	Y / N	
☐ Other_______	Other	OT	***Rush & Urgent Surcharges will be applied***	Sample Disposal: Lab _____	Client _____	

R645-301-300. BIOLOGY

310. **INTRODUCTION**

The following section describes specific biological resources of the Coal Hollow Project near the town of Alton, Utah. Updates to the data sets herein will be a continuous undertaking. This chapter contains information including the following:

311. Vegetative, fish, and wildlife resources of the permit area and adjacent areas as described under R645-301-320.

312. Potential impacts to vegetative, fish and wildlife resources and methods proposed to minimize these impacts during coal mining and reclamation operations as described under R645-301-330 and R645-301-340.

313. Proposed reclamation designed to restore or enhance vegetative, fish, and wildlife resources to a condition suitable for the designated postmining land use as described under R645-301-340.

320. ENVIRONMENTAL DESCRIPTION

321. VEGETATION INFORMATION

321.100. Vegetation Mapping and Plant Community Data in the Permit Area

Coal Hollow Lease

The first vegetation map prepared for the Coal Hollow Project delineated the plant communities that existed within the original permit area. The plant communities on this early map were drafted on a USGS quadrangle map using an existing vegetation map that was prepared in the late-1980s.

A flight was conducted for the Coal Hollow Project in 2006 that provided aerial photography and more detailed information. This aerial photography and photogrammetric mapping has been used in preparation of many updated maps of the project area, including a revised vegetation map where the plant communities were delineated on the new aerial photographs. Also, new quantitative data were recorded in 2006 in some of the first plant communities proposed for disturbance along with reference areas that would *not* be disturbed. This next version of the vegetation map for the Coal Hollow project also provided sample locations of these recently studied areas. This map was submitted to DOGM in MRP submittal (*dated May 25, 2007*) along with the first vegetation quadrangle map, because it continued to provide support for some of the older vegetation data also submitted in the MRP at that time.

Like the earlier vegetation mapping information, and because the area has been studied previously, existing quantitative data sets were also available for the plant communities of the Coal Hollow Lease area. These data were recorded in the late-1980s. The aforementioned earlier quadrangle vegetation map corresponded to this early vegetation information. The early datasets were included in the MRP provided to DOGM (*submittal date: May 25, 2007*). Although this information was valuable at that time because it provided initial baseline data for that time period, plans to re-sample the same plant communities to update the existing data were made. Consequently, new quantitative sampling was accomplished later in 2007 to provide updated information about the plant communities within the permit area. The updated data have been summarized and included in this MRP. Therefore, with the 2006 and 2007 quantitative data for the plant communities submitted in the MRP, the dataset for those plant communities proposed for disturbance in the current mine plan for the entire permit area is complete. **Therefore, the older vegetation datasets and maps created using information from the late- 1980s were replaced by the updated datasets and maps in the MRP**.

Reference areas chosen to represent future revegetation success standards were also chosen and sampled during the same sample periods in 2006 and 2007 as those areas proposed for disturbance by the mining operations. The meadow reference area and the Dame Meadow Sample Area (another potential reference area) was included into the permit boundary in 2014. Although coal is to be removed from this area by undermining only and the surface will not be disturbed, the meadow reference area will be relocated during the 2014 growing season to a representative area due south of the permit boundary that does not contain coal and will not be disturbed by mining operations.

Acreage of each plant community and map symbols shown on the revised Vegetation Map *(Drawing 3-1, dated 12/26/07)* for the Coal Hollow Project permit and adjacent areas are shown below.

Vegetation Communities of the Coal Hollow Permit Area			
MAP SYMBOL (see *Vegetation Map*, Drawing 3-1)	PLANT COMMUNITY	TOTAL ACREAGE	PERCENT OF TOTAL
S/G	Sagebrush/Grass	212.00	33.64
P	Pasture Land	192.00	30.48
P-J	Pinyon-Juniper	114.00	18.10
M	Meadow	69.00	10.95
OB	Oak Brush	40.00	6.35
RB/SB	Rabbitbrush/Sagebrush (Disturbed; previously Sagebrush/Grass)	3.00	0.48
	Total*	**630.00**	100.00

Color photographs of the plant communities within the Coal Hollow Lease area are shown in **PHOTOGRAPHS** section near the end of this chapter.

The above plant communities exist within the boundaries of the Coal Hollow Lease area and will be disturbed by the coal mining and related activities. Consequently, quantitative and qualitative data were recorded by sampling the plant communities in 2006 and 2007. For general, wide-angle views of the plant communities in the permit area, refer to Photographs 3-1, 3-2, 3-3 and 3-4.

[**NOTES**: 1: The rabbitbrush/sagebrush community was not sampled for baseline data information. This small area represented less than one-half of one percent of the permit area. Moreover, it was a *previously disturbed* sagebrush/grass community. Therefore, standards of revegetation success at final reclamation will be the same as those outlined for the *undisturbed* sagebrush/grass plant communities described in this document

As mentioned other areas with similar plant communities were sampled within or near the permit area that will *not* be disturbed by mine-related activities. These native plant communities were chosen to be used as future revegetation success standards at the time of final reclamation of the mine site. Therefore, the same methods and parameters were employed in the reference areas that were used to sample the areas proposed for disturbance. The areas with like-communities sampled (the proposed disturbed area and reference area) for each community type, were compared statistically for their appropriateness as reference areas at this time. Similar comparisons (and additional comparisons) will also be conducted between the communities once the land is reclaimed. Complete results and methodologies used are shown in the final reports prepared from sampling these communities. These reports have been included in the appendices at the end of this chapter. The reports titles are: *Vegetation of the Sagebrush/Grass & Meadow Areas*: *2006* (**Appendix 3-2**) and *Vegetation Sampling in the Coal Hollow Project Area: 2007* (**Appendix 3-4**).

321.200. Productivity

Productivity measurements were recorded for the plant communities of the Coal Hollow Permit Area and The North Private Lease and are located in Appendix 3-2 table 3-34 and ~~Volume 12~~Appendix 3-9 table 43 respectively.

Table 3-34: Production of Plant Communities in the Coal Hollow Permit Area
(1) *Estimates* (from soil and approx. vegetation types) - Source: U.S. Department of Agriculture SCS (NRCS). July 1990. Soil Survey of Panguitch area, Utah: Parts of Garfield, Iron, Kane, and Piute Counties
(2) *Actual measurements*. - Source: Cedar Creek Associates (1986) *in* Mine Permit Application. 1987. Utah International, Inc., Alton Coal Project, Alton, Utah.
(*) *Estimates* - Source: Fieldwork during 2007 by Mt. Nebo Scientific, Inc.

MAP SYMBOL (see *Vegetation Map*, Drawing 3-1)	PLANT COMMUNITY	Pounds/Acre (1)	Pounds/Acre (2)
SB	Sagebrush/Grass	750	762
P	Pasture Land (*)	1100	1100
M	Meadow	2000	2121
P-J	Pinyon-Juniper	50	33
OB	Oak Brush [*called Mountain Brush* (2)]	1500	1471
RB/SB	Rabbitbrush/Sagebrush (*)	700	700

North Private Lease

Plant communities within the North Private Lease study area were first mapped in the field in 2014. The general plant community types within the survey area are shown on **Drawing 3-1 T**he majority of the area was comprised of rangelands that have been converted to pasture lands. As a result of several environmental studies conducted in the area, plans in the North Private Lease have been restricted to mining activities south of the road called "Farm Road" (this east-west road can be easily identified on Vegetation Map 1, south of the center-pivot field). Total acreage of the survey area including those areas north and south of Farm Road was approximately 428 acres. The size of the pasture lands was approximately 307 acres (this includes the uplands along the drainage channels). Although there were differences in plant species and

composition between pastures due to: land ownership and management practices, seed mixtures planted, and soil types, the pasture lands were most often dominated by grass species such as: intermediate wheatgrass *(Elymus hispidus),* western) wheatgrass *(E. smith;),* thickspike wheatgrass (£. *lanceolatus),* smooth brome (Bromus *inerme)* and crested wheatgrass (Agropyron *cristatum).*
There was also a fair amount of land that had been converted to croplands in the survey proper, most of which was north of Farm Road (about 87 acres). Although crops can vary from year-to-year due to rotation practices, the most common crops raised in the study area have been: alfalfa *(Medicago sativa),* wheat *(Triticum aestivum)* and silage crops *(Triticale).* The croplands, however, are currently not proposed for disturbance by mining activities.

Additionally, there was one relatively small area that supported native, mostly undisturbed vegetation (undeveloped rangelands). This area consisted of pinyon-juniper, sagebrush with minor influence of a mountain brush community (including transitional zones between these types). These types comprised nearly 25 acres of the survey area. Examples of plant species common in these communities included: pinyon-pine *(Pinus edulis),* Utah juniper *(Juniperus osteosperma),* Gambel's oak (Quercus *gambelii),* Moki-apple *(Peraphyllum ramosissimum),* Wyoming big sagebrush *(Artemisia tridentata* var. *wyomingensis),* black sagebrush (A. *nova),* alder-leaf mountain-mahogany *(Cercocarpus montanus),* corymb buckwheat *(Eriogonum* corymbosum) and snowberry *(Symphoricarpos oreophilus).*

Next, there were also channels or drainages that dissected the study area. These channels supported some riparian and wetland communities and consisted of about 9 acres of the study area. Volume 10 contains the “Wetland Delineations & Ordinary High Water Mark Identifications Private Lease Area”, along with copies of the Preliminary Jurisdictional Determination (PDJ) from November 2012 and the follow-up PDJ from September 2015. The U.S. Army Corps of Engineers (USACE) issued a nationwide permit (SPK-2011-01248) for the filling 0.0184 acre of wet meadow wetland for the relocation of County Road 136 (K3900) and the construction of a temporary haul road to access Area 1. An application, with the USACE for an individual permit (SPK-2011-01248 was applied for on July 16, 2016 to allow for mining of coal in Area 2 that will result in unavoidable impacts to 2.38 acres of wet meadow wetland and 0.04 acre of stock pond that are situated in an ephemeral drainage swale. In order to have mining access to Areas 2 and 3, the temporary haul road built for Area 1 must be extended to the east to cross Kanab Creek in order to separate mining equipment traffic from public traffic on County Road 136 (K3900). As proposed, the Kanab Creek crossing will require a temporary stream relocation that will impact 257 feet of existing stream channel and 0.05 acre of adjacent wet meadow wetland. As of January 4, 2017, the individual permit is nearing completion. The individual permit will allow for the “take” of wetlands with in the mining area of the North Private Lease and provide for “offsite in-kind mitigation” to compensate for these losses. Field studies indicated some differences in total living cover, species present and composition, but the plants common here were: beaded sedge *(Carex utriculata),* bluegrass *(Poa pratensis),* wooly-sedge *(Carex pellita),* Douglas' sedge (c. *douglasii),* small-wing sedge (c. *microptera),* maritime arrowgrass *(Triglochin maritima),* common threesquare *(Scirpus* pungens), longstyle rush (Juncus *longistylis),* Missouri iris *(Iris missouriensis),* willows *(Salix booth;;* and S. *exigua),* wiregrass (Juncus *arcticus),* Wood's rose *(Rosa woods;;)* and Russian olive *(Elaeagnus angustifolia).*

In addition, there were also upland plant communities supported within the above mentioned drainage channels. Other than grazing pressure and the erosional component common in the area, these upland communities were relatively undisturbed and located on the flood plains and stream terraces bordering the riparian and wetland zones. These communities were primarily dominated by Wyoming big sagebrush and black sagebrush.

The acreage measurements of the channel uplands were not separated from the upland pasture lands, but the acreage is closer to that of the wetlands mentioned above.

See appendix 3-9 for more detailed information. Total living cover, cover by species, and composition for all sample sites are shown Tables 1 *through* 42. Total annual biomass production estimates for all sample sites are shown on Table 43. Woody species density values for the pasture lands that have been proposed for disturbance by mining activities are shown on Table 44. Finally, all vegetation sample site locations are shown on Drawing 3-1; color photographs of the sample sites are provided in Figures 1 *through 21.* A list of all data tables including community types, data classifications, sample site numbers and parameters sampled is summarized in ~~Volume 12~~Appendix 3-9.

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322. **FISH AND WILDLIFE INFORMATION**

322.100.

Agency Consultation and Studies Conducted

Consultations have been made to appropriate state and federal agencies regarding threatened, endangered, and sensitive plant and animal species and their habitats in and adjacent to the Coal Hollow permit area. Species specific details are located in section 322.200. The following is a list of coordination:

Biologists from the USDA Dixie National Forest were consulted for analyses of the species in their forest and in close proximity to the Coal Hollow Project area that have been listed as endangered, threatened, candidate, and management indicator species.

Biologists from the Bureau of Land Management (BLM) and the State of Utah, Division of Wildlife Resources (DWR) located a sage-grouse lek in the area.

In the Spring of 2005 biologists from the BLM captured, collared and began monitoring 4 sage-grouse birds to study the lifecycle and migrating patterns of the local birds.

In June 2005, a field survey for potential habitat of sensitive species within the project and adjacent areas was conducted by N. Duane Atwood, Ph.D. and Patrick D. Collins, Ph.D.

In April 2006, a biologist, Steven L. Petersen, Ph.D., representing the Coal Hollow Project began independent studies and also began participating with the BLM and DWR in sage-grouse studies in the project area.

In May 2006, a raptor survey by helicopter was conducted by Talon Resources, Mt. Nebo Scientific, Inc., and DWR of the permit area and adjacent areas.

In August 2006 sensitive plant species surveys were conducted during quantitative sampling of specific areas proposed disturbed and reference areas for mining year one of the project.

In 2007 the team continued studies of the sage-grouse with biologists from DWR, the BLM, Southern Utah University (SUU), and the Coal Hollow Project by capturing, taking blood samples, and placing radio transmitters on several birds from March through May.

In April 2007, two helicopter flights, arranged by Coal Hollow Project, were conducted to search for satellite leks of the sage-grouse.

In May 2007, another raptor survey by helicopter was conducted by DWR that included the permit area and adjacent areas

In September 2007, sensitive plant species surveys were conducted during quantitative sampling of additional proposed disturbed and reference areas for mining years one through three of the project

In September 2007, additional quantitative sampling was conducted in meadow areas outside the permit area to be used as a companion study with other areas.

To date, an ongoing monitoring program for radio-collared sage-grouse has been conducted with collaborations with DWR, the BLM, SUU and ACD.

In 2012, two helicopter flights, arranged by Coal Hollow Mine, were conducted to search for satellite leks of the sage-grouse.

Cronquist's phacelia (*Phacelia cronquistiana*; BLM sensitive) was identified as having potential to occur in the area of the mine. Surveys of potential habitats for this species were conducted in June 2012, and no individuals were found.

In 2014, ACD funded the purchase of and monitoring of two GPS transmitters in coordination with Dr. Frey of USU. These were deployed on two sage-grouse in the Sink valley area and will provide four locations of the grouse per day.

In 2016, ACD funded the purchase of and monitoring of three additional GPS transmitters in coordination with DR. Frey of USU. These were deployed in November on three young female sage-grouse in the Sink valley area and will provide up to four locations of the grouse per day.

322.200. Site-Specific Resource Information

322.210. Threatened, Endangered, and Candidate Plant and Animal Species

A review of the Utah Heritage Program database for sensitive species in the permit and adjacent areas has been completed. Table 3-35 includes the evaluation of all species protected under the State of Utah and Kane County.

The U.S. Fish & Wildlife Service Information for Planning and Conservation website was used to generate an Official Species List of threatened and endangered species that may occur in the project area. Species on this list are evaluated in Table 3-35.

Field maps with locations of these species have been prepared and have been used for additional surveys and will continue to be used for future biological studies.

Due to the sensitivity of these species, specific location information is considered confidential and has not been submitted in this application. However, review of this information by the regulatory authorities can be arranged.

Table 3-35 shows a list of the plant and animal species that are federally listed as threatened, endangered, or candidates for this designation for Kane County, Utah.

Table 3-35: List of Threatened, Endangered, and Candidate Plant & Animal Species in Kane County, Utah

This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS); other federally listed species likely occur in Utah Counties. This list includes both current and historic records. The list was accessed on-line June 15, 2015. Its last update was dated January 12, 2012.

Additional species were added to the list as requested by Utah State Division of Oil, Gas & Mining in June 2015 and are designated by an asterisk (*)

ENDANGERED		SITE-SPECIFIC NOTES
Empidonax traillii extimus	Southwestern willow flycatcher	This bird has been observed in Kane, County Utah (see the attached DWR distribution map following this table) . Although it is possible that it could have occurred at some time in the project area as noted from its distribution map, it is most often observed in thick willow riparian habitats. The study area has some willow patches on Kanab Creek, but they are not common on this reach of the stream. The Kanab Creek riparian zone will not be disturbed. It is highly unlikely this species would be impacted by mining in this area. However, after consultations with DOGM & USFWS, it seemed prudent to survey specific areas on Kanab Creek. The surveys have been conducted according to protocols by qualified biologists. A habitat assessment and follow up surveys were conducted as recommended by the USFWS (see Yellow-Billed Cuckoo and Southwestern Willow Flycatcher Habitat Assessment & Southwestern Willow Flycatcher Surveys Along Kanab Creek, Kane County, Utah August 2015 (refer to Appendix A). Between the marginal habitat quality at Kanab Creek and the fact that no southwestern willow flycatchers were detected during the surveys conducted, it was concluded that it is highly unlikely that this species would nest in the study area.
Gila cypha	Humpback chub	Humpback chub in Utah are now confined to a few whitewater areas in the Colorado, Green, and White Rivers. These rivers do not occur in the study area and the confluence of Kanab Creek and the Colorado River is well below the known population of this species. There will be no impact to this species from mining in the study area.

Gila elegans	Bonytail	The bonytail is a very rare minnow originally native to the Colorado River system. The known populations of the bonytail are in the Colorado River System well above the confluence of Kanab Creek and the Colorado River. There will be no impact to this species from mining in the study area.
Lesquerella tumulosa (Physaria rubicudula var tumulosa)	Kodachrome bladderpod	In Utah, this federally listed endangered species is known only in an isolated area in Kane County on semi-barren shale knolls of the Carmel Formation. This geologic formation nor the habitat of this species is found on the study area. Consequently, there will be no impact to this species from mining in the study area.

Table 3-35: List of Threatened, Endangered, and Candidate Plant & Animal Species in Kane County, Utah

This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS); other federally listed species likely occur in Utah Counties. This list includes both current and historic records. The list was accessed on-line June 15, 2015. Its last update was dated January 12, 2012.

Additional species were added to the list as requested by Utah State Division of Oil, Gas & Mining in June 2015 and are designated by an asterisk (*)

ENDANGERED		SITE-SPECIFIC NOTES
Oxyloma kanabense	Kanab ambersnail	Known populations of the gastropod are primarily found in 2 locations along Kanab Creek. The primary and more well-known location is in extreme south Kane County, about 6 miles north of the city of Kanab in an area called Three Lakes. The second, much smaller population, is located about 1.3 miles north of the Three Lakes population in Kanab Creek Canyon. According to DWR, however, this population, is thought to be extirpated. Upper Kanab Creek dissects the project area and will not be disturbed from the proposed mining activities. That was associated Kanab Creek will not be impacted, so the downstream habitats, like that of the Kanab ambersnail, will not be negatively impacted by the proposed mine site.
THREATENED		**SITE-SPECIFIC NOTES**
Asclepias welshii	Welsh's milkweed	In Utah this plant in known to occur only on the Coral Pink sand dunes in Kane County. There are no dune habitats in the project area so this species will not be impacted by it.
*Coccyzus americanus**	Yellow-billed cuckoo	The western yellow-billed cuckoo is listed as a threatened species under the Endangered Species Act. It is an obligate riparian nester, meaning that the species is restricted to more mesic habitat along rivers, streams, and other wetlands. The US historical range of this species is thought to have included all states west of the Rocky Mountains. According to DWR database information, the current range of yellow-billed cuckoo is limited to disjunct fragments of riparian habitat in northern Utah, western Colorado, southwestern Wyoming, southeastern Idaho, southern Nevada and California. That said, the distribution of this bird in Utah is poorly understood (see the attached DWR distribution map following this table), so consultations with DOGM and USFWS have been conducted. A habitat assessment was conducted as recommended by the USFWS (see Yellow-Billed Cuckoo and Southwestern Willow Flycatcher Habitat Assessment & Southwestern Willow Flycatcher Surveys Along Kanab Creek, Kane County, Utah, August 2015 (refer

		to Appendix A). No designated critical habitat occurs in the study area.
Cycladenia humilis var jonesii	Jones cycladenia	Jones cycladenia grows in gypsiferous, saline soils derived from strata much lower (older) in the geologic column than what is found in the project area such as Summerville (Jurassic), Chinle (Triassic), and Cutler (Permian) formations. The project area soils are derived mostly from Tropic Shale and Dakota formations of Cretaceous age. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from mining in the study area.

Table 3-35: List of Threatened, Endangered, and Candidate Plant & Animal Species in Kane County, Utah

This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS); other federally listed species likely occur in Utah Counties. This list includes both current and historic records. The list was accessed on-line June 15, 2015. Its last update was dated January 12, 2012.

Additional species were added to the list as requested by Utah State Division of Oil, Gas & Mining in June 2015 and are designated by an asterisk (*)

Cynomys parvidens	Utah prairie-dog	Habitat for this prairie-dog does not exist in the study area. Consequently, there will be no impact to this species as a result of mining in the North Private Lease
Pediocactus sileri	Siler pincushion cactus	In Utah, this small footcactus is known to occur in salt desert shrub communities in Kane and Washington Counties. It tends to be found in gypsiferous, seleniferous and calciferous soils and shales of the Moenkopi formation. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from mining in the study area
Strix occidentalis lucida	Mexican spotted owl	The primary habitats in Utah for this owl are various forest types and steep rocky canyons. DWR distribution maps suggest the project area is out of its range in Kane County. The required habitat and apparent distributional information indicate that the likelihood for impacts to this bird by the proposed mining is remote.
CANDIDATE		**SITE-SPECIFIC NOTES**
Cicindela limbata albissima	Coral Pink Sand Dunes tiger beetle	Like Welsh's milkweed described above, this beetle is known to occur only on the Coral Pink sand dunes of Kane County, Utah. There are no sand dune habitats in the project area so this species will not be impacted by it.
OTHER		**SITE-SPECIFIC NOTES**
*Camissonia exilis**	Meager Camissonia	This is not a federally protected species, however, its conservation status is ranked as "G1" (critically imperiled). This annual plant is a Colorado Plateau endemic found only in gypsiferous strata in Moenkopi and Entrada formations. These formations and habitats are not within the North Private Lease area. Additionally, other gypsiferous substrates have not be found during geologic or soil surveys of the site. There should be no impact to this species from mining in the study area. However, because this species was noted by DWR to occur in the general area, collaborations between cooperating agencies (DWR & USFWS) regarding potential impact are currently in-progress. Results of findings between agencies will be reported to ACD by DOGM.

*Rana pipiens**	Northern Leopard Frog	This frog is not a federally protected species and it is fairly common in Utah. Although some reports suggest numbers may be declining, the conservation status of this amphibian is ranked as "G5" (demonstrably secure). This species occurs in a variety of aquatic habitats some of which occur in the North Private Lease area, but most are in and adjacent to Kanab Creek. This creek will not be mined and a 100 ft protection buffer will be in-place during mining and reclamation periods. Although impacts to the local populations may be possible due to mining activities relatively close to the habitat, they are thought to be relatively minor. However, because this species was noted by DWR to occur in the general area, collaborations between DOGM with cooperating agencies (DWR & USFS) regarding potential impacts are currently in progress (2016). Results of these findings will be reported to ACD by DOGM.

Table 3-35: List of Threatened, Endangered, and Candidate Plant & Animal Species in Kane County, Utah

This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS); other federally listed species likely occur in Utah Counties. This list includes both current and historic records. The list was accessed on-line June 15, 2015. Its last update was dated January 12, 2012.

Additional species were added to the list as requested by Utah State Division of Oil, Gas & Mining in June 2015 and are designated by an asterisk (*)

		cooperating agencies (DWR & USFWS) regarding potential impact are currently in-progress. Results of findings between agencies will be reported by DOGM to ACD
Centrocercus urophasianus	Greater sagegrouse	Greater sage-grouse (*Centrocercus urophasianus*) habitat has been documented in the study area. DWR has mapped much of the area to be *occupied* and *brood-rearing* habitat (Wildlife Map 4). Additionally Utah's Conservation Plan for Greater Sage-grouse (February 14, 2013) shows the Alton area to be "Other Habitat" habitat for the sage-grouse. Other habitat is defined here as sage-grouse habitat but not part of the lek, nesting or wintering areas. Impacts of mining in the North Private Lease have been addressed (see Greater Sage-grouse Management Plans, for the Coal Hollow Mine site).

Table 45 (attachments)

In summary, based on the information provided above and studies conducted to-date, no threatened or endangered species have been located in the permit area.

NOTE: Expansion of the mine includes a new area north of the Coal Hollow Lease. Threatened, endangered and sensitive species information has been updated and incorporated into Table 3-35 For more information, see Appendix 3-9 and 3-10: Supplemental Report section of the MRP in the report called: *Vegetation & Wildlife Habitat of the North Private Lease Area, Coal Hollow Project Kane County, Utah* (October 2015).

322.220. High Value Habitats

The State of Utah, Division of Wildlife Resources (DWR) geographic information system (GIS) database was consulted for high-value habitats. In 2006 DWR updated the habitat value definitions.

Crucial Value was defined as "habitat on which the local population of wildlife species depends for survival because there are not alternative ranges of habitats available. Crucial Value habitat is essential for the life history requirements of a wildlife species".

Substantial Value was defined as "habitat that is used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question".

The DWR database was revisited by project biologists on January 12, 2012. Of the species maintained on the database, important habitat of four species have been mapped by DWR within or adjacent to the Coal Hollow Lease area and the North Private Lease. These habitats are described below.

First, areas adjacent to the permit area and a portion of it have been designated as black bear (*Ursus americanus*) habitat. This habitat has been listed as having year-long, Substantial Value habitat by DWR (Drawing 3-2).

Next, Rocky Mountain elk (*Cervus canadensis*) habitat was located in the area. Crucial Value summer and calving habitat was mapped throughout the entire area from the town of Alton south into Sink Valley, including the permit area. Additionally, year-long Substantial Value habitat was located in areas southeast of the permit area (Drawing 3-3).

Mule deer (*Odocoileus hemionus*) habitat has also been mapped in the area by DWR biologists. The habitat has been classified as "Crucial" summer and fawning habitat. This designation included the entire permit area as well as those areas adjacent to it (Drawing 3-4).

Finally, sage-grouse (*Centrocercus urophasianus*) habitat has been documented in the project area. DWR biologists have mapped much of the area to be Crucial Value brood habitat (Drawing 3-5). Sage-grouse populations continue to be monitored in the area by biologists from DWR, Bureau of Land Management (BLM), Southern Utah University (SUU), and the Coal Hollow Project. The only lek in the vicinity including those areas around Alton and Sink Valley was located west of the Swapp Ranch. This lek was within the permit area boundary. A site-specific study called reported in "*Alton Sage-Grouse Habitat Assessment and Mitigation Plan*" has been conducted for the Coal Hollow Project and has been included in this document (see **Appendix 3-1**). Follow-up studies of the sage-grouse in the area are described in a report called *"Sage-grouse Distribution and Habitat Improvement in Alton, Utah*" (see **Appendix 3-3**). Finally, for the Coal

Hollow Mine a document called *"Alton Sage-Grouse Habitat Mitigation Plan*" has also been included in the MRP (see **Appendix 3-5**). With the addition of the North Private Lease, a document called "*Greater Sage-grouse Management Plan North Private Lease, Alton, Utah*" has been included in the MRP (see **Appendix 3-8**). From 2006 to date, biologists representing the Coal Hollow Project have been involved with a previously assembled team of biologists that have been studying the populations in the area. In 2007, the team captured, drew blood samples for DNA analyses, and placed radio collars on several birds. For more details, refer to **Appendix 3-3**.

In addition to studying the sage-grouse birds as described above, techniques to improve habitat for the birds are currently being conducted. A project conducted by the U.S. Department of Interior, Bureau of Land Management (BLM) and the State of Utah, Division of Wildlife Resources (DWR) was completed that removed many of the juniper trees that have encroached the valley by grinding them up by chipping (also called bull-hogging) equipment. These areas can be easily seen on the new *Vegetation Map, Drawing: 3-1.* These areas are delineated as "SB (chipped)" on the map.

Because they provide perching structure for predatory species, single juniper trees scattered throughout sagebrush communities are known to discourage nesting by sage-grouse. To enhance sage-grouse nesting habitat within the permit area, juniper trees that have encroached some of the sagebrush communities in the valleys of the permit area have been removed by a track hoe using a large grapple claw. This equipment can pull the trees out of the ground, including the roots. To date, it has been estimated that over 10,000 juniper trees have been removed by this technique. In doing so, the technique caused relatively minor impacts to the sagebrush component of the community.

There is a substantially larger sage-grouse lek located north of the project area. The lek, known as the Hoyt's Ranch Lek, has also been studied by state, federal and private biologists. It has been hypothesized that connectivity between the two leks, the Alton lek and the Hoyt's Ranch Lek, could greatly increase the chances of survival for the Alton birds. Therefore, intensive efforts have been made to open a corridor of these two leks by removing juniper and oak stands (see **Appendix 3-5**).

In addition to the habitat improvements mentioned above for sage-grouse, seed mixtures formulated to restore pasture lands disturbed by mining include plant species that are used by the birds for food, cover and breeding. Moreover, some areas that are currently dominated by grass species for domestic livestock use, will be seeded with plants that include species known to provide nesting habitat for sage-grouse such as big sagebrush and black sagebrush [for more detailed information see "Habitat Reclamation Plan" (Chapter 3); "Other Wildlife Enhancement Information" (Chapter 3); "Seed Mixtures" (Chapter 3); Drawing 3-7 and 3-11 (Chapter 3); "Postmining Land Use" (Chapter 4)].

Wetlands

The NPL contains approximately 6.34 acres of palustrine emergent wet meadow wetlands, 0.04 acre of stock pond and 4,632 feet (0.14 acre) of the Kanab Creek stream channel that were delineated and verified by the U.S. Army Corps of Engineers (SPK-2011-01248) September 2015. More information can be found in Volume 10 of the MRP.

NOTE: Expansion of the mine in 2016 includes the North Private Lease. Although required information has been incorporated herein, additional wildlife information for that area can be found in the appendix 3-9in the report called: *Vegetation & Wildlife Habitat of the North Private Lease Area, Coal Hollow Project Kane County, Utah* (October 2015).

322.230. Other Species or Habitats

As mentioned previously, raptor surveys have been conducted in the area by Coal Hollow project and DWR biologists. The 2006 through 2008 surveys show no golden eagle (*Aquila chrysaetos*) or bald eagle (*Haliaeetus leucocephalus*) nests within ½ mine of the permit area. In fact, the most recent survey indicated that there were *no* raptor nests located within ½ of the permit area (see Confidential File, Drawing 3-6). There was, however, one inactive red-tailed hawk (*Buteo jamaicensis*) nest located over one mile from the permit area, three inactive golden eagle nests, one active peregrine falcon (*Falco peregrinus*) nest and another inactive falcon nest located approximately two miles from the permit area.

To date, no other species or habitats have been identified through agency consultation or field studies that require special protection under state or federal law, however, if they are found through the permitting process, they will be appropriately addressed and monitored.

A vegetation map has been prepared that delineates the plant communities in the permit area. The map also shows adjacent areas including those plant communities that will be impacted by the proposed county road realignment (Drawing: 3-1).

Migratory Bird Communities at the North Private Lease

There are six types of habitat within the North Private Lease, some of which will not be disturbed by mining activities. These types include croplands, pasturelands, wetlands, and small areas of riparian, pinyon-juniper and sagebrush. The small areas of pinyon-juniper and sagebrush offer the best avian nesting habitat. Birds likely to nest in these two habitat types within the project area include black-billed magpie *(Pica hudsonia),* mourning dove *(Zenaida macroura),* American robin (Turdus *migratorius),* sage thrasher (Oreoscoptes *montanus),* Brewer's sparrow *(Spizella* breweri), black-throated sparrow *(Amphispiza bilineata),* vesper sparrow *(Pooecetes* gramineus), western meadowlark *(Sturnella neglecta),* and spotted towhee *(Pipilo maculatus).* Killdeer *(Charadrius* vociferus) and horned larks *(Eremophila alpestris)* are two species that may nest in bare areas within the croplands and pasturelands.

There is a small amount of riparian habitat within the project area, which means that some riparian bird species could nest in the project area as well. Riparian species that were detected within *1.0* mile of the project area in Kanab Creek included black-chinned hummingbird *(Archilochus alexandri),* yellow warbler *(Setophaga petechia),* MacGillivray's warbler *(Geothlypis tolmiei),* and song sparrow *(Melospiza melodia).* The riparian habitat is not substantial enough for the federally listed species southwestern willow flycatcher *(Empidonax trail/ii extimus)* and western yellow-billed cuckoo (Coccyzus *american* us) to nest in the project area.

Raptors are unlikely to nest in the North Private Lease area due to the minimal amount of raptor nesting substrate and the proximity to human activity. However, raptors such as red-tailed hawks *(Buteo jamaicensis),* American kestrels *(Falco sparverius),* and northern harriers (Circus *cyaneus)* could nest within *0.5* mile of the project area.

322.300. Fish and Wildlife Service Review

Upon request, the State of Utah, Division of Oil, Gas & Mining (DOGM) will provide the resource information required under R645-301-322 and the protection and enhancement plan required under R645-301-333 to the U.S. Fish and Wildlife Service Regional or Field Office for their review. This information will be provided within 10 days of receipt of the request from the Service.

The Division of Oil, Gas, and Mining conducted Informal Consultation with the Fish and Wildlife Service on August 9, 2016. All species identified during that consultation have been assessed in Table 3-35. See letter dated August 9, 2016 and Consultation Code: 06E23000-2016-SLR-0325 (Appendix 3-10). The Division made the determination that approval of the Coal Hollow Mine Permit would not jeopardize any species protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)

323. **MAPS AND AERIAL PHOTOGRAPHS**

323.100. Reference Area Maps

Several vegetation maps have been prepared for the Coal Hollow Project. A revised vegetation map has been prepared that includes all vegetation sample areas, plus other updated map information [Vegetation Map, Drawing 3-1]. This new map includes reference areas, or plant communities sampled that are similar to those that have been proposed for disturbance by mining activities. These reference areas will be compared to those areas proposed for disturbance during the initial studies for the mine site and will consequently be used as revegetation success standards at the time of final reclamation of mined areas. Reclamation is planned immediately after portions of the land are mined (see Chapter 5).

323.200. Sample Area Maps

Elevations, locations of monitoring stations, proposed disturbed areas, reference areas, and other areas used to gather data for fish and wildlife, and any special habitat features, have been delineated on Drawing 3-1. Due to the Dame Incidental Boundary Change, the Meadow area reference will be relocated to an area that will have no potential impacts from mining. This relocation ~~will occur~~occurred during the growing season of 2014 in consultation with DOGM.

323.300. Protection and Enhancement of Fish & Wildlife Maps

Each facility to be used to protect and enhance fish and wildlife and related environmental values have been represented on the Drawing 3-1.

323.400. Plant Communities Map

See *Vegetation Map, Drawing 3-1*.

330. **OPERATION PLAN**

331. **MINE PLAN & RECLAMATION TIMING**

In each mined segment, the mine plan includes redistributing subsoil and topsoil followed by seeding this segment with the final seed mix contemporaneously, or at the same time the mining begins in the next segment. The mine plan has been engineered to disturb the smallest practicable area at any one time. With prompt establishment and maintenance of vegetation, immediate stabilization of disturbed areas will minimize surface erosion. Details are located in Chapter 5 of the Mining and Reclamation Plan (MRP). One exception, the last pit (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. As shown on Drawing 5-16, this pit is fully contained within the greater Borrow Area and will be fully mined and immediately backfilled (to the intermediate landform shown in Drawings 5-35 and 5-36) in 2016. This backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pit 10. Subsoil will be placed over the final graded mining surface to an average depth of 1.5 feet for interim reclamation after mining has been completed. Organic mulches will be incorporated into the soil to improve the fertility of the subsoil placed on the interim reclamation surface and seeded with the intermediate seed mix. Incorporation of mulch into the soil will improve the fertility of the subsoil used for interim reclamation cover. The surface foot (12) inches) of amended subsoil will be salvaged as cultivated topsoil at the end of the interim reclamation period.

332. **SUBSIDENCE**

Mining in the Coal Hollow project area will be a combination of surface mining, either open pit or highwall mining and underground mining. Mining in the North Private Lease will be a combination of surface mining, either open pit or highwall mining. Both the highwall mining and underground mining are designed such that subsidence is not expected to occur or have a negative impact on renewable resource lands. This is further discussed in Section 525 of Chapter 5. As indicated in that Section, no subsidence is projected. As requested by the Division, however, the company will conduct surface observations walkovers of each of the 4 developed panel areas in this proposed plan within 60 days of completion of mining in those areas. If the observations determine that no affects or voids have developed to the surface, it will be documented and forwarded to the Division. If surface cracking, sinkholes or other surface impacts are noted during the walkovers, they will be documented, located on a surface topographic map, reported to the Division, photographed and repaired after approval by the Division.

Also, based on the proposed underground mining plan, and as discussed in Appendix 7-15 (Probable Hydrologic Consequences for Underground Coal Mining at the Alton Coal Development, LLC Coal Hollow Mine) there are no likely adverse effects to the hydrologic regime in the area. However, in the event that diminution of discharge rates from seeps and springs does occur as a consequence of mining activities, any lost water will be replaced according to all applicable Utah State laws and regulations, using the water replacement source specified in R645-301-727. The quantity and quality of replacement water detailed in that Section, will be suitable for the existing premining uses and approved postmining land uses.

However, current elevation of the existing topography may be slightly altered in the mining and reclamation operations with open pit mining. The alternate Highwall mining or underground mining will have only the disturbance associated with the trench for placement of the highwall miner or portals and will have no impact on the surface above the highwall panels

Reclamation has been planned to minimize the impact to the renewable resources identified in this section by promptly reclaiming each mine segment contemporaneously by controlling erosion and re-seeding with a mixture of native plant species that will re-establish the plant communities to vegetative cover that will be diverse, effective, permanent, and consistent with the postmining land use. More details regarding postmining land and topography have been provided in Chapter 4 and Chapter 5 of this document, respectively.

The mine plan is not expected to negatively impact the plants and wildlife in the Coal Hollow Lease and North Private Lease areas. Onsite revegetation research and sage-grouse mitigation plans have been designed and incorporated as Appendix 3-8. Details of this work have been made available to DOGM specialists for their comments and participation in the process.

333. **PROCEDURES TO MINIMIZE ADVERSE IMPACTS TO FISH & WILDLIFE**

Section Preface

In addition to the language in the main body of the MRP regarding sensitive species, four appendices (Appendix 3-1, Appendix 3-3, Appendix 3-5 and Appendix 3-8) were prepared separately and have been included to address the sage-grouse in the Alton area. Each of these appendices was submitted in different submittals to the State of Utah, Division of Oil, Gas & Mining (DOGM). After each submittal, they were reviewed by the DOGM and other agencies, which provided comments. Accordingly, the comments were addressed and the next sage-grouse appendix was then written. In other words, the appendices were written in chronological order and each subsequent appendix was a result of comments from the previous one. Therefore, the last appendices written (Appendix 3-5 and 3-8) explains ACD's final mitigation plan for the sage-grouse in the Alton area. However, the previous Appendices (Appendix 3-1 and 3-3) remain in the MRP because they continue to provide valuable information regarding the natural history, previous work and process of addressing the sage-grouse issues in the Alton area. In summary, ACD has committed to compensatory mitigation at a rate of 1,700 acres for the disturbance associated with the Coal Hollow Lease and 4:1 (habitat improvement : disturbance) for the North Private Lease.

Greater- Sage-Grouse Mitigation

The Coal Hollow Project will minimize disturbances and adverse impacts to fish and wildlife and related environmental values during coal mining and reclamation operations. The project will comply with the Endangered Species Act of 1973 during coal mining and reclamation operations. The location and operation of haul and access roads and support facilities will be placed to avoid or minimize impacts on important fish and wildlife species or other species protected by state or federal law. The implementation of the highwall miner provides an additional method of recovering the coal resource while minimizing disturbance to the surface and associated wildlife species. Enhancement of such resources will be achieved, where practicable. An example is provided below for sage-grouse habitat.

After consultation with appropriate agencies and biologists regarding habitats and sensitive species, the Greater Sage-grouse and its habitat were of greatest concern in the area. There has been a decreasing trend in the populations of this species since 1964 (see Appendix 3.1 and Appendix 3-3 for more details). There was a general consensus among the biologists and agencies consulted that due to the marginal habitat in the Alton Amphitheater area, the loss of habitat in recent years for nesting and brood-rearing and the relatively low population numbers in the area, that the local population of sage-grouse is vulnerable to elimination, regardless of mining activities proposed by the Coal Hollow Project.

On March 15, 2012 the Stipulated Settlement reached before the Board established 1,700 acres of compensatory mitigation for the 635.64 acres of disturbance at the Coal Hollow Mine. As of June 2016, the **1,700 acres** of habitat improvement required for the original Coal Hollow Lease have been completed. Compensatory Sage-grouse mitigation for the North Private Lease has been set in line with the State of Utah's Conservation Plan for Greater Sage-grouse using an offsite mitigation treatment ratio of 4 acres of land treated to every 1 acre disturbed (4:1 mitigation ratio).

North Private Lease ACD plans to mine 224.8 acres of the North Private Lease (including areas 1, 2, and 3) and consequently commits to 1,000 acres of habitat improvement in accordance with Appendix 3-8, the Greater Sage-grouse Management Plan and Utah's Conservation Plan for Greater Sage-grouse. Habitat improvement treatments will be completed prior to mining disturbance. The location and type of mitigation project will be determined from input and recommendations provided by ACD, UDOGM, UDWR, CCARM, FWS, and BLM which was formalized in a mitigation agreement (Appendix 3-8) between WRI (manages the mitigation project) and ACD (funds the project). ACD's commitment is complete once the project is paid for. WRI completes, maintains, and monitors the project into the future. See Appendix 3-8 for details on the Greater Sage-grouse Management Plan and ~~ACH~~ ACD commitments for mitigation.

Other aspects of ACD's sage-grouse mitigation plan can be found in Appendix 3-5 and 3-8.

Other compensatory mitigation

Reestablishing Connectivity Between Alton and Hoyt's Ranch

Over time, juniper encroachment has likely been the primary factor in isolating the Alton sage-grouse population from nearby populations. There is a larger sage-grouse population located approximately 6 miles north of Alton. It is likely that migration once occurred between these populations allowing an exchange of individuals and genes between the two populations. Fragmentation of the landscape by juniper has likely resulted in minimal or no movement of birds between the two populations. Similarly, two populations that once occurred further south (near Kanab) have become locally extinct, likely due to the lack of connectivity with more northern populations. According to Fuhlendorf (2001), small populations of prairie chickens became disconnected from other larger populations with increased croplands and juniper invasion. These small populations became locally extinct due to the lack of migration and gene flow potential. Therefore, by reducing the degree of fragmentation caused by expanding juniper, the potential for migration and population sustainability is increased.

A plan has been made to establish connectivity by removing juniper and scrub oak trees from private land between the Alton and Hoyts Ranch populations. An area that is approximately 1,700 acres has been delineated that, with treatment, could provide connectivity between the two populations (Appendix 3-5). Funds have been earmarked by ACD to work with DWR and/or the landowners (Heaton Brothers, LLC) to provide technical and financial support to establish a migration corridor through the 1,700 acres. It is anticipated that this habitat improvement will create easier access for birds to travel more freely between the two populations.

Although ongoing, much of the corridor development work has been accomplished. A field visit that included a Division biologist, representatives from Heaton Brothers and ACD, and other independent biologists to this area to observe the progress of the project was conducted in late September 2009. Additionally, preliminary field monitoring data from radio-collared sage-grouse suggest that the corridor is beginning to be used by the birds.

Establishment of a Core Sage-Grouse Conservation Area

The east end of the valley maintains one of the few remaining intact sagebrush stands in the valley. This area is located northeast of the lek and provides sites for roosting during the mating season (Drawing 3-1 and Drawing 3-5). This area will not be mined, rather, it will be preserved to create a harbor area for bird breeding, nesting, and brood rearing (Figure 3-1). Within this “Conservation Area”, habitat will be protected for sheltering displaced sage-grouse, especially during the breeding and brood-rearing seasons. Most of the juniper trees that encroached into sagebrush communities within the permit area have been removed. This has been accomplished by felling and removing individual juniper trees while minimizing the impacts to the sagebrush community (see “Juniper Removal” above). In addition to juniper, some Gambel oak (Quercus gambelii) trees have also been removed to expand the sagebrush community and provide greater suitable habitat for sage-grouse.

In addition to juniper and oak removal, sagebrush treatments (mechanical) will be applied to reduce shrub cover and density in small areas (patches) if quantitative sampling in that area suggests that these parameters exceed optimal sage-grouse habitat requirements. Forb species that are known to be important sage-grouse forage will then be seeded to provide an additional food source for hens and chicks, primarily during the brood rearing period. Grasses will also be seeded to provide additional hiding cover and a potential source of insects for chick foraging. These treatments could initially be done in a few, relatively small areas to determine whether forb and grass densities actually do increase and if birds are observed using these areas for foraging. If successful, these treatments can then be used in other areas where benefits are expected. Conversely, if the results from preliminary vegetation sampling, along with the current research literature regarding sage-grouse habitat requirements, indicate that widespread treatments should be made to the existing sagebrush community, then this will be the course of action.

Maintaining optimal shrub cover for nesting, brood rearing, predator avoidance, roosting, and as a source of shelter will remain the highest priority for these sites.

Predator Control Plan

Several species that prey on sage-grouse eggs, chicks and adults live in the Alton region including common ravens (*Corvus corax*), American crows (*Corvus brachyrhynchos*) and coyotes (*Canus latrans*). ACD will coordinate with the appropriate government agency to help implement a predator control program to enhance survival of the sage-grouse in the area. The operator will not conduct the predator control measures but will assist the appropriate agency with developing technical expertise to formulate a plan to implement such a program through the appropriate government agency.

Restoration of Sagebrush Habitat (on-site mitigation)

After mining has been completed, reclamation specialists will return the original grade and valley form to approximate pre-disturbance conditions. An emphasis will be placed on restoring sagebrush ecosystems. Reclamation will include seeding similar plant species with comparable plant composition, structure and function as those of the original plant community. Final reclamation seed mixtures have been formulated to include forb species critical for survival of hens and their chicks.

Seed mixes that are used for reclamation will consist of native shrub, grass and forb species that provide cover and food. In order to accelerate shrub re-establishment, bareroot or containerize sagebrush and bitterbrush transplants can be planted (in addition to sage-grouse preferred forb species) to enhance sagebrush ecosystem restoration (see Coal Hollow Project, Mining & Reclamation Plan, Chapter 3, Revegetation Seed Mixtures). Cursory surveys conducted on April 30, 2006 found that there is a low probability that a dominant invasive species (i.e. cheatgrass, medusahead) could establish on reclaimed sites. However, post-reclamation surveys will be conducted for undesirable invasive plants. If a breakout does occur, mechanical and/or chemical treatments will be applied.

Primary brood-rearing habitat in the Alton valley is associated with alfalfa fields near the town of Alton. Birds likely utilize these areas due to the availability of forbs, insects, and water. To reduce the dependency of the birds on these areas, areas that are currently pasture lands will be returned to sagebrush/grass/forb communities. Seed mixtures for final reclamation have been created with this goal in mind.

Seeding and planting will occur in the fall season following the growing season and into dormancy, or in the spring if timing and conditions appear more favorable. During the following growing season, vegetation sampling will be conducted to monitor reclamation success. Measurements will be continued each year until the reclamation goals have been achieved. Additional seeding can be applied during subsequent years if the minimum standards of acceptance have not been achieved. Juniper seedlings found in reclaimed areas will be removed.

Restoration of Lekking Habitat

The current lek is located in a low-growing pasture in the south end of the mining area. The lek is dominated by perennial grasses and forbs. Following mining, this site will be seeded with similar perennial species occurring at the lek prior to disturbance. Several studies demonstrate the plant structure of greater sage-grouse leks. They are described as occurring in sparsely vegetated areas (surrounded by sagebrush communities) that provide escape and protection from predators (Gill 1965, Connelly et al. 1981, Connelly et al. 2000, Call and Maser 1985, Crawford et al. 2004). After mining, the Alton lek will be restored to resemble pre-disturbance conditions. Plant species will be seeded to most closely represent the original lekking environment. Depending on post-mining soil water conditions and the presence of dominated perennial grass species, vegetation growth of seeded species may exceed the height tolerated by displaying sage-grouse during the lekking period. Additionally, weedy species may occur that grow taller than conditions typical of sage-grouse lekking habitat. With excessive plant growth, sage-grouse may choose not to attend the lek for display.

If needed, the reduction of plant growth may be required to create “sparsely vegetated conditions” (Figure 8) within the lekking area, by reducing both living and decadent plant materials. In cases where grass growth at the restored lek exceeds this maximum height requirement, ACD will work with the DWR prior to any vegetation treatments to identify optimal methods for vegetation management on the lek.

Figure 7. Sage-grouse males displaying on the Sink Valley lek on March 30, 2006.

Wildlife Awareness Program

A Wildlife Awareness Program will be implemented during the active phases of mining for the Coal Hollow Project. The objectives of the program will be to provide protection of the resident wildlife, decrease collisions by heavy equipment and other vehicles, as well as minimize impact to the wildlife during the mining operations. During this program, qualified biologist will provide employees specific training on sage-grouse identification, seasonal patterns in sage-grouse development and movement, and deer and elk observations and migratory patterns in the Alton area. Annual refresher training for all ACD employees occurs in January, UDWR and UDOGM are invited to participate in the Wildlife Awareness training.

The coal operations will, to the extent possible using the best technology currently available, minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and will achieve enhancement of such resources where practicable. In doing so, the following procedures will be implemented.

- Speed limits of all vehicles will be posted at 25 mph inside the permit area.
- The safety meetings conducted on the mine site to all employees will include information regarding awareness of important wildlife species in the area.
- No coal mining and reclamation operations will be conducted that would likely jeopardize the continued existence of federally listed endangered or threatened

or which is likely to result in the destruction or adverse modification of designated critical habitats of such species in violation of the Endangered Species Act of 1973.

- As mentioned above and in following sections, extensive measures for protecting, enhancing and mitigating habitat for the sensitive bird species, sage-grouse, have been conducted. Mitigation plans for this species have also begun and continue through operations (see Appendix 3-5 and Appendix 3-8).
- The mining operator will promptly report to the State of Utah, Division of Oil, Gas & Mining any state- or federally-listed endangered or threatened species within the permit area of which the operator becomes aware. Upon notification, the Division will consult with appropriate state and federal fish and wildlife agencies and, after consultation, will identify whether, and under what conditions, the operator may proceed.
- The mining operator keep log records of any road kill of deer, elk, sage-grouse and domestic livestock from coal haul and associated vehicles from the mine site to highway 89.
- The operator will ensure that electric powerlines and other transmission facilities used for, or incidental to, coal mining and reclamation operations on the permit area are designed and constructed to minimize electrocution hazards to raptors, except where the Division determines that such requirements are unnecessary.
- The operator will design fences, overland conveyers, and other potential barriers to permit passage for large mammals, except where the Division determines that such requirements are unnecessary.

The following table outlines each of compensatory mitigation projects to date (June 2016):

	Year	Treatment	Location	Program	Acres of Habitat Improvement	Completion documentation
South Lease (Coal Hollow Lease)	2011	PJ/Oak removal, reseeding	Corridor located north of Alton	ACD	428	See letter from DOGM dated 5/16/2016, task 3987
	2009	PJ Removal, sagebrush thinning and seeding The conservation area is 72 acres, 40 of which are dense sagebrush. 2.5 acres were treated by disking and planing in 2010.	Conservation Area	ACD	72	See letter from DOGM dated 5/16/2016, task 3987
	2012	lop and scatter of PJ and chemical treatment of Rabbitbrush	east of property	ACD	146	See appendix 3-6 part 2
	2013	lop and scatter of PJ	west boundary	BLM	355	See letter from BLM dated 1/26/16
	2014	Paunsaugunt rabbitbrush removal phase II		WRI Project ID 3011	300	See UDWR Contract dated 8/18/14
	2014	UKC Thompson Creek		WRI Project ID 2701	300	See UDWR Contract dated 8/18/14
	2015	Broad Hollow Rabbitbrush Mitigation		WRI Project ID 3419	443	See UDWR Contract dated 2/23/16
				Total Mitigation	2044	
				Transfer to North Lease	344	
				New Total for South Lease	**1700**	
North Private Lease	2015	Transferred from previous mitigation			344	
	2016	Willow/Rabbitbrush removal in wet meadow habitat	Kane County	WRI Project ID 3876	247.79	See UDWR Contract dated 8/19/2016
				New Total for North Lease	**591.79**	

Minimization of Impacts to Migratory Birds

Potential impacts to migratory birds include both indirect and direct impacts. Indirect impacts include the displacement of the birds due to human activity. Direct impacts include the loss of habitat, both nesting and foraging, as well as the potential "take" of active nests. However, as described below, steps will be taken to avoid the take of any migratory birds.

Loss of *Habitat.* In all, about 310 acres of potential foraging and nesting habitat could be lost to the local bird communities. However, the habitat type being lost in the lease area is prevalent in the surrounding area, and therefore, this loss would be expected to have no negative impact on the local bird populations.

Potential Take. The Migratory Bird Treaty Act (MBTA) prohibits the take of migratory birds, their parts, nests, eggs, and nestlings. To ensure that ground-disturbing activities do not result in the "take" of an active nest or a migratory bird protected under the MBTA, mitigation steps will be taken.

Mitigation Efforts

Passerines - The U.S. Fish and Wildlife Service (USFWS) recommends that ground-disturbing activities or vegetation treatments should begin before the migratory bird-nesting season begins or after any nests have fledged (USFWS 2015(1»). However, if activities that would remove potential nesting vegetation are scheduled to begin during the breeding season, which starts after March 1 (see Bird Nesting Seasons below), steps will be taken to keep birds from nesting in the area (It should be noted that once nests are established, they cannot be harassed). Nest surveys will be completed no more than 2 weeks before the start of activities. All active passerine nests that are detected during the nest survey will be protected by a 100-foot buffer between the nest and any activities. The buffer must remain in place until the nest fledges or fails.

Raptors - Nesting raptors can be negatively impacted by human activity even if their nest is not within the lease area itself. If activities are scheduled to begin during the raptor nesting season (see Bird Nesting Seasons below), a raptor nest survey will be conducted within 0.5 mile of the lease area to avoid any potential take. Any raptor nests that are detected within 0.5 mile of the lease area must be afforded the appropriate buffer, as listed in Romin and Muck 2002(2). Depending on the topography of the area and other variables, the USFWS may be inclined to reduce the size of the buffer if the given activities are not deemed a threat to the active nest.

NESTING SEASONS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Raptors												
General Passerines												

340. **RECLAMATION PLAN**

341. **REVEGETATION**

This document contains the revegetation plan for final reclamation of all lands disturbed by coal mining and reclamation operations, except water areas and the surface of roads approved as part of the postmining land use, as required in R645-301-353 *through* R645-301-357. It also shows how the Coal Hollow Project will comply with the biological protection performance standards of the State Program.

341.100. Reclamation Timetable

A detailed schedule and timetable for the completion of each major step in the mine plan has been included in Chapter 5 of the MRP. Drawing 5-38 shows the schedule for the Coal Hollow Lease Area and Drawing 5-76 shows the schedule for the North Private Lease. Briefly, the mine will conduct operations in one area (segment) at a time. Initial mine development will involve removal and storage of topsoil from mine infrastructure locations. Facilities for equipment maintenance/warehouse, coal handling, and offices will be constructed. During the development and initial mining period, facilities temporary in nature may be used until permanent facilities can be built. Construction of sedimentation ponds, diversion ditches, and mine roads accessing the initial mining areas will also be ongoing.

Mining will employ typical open pit methods using truck/loader type equipment to remove overburden and recover the coal. Mining will advance across the property in successive cuts approximately 250 ft. in width and 800 to 1,300 ft. long (generally equal to the width of the property less property barriers). Layout of these pits can be viewed on Drawings 5-10 and 5-53. In practice, these overburden lifts are mined in a stairstep fashion ahead of the coal removal operation to provide adequate working room for the equipment and stable advancing slopes. Once mining is complete, excavated overburden (spoil) from a successive cut is used to backfill the excavation. General cross sections of this process can be viewed on Drawings 5-11 and 5-12. For the highwall miner method, mining of the trench will be in successive cuts approximately 150 ft. in width and 550 to 600 ft. long. Layout of these trenchs can be viewed on Drawing 5-10 and 5-53. Otherwise, mining and reclamation will proceed as described for the typical open pit method.

Prior to beginning mining, the area will be cleared of vegetation, and the topsoil will be recovered and either stockpiled or live hauled to regraded areas. Overburden will then be removed using large hydraulic excavator(s) or front end loaders and off-road trucks which will haul the spoil and place it in parts of the pit where the coal has been removed, or in the excess spoil area shown on Drawings 5-3, 5-37 and 5-37A for the Coal Hollow Mine and Drawing 5-47 for the North Private Lease. Overburden is removed in successively deeper benches until the coal seam is exposed. Some overburden in lower lifts may be moved by direct dozing into the mined out pit by large bulldozers.

Once the coal is removed, the pit will be backfilled by spoil from adjacent mine pits. Once the pit is backfilled to the planned final surface contour, suitable topsoil and subsoil will be replaced, and the area reseeded. Revegetation work will proceed seasonally as appropriate for planting. The mine plan has been engineered to disturb the smallest practicable area at any one time. The Alternate highwall mining will reduce the practicable area to be reclaimed. With prompt establishment and maintenance of vegetation, immediate stabilization of disturbed areas will minimize surface erosion. Details of the plan has been included in Chapter 5, Section 540 of the MRP. One exception, the last pit (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. As shown on Drawing 5-16, this pit is fully contained within the greater Borrow Area and will be fully mined and immediately backfilled (to the intermediate landform shown in Drawings 5-35 and 5-36) in 2016. This backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pit 10. Subsoil will be placed over the final graded mining surface to an average depth of 1.5 feet for interim reclamation after mining has been completed. Organic mulches will be incorporated into the soil to improve the fertility of the subsoil placed on the interim reclamation surface and seeded with the intermediate seed mix. Incorporation of mulch into the soil will improve the fertility of the subsoil used for interim reclamation cover. The surface foot (12) inches) of amended subsoil will be salvaged as cultivated topsoil at the end of the interim reclamation period.

341.200. Reclamation Description

The Coal Hollow Projects will be reclaimed and revegetated to meet the appropriate postmining land use. Most areas will be reclaimed to the native plant communities that existed prior to mining conditions. Other areas will be reclaimed to enhance habitat for sage-grouse or other wildlife species. Finally, in those areas where the landowner requests a change in the plant community to increase productivity for domestic livestock, they will be reclaimed accordingly. Exhibit 4-1 and 4-2 in Chapter 4 show the land use for the Coal Hollow Mine and the North Private Lease respectively.

341.210. Seed Mixtures

Revegetation seed mixtures for each plant community disturbed by mining activities in the Coal Hollow Project area are given in this section. Table 3-36 shows the plant communities that may eventually be disturbed by mining operations at the Coal Hollow Project area.

Table 3-36: Vegetation Communities of the Coal Hollow Permit Area Proposed for Disturbance			
MINE AREA	MAP SYMBOL (see *Vegetation Map,* Drawing 3-1)	PLANT COMMUNITY	**Post Mining Land Use**
Coal Hollow Lease	S/G	Sagebrush/Grass	Primarily domestic grazing/limited wildlife
	P	Pasture Land	Domestic grazing
	P-J	Pinyon-Juniper	Primarily domestic grazing/limited wildlife
	M	Meadow	Primarily domestic grazing/limited wildlife
	OB	Oak Brush	Primarily domestic grazing/limited wildlife
	RB/SB	Rabbitbrush/Sagebrush (Disturbed; previously Sagebrush/Grass)	Primarily domestic grazing/limited wildlife
North Private Lease	P	Pasture Land	Domestic grazing
	P-J	Pinyon-Juniper/Sagebrush	
			Domestic grazing
	W	Wetlands	Domestic grazing

Seed mixtures for each disturbance type are shown on Tables 3-37 *through* 3-43. These rates have been based on drill seeding methods described in this document. When broadcast seeding is employed these rates will be doubled. ACD may add or remove plant species if requested by the landowner.

Table 3-37: Revegetation Seed Mixture for the Sagebrush/Grass Community at the Coal Hollow Project

	Rate** (# PLS/Ac)	Seeds/ft2
SHRUBS		
*Artemisia nova**	0.20	4.16
*Artemisia tridentata**	0.10	5.74
Ceratoides lanata	1.00	1.26
Purshia tridentata	2.00	0.69
Symphoricarpos oreophilus	1.00	1.72
FORBS***		
Achillea millefolium	0.03	1.91
Hedysarum boreale	1.00	0.77
Linum lewisii	0.70	4.47
Lupinus argenteus	1.00	0.29
Penstemon palmeri	0.30	4.20
Sphaeralcea grossulariifolia	0.40	4.59
Viguiera multiflora	0.20	4.84
GRASSES		
Elymus smithii	1.50	4.34
Elymus trachycaulus	1.50	5.51
Poa pratensis	0.10	5.00
Poa secunda	0.20	4.25
Stipa hymenoides	1.00	4.32
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	22.23	62.66

* This species could also to be planted by containerized seedlings at a rate of 200 plants per acre to enhance sage-grouse habitat.

** Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

*** Seeds used may be based on commercial availability. Other forb species that would be beneficial for sage-grouse enhancement include: Achillea millefolium, Agoseris glauca, Crepis acuminata, Gayophytum spp., Lomatium spp., Tragopogon dubius, Trifolium spp.

Table 3-38: Revegetation Seed Mixture for the Pasture Lands at the Coal Hollow Project

(Final determination to be made by landowners)	Rate* (# PLS/Ac)	Seeds/ft2
SHRUBS		
FORBS **		
Achillea millefolium var. occidentalis	0.04	2.55
Astragalus cicer	1.5	4.22
Hedysarum boreale	1	0.77
Linum perenne	1	6.39
Medicago sativa	1	5.21
GRASSES		
Bromus inermis	1	2.45
Dactylis glomerata	0.2	0.00
Pascopyrum smithii	1.5	4.34
Elymus lanceolatus ssp. lanceolatus	1.5	5.27
Psathyrostachys juncea	1	0.00
Thinopyrum intermedium	2	0.00
Phleum pretense	0.2	0.00
Poa pratensis	0.1	5.00
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	22.04	40.78

* Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.	10	
*** Seeds used may be based on commercial availability. Other forb species that would be beneficial for sage-grouse enhancement include: Achillea millefolium, Agoseris glauca, Crepis acuminata, Gayophytum spp., Lomatium spp., Tragopogon dubius, Trifolium spp.		

Table 3-39: Revegetation Seed Mixture for the Pinyon-Juniper Community at the Coal Hollow Project

	Rate* (# PLS/Ac)	Seeds/ft2
SHRUBS		
Amelanchier Utahensis	5.00	2.96
Artemisia nova	0.20	4.16
Artemisia tridentata vaseyana	0.07	4.02
Ceratoides lanata	3.00	3.79
Purshia tridentata	12.00	4.13
Symphoricarpos oreophilus	2.50	4.30
FORBS		
Artemisia ludoviciana	0.04	4.13
Eriogonum umbellatum	1.00	4.80
Hedysarum boreale	5.00	3.86
Lupinus argenteus	15.00	4.30
Sphaeralcea coccinea	0.50	5.74
Viguiera multiflora	0.20	4.84
GRASSES		
Elymus spicatus	1.00	3.21
Elymus smithii	1.50	4.34
Elymus trachycaulus	1.50	5.51
Poa pratensis	0.10	5.00
Poa secunda	0.20	4.25
Stipa hymenoides	1.00	4.32
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	59.81	82.25

* Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

Table 3-40: Revegetation Seed Mixture for the Meadow Community at the Coal Hollow Project

	Rate* (# PLS/Ac)	Seeds/ft2
SHRUBS		
FORBS **		
Iris missouriensis	2	0.96
Achillea millefolium var. occidentalis	0.1	6.37
GRASSES		
Carex microptera	0.2	3.89
Carex nebrascensis	0.5	6.13
Elymus trachycaulus ssp. trachycaulus	2	7.35
Phleum pretense	0.2	5.97
Poa pratensis	0.1	5.00
Poa secunda ssp. sandbergii	0.3	6.38
Schoenoplectus americanus	1	4.13
Sporobolus airoides	0.2	8.03
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	16.60	58.79

* Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

*** Seeds used may be based on commercial availability. Other forb species that would be beneficial for sage-grouse enhancement include: Achillea millefolium, Agoseris glauca, Crepis acuminata, Gayophytum spp., Lomatium spp., Tragopogon dubius, Trifolium spp.

Table 3-41: Revegetation Seed Mixture for the Oak Brush Community at the Coal Hollow Project

	Rate* (# PLS/Ac)	Seeds/ft2
SHRUBS		
Amelanchier utahensis	1	0.59
Artemisia nova	0.2	4.16
Artemisia tridentate ssp. vaseyana	0.07	4.02
Cercocarpus montanus	1	1.35
Purshia tridentate	2	0.69
Symphoricarpos oreophilus	1	1.72
Ephedra viridis	2	1.15
FORBS		
Artemisia ludoviciana	0.04	4.13
Sphaeralcea coccine	0.2	2.30
Hedysarum boreale	1	0.77
Heliomeris multiflora	0.2	4.84
GRASSES		
Bromus marginatus	2	4.90
Pseudoroegneria spicata ssp. spicata	1.5	4.82
Elymus trachycaulus ssp. trachycaulus	1.5	3.96
Poa pratensis	0.1	5.00
Poa secunda ssp. sandbergii	0.2	4.25
Achnatherum hymenoides	1	4.32
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	25.01	57.56

* Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

Table 3-42: Revegetation Seed Mixture for the Rabbitbrush/Sagebrush Community (disturbed Sagebrush/Grass Community) at the Coal Hollow Project

	Rate** (# PLS/Ac)	Seeds/ft2
SHRUBS		
*Artemisia nova**	0.2	4.16
*Artemisia tridentate ssp. Tridentate**	0.1	5.74
Krascheninnikovia lanata	1	1.26
Purshia tridentate	2	0.69
Symphoricarpos oreophilus	1	1.72
FORBS ***		
Achillea millefolium var. occidentalis	0.03	1.91
Hedysarum boreale	1	0.77
Linum perenne	0.7	4.47
Lupinus argenteus ssp. rubricaulis	1	0.29
Penstemon palmeri	0.3	4.20
Sphaeralcea grossulariifolia	0.4	4.59
Heliomeris multiflora	0.2	4.84
GRASSES		
Pascopyrum smithii	1.5	4.34
Elymus trachycaulus ssp. trachycaulus	1.5	5.51
Poa pratensis	0.1	5.00
Poa secunda ssp. sandbergii	0.2	4.25
Achnatherum hymenoides	1	4.32
Sterile Triticale - Quick Guard	10.00	4.59
TOTALS	22.23	62.66

* This species could also to be planted by containerized seedlings at a rate of 200 plants per acre to enhance sage-grouse habitat.

** Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

*** Seeds used may be based on commercial availability. Other forb species that would be beneficial for sage-grouse enhancement include: Achillea millefolium, Agoseris glauca, Crepis acuminata, Gayophytum spp., Lomatium spp., Tragopogon dubius, Trifolium spp.

Table 3-43: Revegetation Seed Mixture for the Wetland Community in the North Lease Area of the Coal Hollow Project

	Rate* (# PLS/Ac)	Seeds/ft2
SHRUBS		
Rosa woodsii	5.00	5.20
FORBS ***		
Iris missouriensis	10.00	4.82
GRASSES/GRASS-LIKE		
Agrostis stolonifera	0.05	7.35
Carex microptera	0.40	7.78
Carex nebrascensis	0.50	6.13
Carex pellita	1.00	7.16
Carex utriculata	0.50	5.10
Juncus arcticus	0.05	6.89
Poa pratensis	0.07	3.50
Scipus americanus	2.00	8.26
Triglochin maritima	0.50	5.17
TOTALS	20.07	67.34

* Based on drill seeding methods. The number reflects the pounds of pure live seed (PLS) per acre.

** Seeds used may be based on commercial availability. Other substitute species could include: Carex aquatilis, Carex obnupta, Carex praegracilis, Juncus tenuis, Juncus torrevi

341.220. Planting & Seeding Methods

Seedbed Preparation & Analyses

The final seedbed of the reclaimed areas will be prepared following the procedures found in section 243 of Chapter 2.

If heavy equipment operation results in excessive soil compaction at the surface of the reclaimed areas, they will then be ripped, disked, or harrowed to loosen the seedbed prior to seeding. Excessive compaction that could impact seeding success will be determined by observation and judgment of an environmental professional. In other areas where less compaction has occurred, the areas will be disked and harrowed. The disking and harrowing of all areas will be done parallel with the contour wherever possible to decrease the potential for water erosion downslope. In other areas where compaction is not a problem, dozer tracking can be used to roughen the surface, and to trap seed, fertilizer, mulch, and other amendments as well as decrease erosion by wind and water. In such cases, seeding will be done immediately after this treatment, whereas soil amendments, where required, would be applied over the surface during seedbed preparations. Seeding will mainly occur in the early spring and late fall.

Seeding & Transplanting

Seeding will be accomplished using different methods depending on the area to be seeded. In the more flat areas such as the meadows and existing pasture lands, a typical farmland drill will be used for seeding. In other areas where the surface may be more rough, a modified rangeland drill or “rough terrain seeder” will be used. Finally, in the areas where access is more difficult to reach by heavy equipment due to slope steepness or other limiting factors, broadcast seeding or hydro-seeding will be employed. For a list of plant species to be seeded refer to Tables 3-37 *through* 3-43.

Containerized plants can be planted in those areas proposed for sage-grouse habitat enhancement. These plants will be planted from containers at least 10 cubic inches in size and inoculated with appropriate site-specific or commercial mycorrhizal inocula at specified infection rates. The containerized plants will be planted at a rate that totals at least 400 individuals per acre. For a list of the species to be planted, refer to Table 3-37. Containerized plants should be dormant when they arrive at the site in the spring or fall and will be planted as soon after delivery as possible. Plants will be planted in a fashion to simulate a natural habitat. If competing vegetation is present at the time of planting, this vegetation will be removed by scalping the area or herbicide application beforehand that provide a time period ample as to not affect the containerized seedling. A small depression will be created in the seedbed around the seedling at the time of planting to increase survivability by harvesting and holding water. The plants will be “wateredin” when they are planted by adding water to the depression. If possible, the plants will be watered during dry periods for the first growing season.

341.230. Mulching Techniques

Mulch will be placed on the seedbed surface once soil amendments have been incorporated and seeding has been accomplished. Mulching will occur by one of the following methods:

• Certified noxious weed free straw applied at a rate of 1 ton/acre anchored by crimping or a chemical binder.

• Wood fiber hydromulch at a rate of ¾ ton per acre for slopes flatter than 3:1 and 1 ton per acre for slopes at 3:1 which is the steepest slope planned at the project. This hydromulch would be anchored with a chemical binder at the manufacturer's suggested rate.

- Live mulch by use of quick growing sterile nurse crop such as "Quick Guard" with recommended rates of 5-10 lbs. /acre.

The mulch should control erosion by wind and water, decrease evaporation and seed predation, and increase survivability of the seeded species. Since there is only one post mining land use, mulching will follow one of the above described methods for all reclaim areas.

341.240. Irrigation

Irrigation has not been planned for the reclaimed area with the exception of watering the containerized plants as mentioned above.

341.250. Revegetation Monitoring

Vegetation of the reclaimed areas will be monitored regularly to measure the success of plant establishment and to determine if problem areas exist. Qualitative data will be recorded every year and quantitative data will be recorded in years 2, 4, 6, 9, and 10 post seeding. The qualitative data will include: site location, sample date, observers, slope, exposure, acreage, animal disturbance, erosion damage, dominant plant species observed, rainfall and other pertinent notes. Quantitative data recorded will include: total cover (living cover, rock, litter, bare ground), cover by species, composition, frequency, and woody species density.

The Division's "Vegetation Information Guidelines, Appendix A" will be used to determine specific sampling techniques for data collection.

Weed control through chemical means will follow the current Weed Control Handbook (published annually or biannually by the Utah State University Cooperative Extension Service) and herbicide labels.

Weed surveys will also be conducted on the reclaimed areas on a yearly basis or during the revegetation monitoring studies. If undesirable, exotic or “weedy” plant species are present at a density that could impede revegetation or out-compete desirable plant species, chemical, mechanical, or biological treatment will be used in accordance with R645-301-357.320.

341.300. Mining, Reclamation & Revegetation Research

DOGM may require greenhouse studies, field trials, or equivalent methods of testing proposed or potential revegetation materials and methods to demonstrate that revegetation is feasible pursuant to R645-300-133.710.

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342. **FISH AND WILDLIFE ENHANCEMENT**

This section includes a fish and wildlife plan for the reclamation and postmining phase of the operation consistent with R645-301-330 and the performance standards of R645-301-358. (for specific details see section 330, OPERATION PLAN).

342.100. Measures for Enhancement of Habitat

Enhancement measures that will be used during the reclamation and postmining phase of the operation to develop aquatic and terrestrial habitat. Such measures may include restoration of streams and other wetlands, retention of ponds and impoundments, establishment of vegetation for wildlife food and cover, and the replacement of perches and nest boxes (see also section 330, **OPERATION PLAN**).

The NPL contains approximately 6.34 acres of palustrine emergent wet meadow wetlands, 0.04 acre of stock pond and 4,632 feet (0.14 acre) of the Kanab Creek stream channel that were delineated and verified by the U.S. Army Corps of Engineers (SPK-2011-01248) from November 2012 and the follow-up PDJ from September 2015.. Of the 6.34 acres, mining would only impact approximately 2.~~5~~ 38 acres of ~~waters of the United States, including wetlands~~wet meadow wetlands and 0.04 acre of stock pond that are situated in an ephemeral swale. In order to have mining access to Areas 2 and 3, the temporary haul road built for Area 1 must be extended to the east to cross Kanab Creek in order to separate mining equipment traffic from public traffic on County Road 136 (K3900). As proposed, the Kanab Creek crossing will require a temporary stream relocation that will impact 257 feet of existing stream channel and 0.05 acre of adjacent wet meadow wetland.~~Wetlands along Kanab Creek will not be disturbed. Only the wet meadow and stockpond in area 2 will be disturbed and they will not be reconstructed.~~ Therefore, ACD through an individual permit, will provide for offsite mitigation for the loss of this habitat. ACD has proposed to mitigate wetland and stream losses within the North Private Lease Area with a project approximately 1.5 miles downstream of the project area on Kanab Creek. The mitigation proposal involves restoring approximately 2,760 feet of stream channel that has been degraded by headcutting and erosion to create conditions that would allow the lost adjacent wetland/riparian areas to redevelop. ACD has proposed to enhance/rehabilitate an additional 1,800 foot long stretch of stream and its adjacent wetland/riparian located just upstream of the stretch to be restored.

342.200. Reclamation Plants for Enhancement

Where fish and wildlife habitat is to be a postmining land use, the plant species to be used on reclaimed areas have been selected on the basis of the criteria described below.

342.210. Nutritional Values of Plant Species

Among other qualities (e.g. erosion control qualities, establishment capabilities, and seed availability), plant species for revegetation of the Coal Hollow Project have been chosen for their proven nutritional value for wildlife (see Table 3-37 *through* 3-43).

342.220. Cover Quality of Plant Species

Among other qualities (e.g. erosion control qualities, establishment capabilities, and seed availability), plant species for revegetation of the Coal Hollow Project have been chosen for their cover qualities for wildlife (see Table 3-37 *through* 3-43).

342.230. Habitat Enhancement & Plant Species

Among other qualities, plant species for revegetation of the Coal Hollow Project have been chosen for their proven habitat enhancement qualities for wildlife (see Table 3-37 *through* 3-43). The plants have also been chosen for their ability to support and enhance fish or wildlife habitat after the release of performance bonds. At final revegetation, the selected plants will be grouped and distributed in a manner which optimizes edge effect, cover, and other benefits to fish and wildlife.

After consultation with agencies responsible for the administration of forestry and wildlife programs regarding habitats and sensitive species, the sage-grouse and its habitat were of greatest concern in the area. Accordingly, the several measures to minimize impacts and enhance habitat for this species have been considered by the operator and regulatory agencies and incorporated into the MRP as Appendix 3-5 and 3-8 (see Section 333 above).

342.300. Cropland & Revegetation

Where cropland is to be the postmining land use, where appropriate for wildlife- and crop-management practices, and with approval from the private landowners, the Coal Hollow Project will intersperse the fields with trees, hedges, or fence rows throughout the harvested area to break up large blocks of monoculture and to diversify habitat types for birds and other animals. Pursuant to R645-301-356.220, the requirements of R645-302-310 and R645-302-317 apply for areas identified as prime farmland. In 2016, the Natural Resources Conservation Service (NRCS) established specifications for prime farmland soil removal, storage, replacement, and reconstruction. See Chapter 2 Section R645-302-317 for additional information regarding soil management.

342.400. Residential & Industrial Reclamation
No residential or industrial areas have been planned at this time.

350. **PERFORMANCE STANDARDS**

351. **GENERAL REQUIREMENTS**

All coal mining and reclamation operations will be carried out according to plans provided under R645-301-330 *through* R645-301-340.

352. **CONTEMPORANEOUS RECLAMATION**

Revegetation on all land that is disturbed by coal mining and reclamation operations, will occur as contemporaneously as practicable with mining operations, except when such mining operations are conducted in accordance with a variance for combined Surface and Underground Coal Mining and Reclamation Activities issued under R645-302-280. See Section 341.100 for the reclamation timetable. DOGM may establish schedules that define contemporaneous reclamation. One exception, the last pit (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. As shown on Drawing 5-16, this pit is fully contained within the greater Borrow Area and will be fully mined and immediately backfilled (to the intermediate landform shown in Drawings 5-35 and 5-36) in 2016. This backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pit 10.

353. **REVEGETATION: GENERAL REQUIREMENTS**

ACD will establish on re-graded areas and on all other disturbed areas, except water areas and surface areas of roads that are approved as part of the postmining land use, a vegetative cover that is in accordance with the mine permit and reclamation plan.

353.100. Vegetative Plant Cover Qualities

353.110. Diverse, Effective, & Permanent

The vegetation cover established at final reclamation will be diverse, effective and permanent.

353.120. Native Plant Species

The cover will be comprised of species native to the area, or of introduced species where desirable and necessary to achieve the approved postmining land use and approved by the DOGM (see Table 3-37 *through* 3-43).

353.130. Final Vegetation Cover & Quantities

The final cover will be at least equal in extent of cover to the natural vegetation of the area, or those standards set for final revegetation success.

353.140. Vegetation Cover and Soil Stabilization

The cover will be capable of stabilizing the soil surface from erosion.

353.200. The reestablished plant species will also contain the qualities listed below.

353.210. (a) Be compatible with the approved postmining land use.

353.220. (b) Have the same seasonal characteristics of growth as the original vegetation.

353.230. (c) Be capable of self-regeneration and plant succession.

353.240. (d) Be compatible with the plant and animal species of the area.

353.250. (e) Meet the requirements of applicable Utah and federal seed, poisonous and noxious plant; and introduced species laws or regulations.

353.300. Vegetative Cover Exceptions

DOGM may grant exception to the requirements of R645-301-353.220 and R645-301-353.230 when the species are necessary to achieve a quick-growing, temporary, stabilizing cover, and measures to establish permanent vegetation are included in the approved permit and reclamation plan.

353.400. Cropland Exceptions

When the approved postmining land use is cropland, DOGM may grant exceptions to the requirements of R645-301-353.110, R645-301-353.130, R645-301-353.220 and R645-301-353.230.

354. **TIMING OF REVEGETATION**

Disturbed areas will be planted during the first normal period for favorable planting conditions after replacement of the plant-growth medium. The normal period for favorable planting is that planting time generally accepted locally for the type of plant materials selected (see section 341.100, Reclamation Timetable).

355. MULCHING & OTHER SOIL STABILIZING PRACTICES FOR REVEGETATION

Suitable mulch and other soil stabilizing practices will be used on all areas that have been re-graded and covered by topsoil or topsoil substitutes (see section 340, RECLAMATION PLAN).

356. **STANDARDS FOR REVEGETATION SUCCESS**

356.100. Success Criteria

Success of revegetation will be judged on the effectiveness of the vegetation for the approved postmining land use, the extent of cover compared to the extent of cover of the reference area or other approved success standard, and the general requirements of R645-301-353.

356.110. Vegetation Information Guidelines

Standards for success, statistically valid sampling techniques for measuring success, and approved methods are identified in the DOGM's "Vegetation Information Guidelines, Appendix A." The approved techniques in that document will be used for measuring reclamation success. The reclaimed areas will be compared to the reference areas identified on Drawing 3-1. GPS coordinates in UTM NAD 27 are provided on Drawing 3-1 to assist in navigation to each reference location.

356.120. Revegetation Success Standards

Standards for revegetation success will include comparisons of unmined lands (reference areas), or other success standards approved by the Division, with the areas being reclaimed to evaluate ground cover, production, or stocking. Ground cover, production, or stocking will be considered equal to the approved success standard when they are not less than 90 percent of the success standard. The sampling techniques for measuring success will use a 90-percent statistical confidence interval (i.e., one-sided test with a 0.10 alpha error).

The standards recommended for revegetation success at the Coal Hollow Mine are the result of consultations and collaborations with DWR, DOGM, ACD, consulting biologists and the private landowners of the mine area. The landowners generally prefer that their land be returned to vegetation with the primary focus on grazing for domestic livestock. Some, but not all, of the landowners are not opposed to re-seeding with some plant species, both woody and herbaceous, that could also benefit wildlife habitat (see Chapter 4). The rationale for the success standards is that those areas reclaimed to include woody and herbaceous plants to enhance wildlife will model ecological secondary succession and the dynamics that follow reestablishment of plant communities that have been severely disturbed by forces such as floods, wildfires, severe winds or man-caused disturbances like surface mining. With that concept in mind, the consensus for the standards for future revegetation success along with the postmining land uses for the Coal Hollow Lease and the North Lease Area are summarized on the table below.

Revegetation success standards and postmining land uses at the Coal Hollow Mine, Utah			
COAL HOLLOW LEASE			
RECLAIMED AREA	**TOTAL LIVING COVER**	**WOODY SPECIES DENSITY**	**PRODUCTION**
Sagebrush/Grass(~~6~~5)	Sagebrush/Grass Reference Area	10% of the total value in the Sagebrush/Grass Reference Area (1)	Sagebrush/Grass Reference Area
Pasture Land(7)	64.50% (~~5~~4)	No woody species density standard	1,100 lbs/ac (~~8~~7)
Pinyon-Juniper(~~6~~5)	~~49.75% (4)~~Sagebrush/Grass Reference Area	~~10% of the total value in the Pinyon-Juniper~~Sagebrush/Grass Reference Area (1)	~~700 lbs/ac (9)~~Sagebrush/Grass Reference Area
Meadow (~~6~~5)	Meadow Reference Area	10% of the total value in the Meadow Reference Area (1)	Meadow Reference Area
Oak Brush(~~6~~5)	Oak Brush Reference Area	10% of the total value in the Oak Brush Reference Area (1)	Oak Brush Reference Area
Meadow (Dry) (~~6~~5)	Meadow (Dry) Reference Area	10% of the total value in the Meadow (Dry) Reference Area (1)	Meadow (Dry) Reference Area
NORTH PRIVATE LEASE			
Pasture Land(~~7~~6)	64.50% (~~5~~4)	No woody species density standard	1,100 lbs/ac(~~8~~7)
Sagebrush Drainage(~~7~~6) Sagebrush within the incised channels west of Kanab Creek channel (i.e. Sample Site: V-07)	Sagebrush Drainage Reference Area (Sample Site: V-03)	10% of the total value Sagebrush Drainage Reference Area (1) (Sample Site: V-03)	Sagebrush Drainage Reference Area (Sample Site: V-03)
Wetlands(7)	U.S. Army COE standards	U.S. Army COE standards	U.S. Army COE standards

(1) Can include shrubs and subshrubs. Rabbitbrush (*Chrysothamnus nauseosus*) cannot account for more than 10% of the total density.

(2) ~~Recommended index:~~Diversity for Forbs: MacArthur=s Diversity Index for forbs.

(3) ~~Recommended index:~~ Diversity for Grasses: MacArthur=s Diversity Index for grasses.

(~~5~~4) This is the average total living cover measured for all Pasture Lands sampled (see Appendix 3-4 and Volume 12 for Pasture Land cover data).

(~~6~~5) Postmining land use is primarily domestic grazing with limited wildlife use.

(~~7~~6) Postmining Land use is domestic grazing.

(~~8~~7) Refer to Volume 12, Table 43 for production information.

356.200. Postmining Land Use

Standards for success will be applied in accordance with the approved postmining land uses (see Chapter 4 Exhibit 4-1 and 4-2).

356.210. Grazing or Pasture Land

Areas to be reclaimed as pasture and grazing land (see *Vegetation Map, Drawing 3-1*) ~~*and Volume 12, Vegetation Map 1*~~ the ground cover and production of living plants on the revegetated area will be at least equal to that of a reference area or other success standards approved by DOGM.

356.220. Cropland

For areas developed for use as cropland, crop production on the revegetated area will be at least equal to that of a reference area or such other success standards approved by DOGM. The requirements of R645-302-310 through R645-302-317 apply to areas identified as prime farmland.

~~356.~~ Wetlands

Portions of the North Private Lease supports wetland communities, some of which ~~could~~ will be disturbed by proposed mining in that area. Those areas which are returned to wetlands will be reclaimed under U.S. Army COE standards governed by nationwide permit (SPK-2011-01248) and individual permit (SPK-2011-01248).

356.230. Wildlife Habitat

Several areas will be returned to wildlife habitat. For these areas success of vegetation will be determined on the basis of tree and shrub stocking and vegetative ground cover (see also section 356.100, Success Criteria).

356.231. Consultation & Approval

In 2016, ACD consulted with the DOGM and Utah Division of Wildlife and all parties agreed a shrub (and half-shrub) stocking density of 10% compared to the reference site would be adequate success measures for stocking density. See consultation letter, Appendix 10.

356.232. Woody Species Success Criteria

Trees and shrubs that will be used in determining the success of stocking and the adequacy of plant arrangement will have utility for the approved postmining land use. At the time of bond release, such trees and shrubs will be healthy, and at least 80 percent will have been in place for at least 60 percent of the applicable minimum period of responsibility. No trees and shrubs in place for less than two growing seasons will be counted in determining stocking adequacy.

356.233. General Vegetative Cover

Vegetative ground cover will not be less than that required to achieve the approved postmining land use.

356.240. Industrial, Commercial or Residential Success Criteria

No areas have been proposed to be reclaimed as industrial, commercial or residential for the Coal Hollow Project or the North Private Lease.

356.250. Previous Disturbed Areas Success Criteria

Other than those lands where the native plant communities have been disturbed for rangeland improvements or pasture lands, no areas would be considered "previously disturbed" in the project area.

356.300. Sediment Control Structures

Siltation structures will be maintained until removal is authorized by the DOGM and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding.

356.400. Removal of Sediment Control Structures

When a siltation structure is removed, the land on which the siltation structure was located will be revegetated in accordance with the reclamation plan and R645-301-353 *through* R645-301-357.

357. **REVEGETATION RESPONSIBILITY PERIODS**

357.100. Beginning Date

The period of extended responsibility for successful vegetation will begin after the last year of augmented seeding, fertilization, irrigation, or other work, excluding husbandry practices that are approved by DOGM in accordance with R645-301-357.300.

357.200. Duration

Vegetation parameters identified in R645-301-356.200 will equal or exceed the approved success standard during the growing seasons for the last two years of the responsibility period. The period of extended responsibility will continue for five or ten years based on precipitation data reported pursuant to R645-301-724.411 and the following conditions.

357.210. (a). In areas of more than 26.0 inches average annual precipitation, the period of responsibility will continue for a period of not less than five full years.

357.220. (b). In areas of 26.0 inches or less average annual precipitation, the period of responsibility will continue for a period of not less than ten full years.

357.300. Husbandry Practices

357.301. Approval Information

DOGM may approve certain selective husbandry practices without lengthening the extended responsibility period. Practices that may be approved are identified in R645-301-357.310 *through* R645-301-357.365. The operator may propose to use additional practices, but they would need to be approved as part of the Utah Program in accordance with 30 CFR 732.17. Any practices used will first be incorporated into the mining and reclamation plan and approved in writing by DOGM. Approved practices are normal conservation practices for unmined lands within the region which have land uses similar to the approved postmining land use of the disturbed area. Approved practices may continue as part of the postmining land use, but discontinuance of the practices after the end of the bond liability period will not jeopardize permanent revegetation success. Augmented seeding, fertilization, or irrigation will not be approved without extending the period of responsibility for revegetation success and bond liability for the areas affected by said activities and in accordance with R645-301-820.330.

357.302. Demonstration of Appropriate Reclamation Techniques

The Coal Hollow Project will demonstrate that husbandry practices proposed for a reclaimed area are not necessitated by inadequate grading practices, adverse soil conditions, or poor reclamation procedures.

357.303. Bonded Area & Husbandry Practices

DOGM will consider the entire area that is bonded within the same increment, as defined in R645-301- 820.110, when calculating the extent of area that may be treated by husbandry practices.

357.304. Separate Responsibility Periods

If it is necessary to seed or plant in excess of the limits set forth under R645-301-357.300, DOGM may allow a separate extended responsibility period for these reseeded or replanted areas in accordance with R645-301-820.330.

357.310. Reestablishing Trees and Shrubs

357.311. Planting Within the Responsibility Period

Trees or shrubs may be replanted or reseeded at a rate of up to a cumulative total of 20% of the required stocking rate through 40% of the extended responsibility period.

357.312. Planting Shrubs in Established Vegetation If shrubs are to be established by seed in areas of established vegetation, small areas will be scalped (see section 341.220, Planting & Seeding Methods). The number of shrubs to be counted toward the tree and shrub density standard for success from each scalped area will be limited to one.

357.320. Weed Control and Associated Revegetation

Weed control through chemical, mechanical, and biological means discussed in R645-301-357.321 *through* R645-301-357.323 may be conducted through the entire extended responsibility period for noxious weeds and through the first 20% of the responsibility period for other weeds.

Any revegetation necessitated by the following weed control methods will be performed according to the seeding and transplanting parameters set forth in R645-301-357.324.

357.321. Chemical Weed Control

Weed control through chemical means will follow the current Weed Control Handbook (published annually or biannually by the Utah State University Cooperative Extension Service) and herbicide labels.

Weed surveys will also be conducted on the reclaimed areas on a yearly basis or during the revegetation monitoring studies. If undesirable, exotic or "weedy" plant species are present at a density that they could impede revegetation or out-compete desirable plant species, a certified or trained specialist will spray herbicide, kill or remove the weeds mechanically (see below).

357.322. Mechanical Weed Control

Mechanical practices that may be approved include hand rouging, grubbing and mowing.

357.323. Biological Weed Control

Selective grazing by domestic livestock may be used. Biological control of weeds through disease, insects, or other biological weed control agents is allowed but will be approved on a case-by-case basis by DOGM, and other appropriate agency or agencies which have the authority to regulate the introduction and/or use of biological control agents.

357.324. Weed Control & Desirable Species Damage

Where weed control practices damage desirable vegetation, areas treated to control weeds may be reseeded or replanted according to the following limitations. Up to a cumulative total of 15% of a reclaimed area may be reseeded or replanted during the first 20% of the extended responsibility period without restarting the responsibility period. After the first 20% of the responsibility period, no more than 3% of the reclaimed area may be reseeded in any single year without restarting the responsibility period, and no continuous reseeded area may be larger than one acre. Furthermore, no seeding will be done after the first 60% of the responsibility period or Phase II bond release, whichever comes first. Any seeding outside these parameters will be considered to be "augmentative seeding," and will restart the extended responsibility period.

357.330. Control of Other Pests

357.331. Big Game

Control of big game (deer, elk, moose, antelope) may be used only during the first 60% of the extended responsibility period or until Phase II bond release, whichever comes first. Any methods used will first be approved by DOGM and, as appropriate, the land management agency and the State of Utah Division of Wildlife Resources (DWR). Methods that may be used include fencing and other barriers, repellents, scaring, shooting, and trapping and relocation. Trapping and special hunts or shooting will be approved by DWR. Other control techniques may be allowed but will be considered on a case-by-case basis by the DOGM and by DWR. Appendix C of the DOGM's "Vegetation Information Guidelines" includes a non-exhaustive list of publications containing big game control methods.

357.332. Small Mammal & Insects

Control of small mammals and insects will be approved on a case-by-case basis by DWR and/or the Utah Department of Agriculture. The recommendations of these agencies will also be approved by the appropriate land management agency or agencies. Small mammal control will be allowed only during the first 60% of the extended responsibility period or until Phase II bond release, whichever comes first. Insect control will be allowed through the entire extended responsibility period if it is determined, through consultation with the Utah Department of Agriculture or Cooperative Extension Service, that a specific practice is being performed on adjacent unmined lands.

358.400. Riparian & Wetland Areas

There are some riparian and wetland areas associated with springs and seeps in the Coal Hollow Lease area. These areas include the 85.88-acre Dame Lease IBC area (see Chapter 7). The habitat in the vicinity of springs SP-8, SP-14, SP-20, SP-22, and SP-40, and wells C4, C2, C3, C5, and Y-61 will be protected through the use of highwall mining techniques in the 85.88-acre Dame Lease IBC. Unlike coal mining using conventional mine pit surface mining techniques (utilized elsewhere at the Coal Hollow Mine), mining using highwall mining techniques does not result in disturbance to the land surface above coal extraction areas (the coal is extracted through a series of excavated horizontal holes, with sufficient coal left in place between holes to fully support the overlying land surface). The highwall mining plan for the 85.88-acre Dame Lease IBC, including the spacing and dimensions of the excavated holes, has been engineered to prevent subsidence of the land surface. The highwall mining will occur in the Smirl coal seam, which is separated from overlying shallow alluvial groundwater systems by a thickness of soft, low-permeability Tropic Shale bedrock. The presence of the Tropic Shale bedrock between the coal seam and the overlying alluvium minimizes the potential for downward migration of alluvial groundwaters into the excavated coal holes. Accordingly, impacts to water quantity in the overlying and adjacent shallow alluvial groundwater systems are not anticipated (Appendix 7-14). Similarly, as no surface disturbance is anticipated over highwall mined areas, impacts to water quality in the overlying alluvial groundwater systems are not anticipated. For these reasons, impacts to ecosystems in and around the monitoring sites mentioned above are not anticipated and the habitat will be protected.

In the event that diminution of discharge rates from seeps and springs does occur as a consequence of mining and reclamation activities, any lost water will be replaced according to all applicable Utah State laws and regulations using the water replacement source specified in R645-301-727. The quantity and quality of replacement water detailed in R645-301-727 will be suitable for the existing premining uses and approved postmining land uses. The methodology for restoring possible diminution of discharge from a spring would include piping from ACD's current water replacement well to the approximate location of the impacted water source. Implementation will occur after consultation with all parties (DOGM, ACD and Richard Dame).

Vegetation will be monitored in the 85.88 acre Dame Lease by monitoring the existing meadow reference transect and one additional random transects within the lease area. Monitoring will begin with the first appropriate season and will continue until the first appropriate season following highwall mining within the Dame lease.

Next, there were also channels or drainages that dissected the North Private Lease study area (refer to Appendix 3-9). These channels supported some riparian and wetland communities and consisted of about 9 acres of the study area. Volume 10 contains the "Wetland Delineations & Ordinary High Water Mark Identifications Private Lease Area", along with copies of the Preliminary Jurisdictional Determination (PDJ) from November 2012 and the follow-up PDJ from September 2015. The U.S. Army Corps of Engineers (USACE) issued a nationwide permit (SPK-2011-01248) for the filling 0.0184 acre of wet meadow wetland for the relocation of County Road 136 (K3900) and the construction of a temporary haul road to access Area 1. An application, with the USACE for an individual permit (SPK-2011-01248 was applied for on July 16, 2016 to allow for mining of coal in Area 2 that will result in unavoidable impacts to 2.38 acres of wet meadow wetland and 0.04 acre of stock pond that are situated in an ephemeral drainage swale. In order to have mining access to Areas 2 and 3, the temporary haul road built for Area 1 must be extended to the east to cross Kanab Creek in order to separate mining equipment traffic from public traffic on County Road 136 (K3900). As proposed, the Kanab Creek crossing will require a temporary stream relocation that will impact 257 feet of existing stream channel and 0.05 acre of adjacent wet meadow wetland. As of January 4, 2017, the individual permit is nearing completion. The individual permit will allow for the "take" of wetlands with in the mining area of the North Private Lease and provide for “offsite in-kind mitigation” to compensate for these losses.~~There are also some riparian and wetland areas associated with the North Private Lease (refer to Appendix 3-9 and 404 Permit SPK-2001-01248)~~.

~~-~~Although a 200’ buffer of undisturbed habitat located along Kanab Creek has been left between Areas 2 and 3 mining disturbance (approximately 20 acres), an additional 80 acres of sage-grouse mitigation was added to the North Private Lease compensatory mitigation to compensate for the temporary impacts of mining activities in close proximity. At the Divisions request, of the 1,000 acres’ total compensatory mitigation for the North Private Lease, 100 acres would be required to be mitigation in a riparian/wetland type environment. WRI Project ID 3876 (approximately 247.79 acres of willow/rabbitbrush removal in a wet meadow habitat) was undertaken in 2016 to fulfill this requirement.

358.500. Best Technology Available

ACD will apply the best technology currently available in all disciplines of the coal mining and reclamation activities.

358.510. Powerline & Transmission Facilities

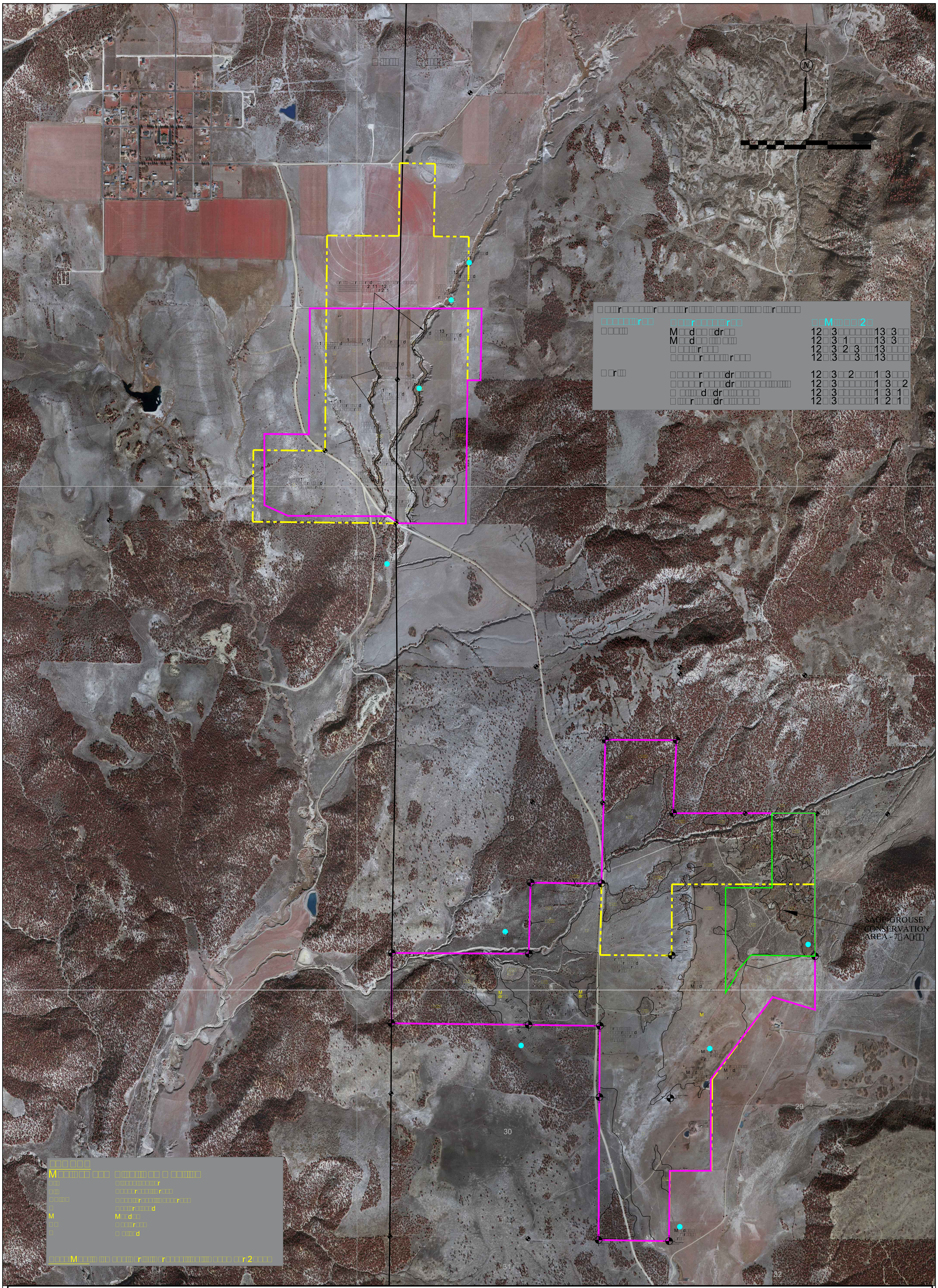
ACD will ensure that electric powerlines and other transmission facilities used for, or incidental to, coal mining and reclamation operations on the permit area are designed and constructed to minimize electrocution hazards to raptors, except where DOGM determines that such requirements are unnecessary.

358.520. Fences & Conveyers

ACD will design fences, overland conveyers, and other potential barriers to permit passage for large mammals, except where the DOGM determines that such requirements are unnecessary.

358.530. Toxic-Forming Areas

ACD has no plans for ponds that contain hazardous concentrations of toxic-forming materials.



LEGEND:

- PERMIT AREA
- PRIVATE COAL
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER
- REFERENCE AREA

DRAWN BY:	CHECKED BY:
K.NICHOLES	LWJ
DRAWING:	DATE:
3-1	8/22/16
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JOB NUMBER:	SHEET

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VEGETATION MAP

COAL HOLLOW PROJECT
ALTON, UTAH

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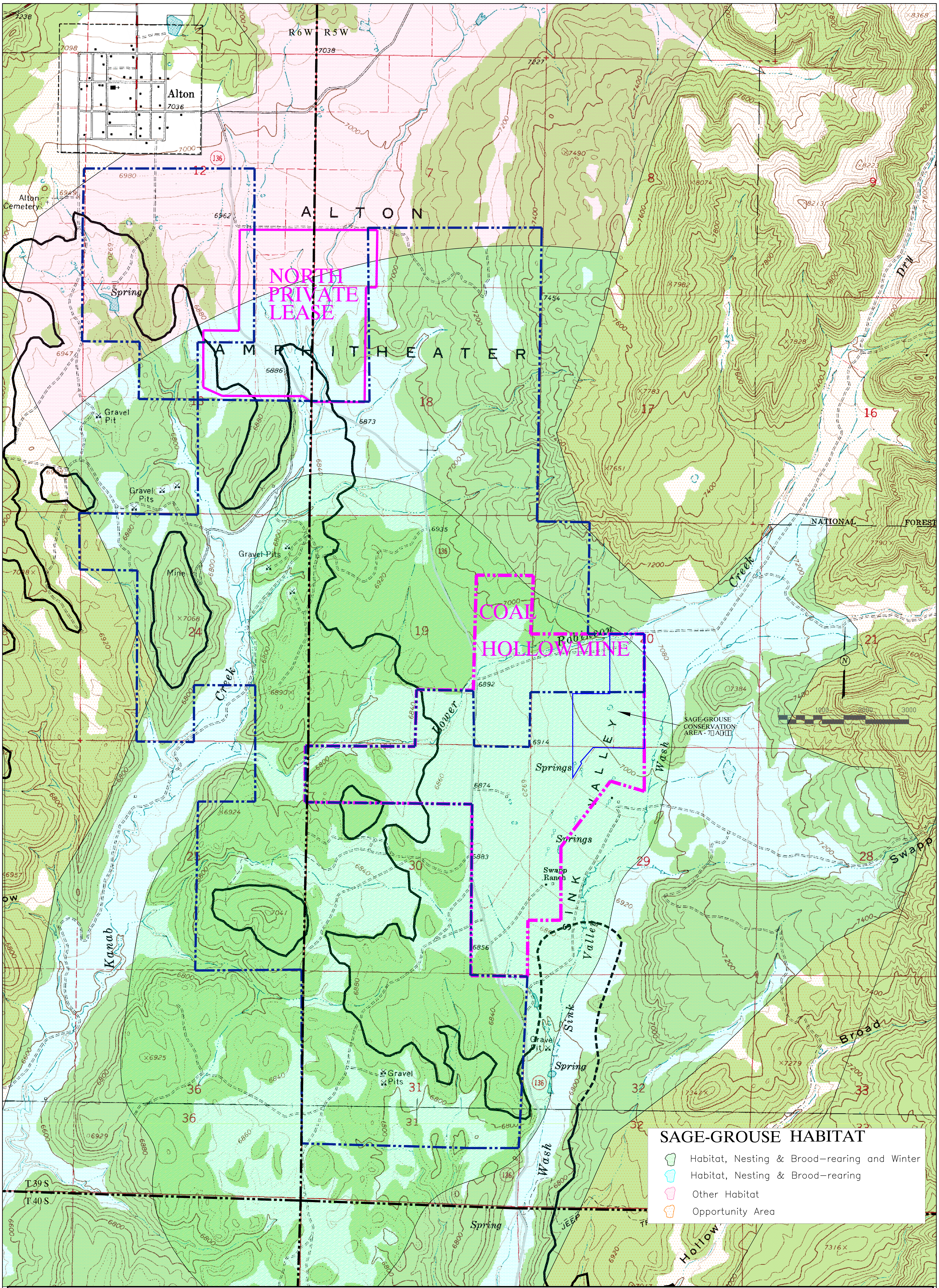

LEGEND:

PROPOSED LBA BOUNDARY

PERMIT AREA

COUNTY ROAD

COAL LINE BOUNDARY

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K. NICHOLES	APC
DRAWING: 3–5	DATE: 8/16/04
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[illegible]7	[illegible]N

SAGE-GROUSE BROOD HABITAT MAP

COAL HOLLOW PROJECT
ALTON, UTAH

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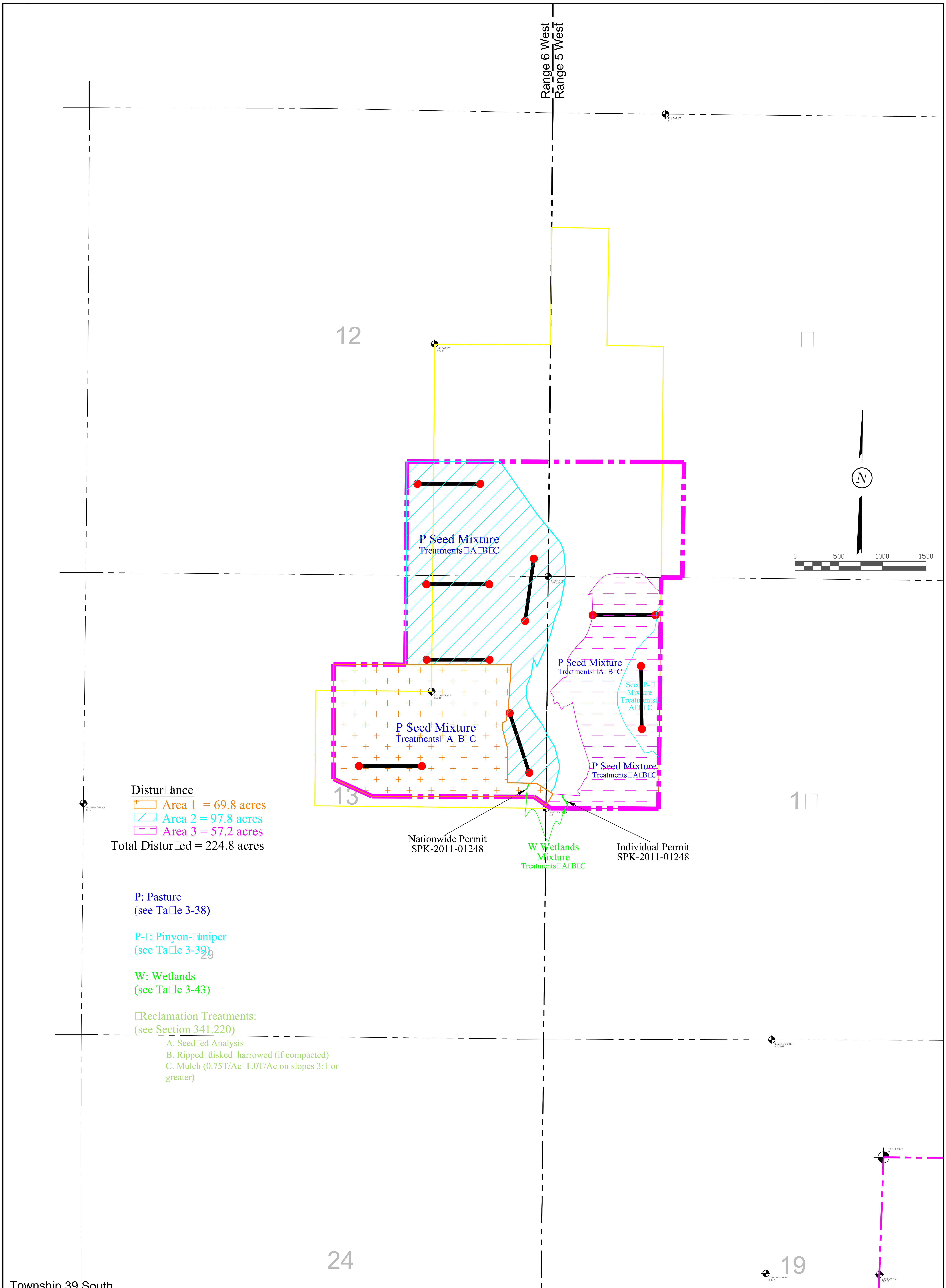
Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867–5331
Fax (435)867–1192



LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

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K. NICHOLES	AC
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RECLAMATION TREATMENTS, MONITORING SAMPLE LOCATIONS

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

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UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

CHAPTER 4

R645-301-400. LAND USE

410. REGIONAL LAND USE

Land use and agricultural production in the Coal Hollow Project region centers around livestock production. Rangeland use for cattle grazing is the predominant land use in the area, but the land is also used as watershed, recreational hunting, and wildlife habitat.

The majority of the land in the current Coal Hollow Mine area is classified as unimproved rangeland. Some farming is done within the surrounding lands but crop choice and production levels are severely restricted by climate, soil, and water availability. Alton and Sink Valley incur frequent early spring frost conditions as a result of cold air drainage into these low-lying valleys. These conditions and the resultant short growing season restrict crop choice to the more hardy wheat and small grain crops and alfalfa hay.

The North Private Lease area, located less than a mile from the current Coal Hollow Mine permit, consists mostly of rangelands that have been converted to pasture lands. Although there are differences in the vegetation between pastures due to management practices, seed mixtures planted and soils, the pasture lands are primarily dominated by grass species. Additionally, in the North Private Lease there is also a fair amount of land that has been converted to croplands, most of which lie outside the area to be mined. Although crops can vary from year-to-year due to rotation practices, the most common crops raised are alfalfa, wheat and silage crops. Like the current mine area, there are other areas that support native, relatively undisturbed, plant communities (or undeveloped rangelands). These areas consist of pinyon-juniper, sagebrush and mountain brush communities -- including transitional zones between these types. Finally, there are also drainage channels that dissect the North Private Lease area. Some of these channels support riparian and wetland communities along with native upland plant communities adjacent to them.

411. ENVIRONMENTAL DESCRIPTION

The Coal Hollow Project area lies within elevations 6,840 feet and 7,000 feet above sea level. It incorporates valley floors and hills, and is cradled between the Dixie National Forest. Climate is largely determined by local topography and the location of the area relative to the principal sources of moisture, the Pacific Ocean and the Gulf of Mexico. The existence of barriers between southern Utah and these moisture sources produces the dry temperature climate for which this area is renowned. A weather station was constructed in the summer of 2005 to monitor monthly precipitation, temperature, wind direction and speed; it is shown in Photographs 4-1 and 4-2.

Winter season Pacific storms reaching the Utah area must first cross the Sierra Nevada and Cascade Ranges to the west. Lifting of the air masses during storm passage over these barriers result in the majority of the moisture in the air condensing and falling out as precipitation. Thus, air mass reaching southern Utah from the west is generally dry and the associated precipitation is light. A similar barrier to moisture from the Gulf of Mexico can be found in the Rocky Mountains east of southeast Utah. During the summer, moist air masses do move into the southern part of Utah from the Gulf of California. Precipitation usually falls as thundershowers associated with these air masses. Precipitation for the area generally averages 16 inches per year. Temperature varies from a mean maximum temperature of 92 degrees Fahrenheit during the summer months to a mean minimum temperature of 18 degrees during the winter months. Maximum snow depths average about 12" but usually melt fairly rapidly.

The predominant wind direction of south-central Utah ranges from southwest through west, with secondary peaks from the southeast and northwest. Surface winds near the permit area average about eight miles per hour. Higher wind speeds are usually associated with the passage of frontal systems or thunderstorms, generally during the springtime.

411.100 Premining Land Use Information

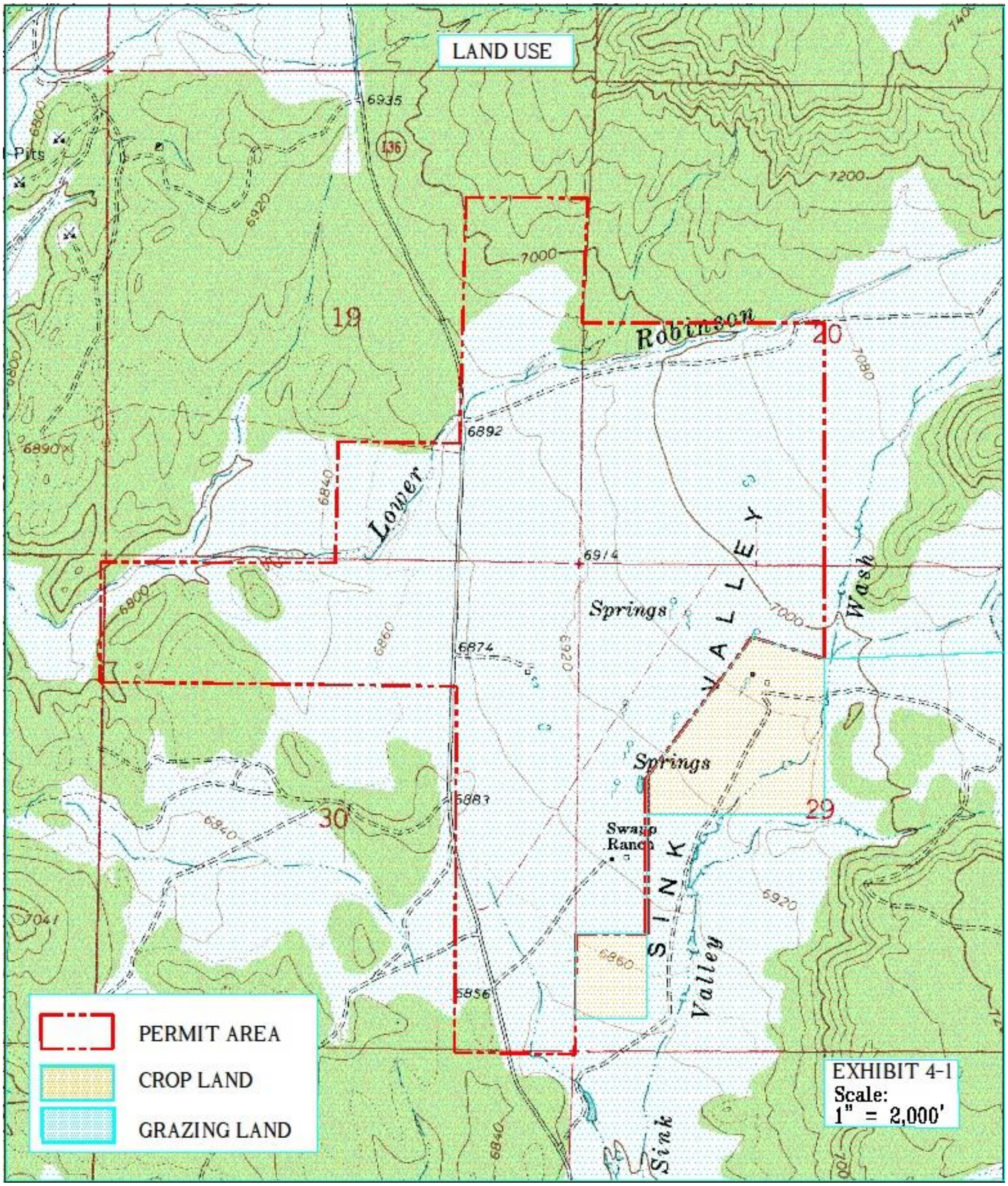
The premining use of the land within the permit boundaries is grazing and wildlife habitat. Rangeland use for cattle grazing is the predominant land use in the Alton area. Together with lands too steep or unproductive for cattle grazing, these two land types account for 90% of land uses.

The land within the permit area consists of managed and unmanaged expanses of rolling to steep pinyon-juniper, sagebrush, mountain brush, meadows, wetlands, riparian zones and pasture lands. Some horse and cattle grazing occurs within the pasture land, but is limited due to the short growing season.

Agricultural crop production is sustained on some land east of the current permit area. 85% to 90% of this crop is not harvested, but is used for cattle grazing. Croplands located north of the permit area and south of the town of Alton (i.e. the North Private Lease) are devoted to hay, wheat and silage production for on-ranch winter cattle feed. Exhibit 4-1 and 4-2 reflect land use within and around the permit areas. Photographs 4-3 and 4-4 show actual layout of cropland and grazing land.

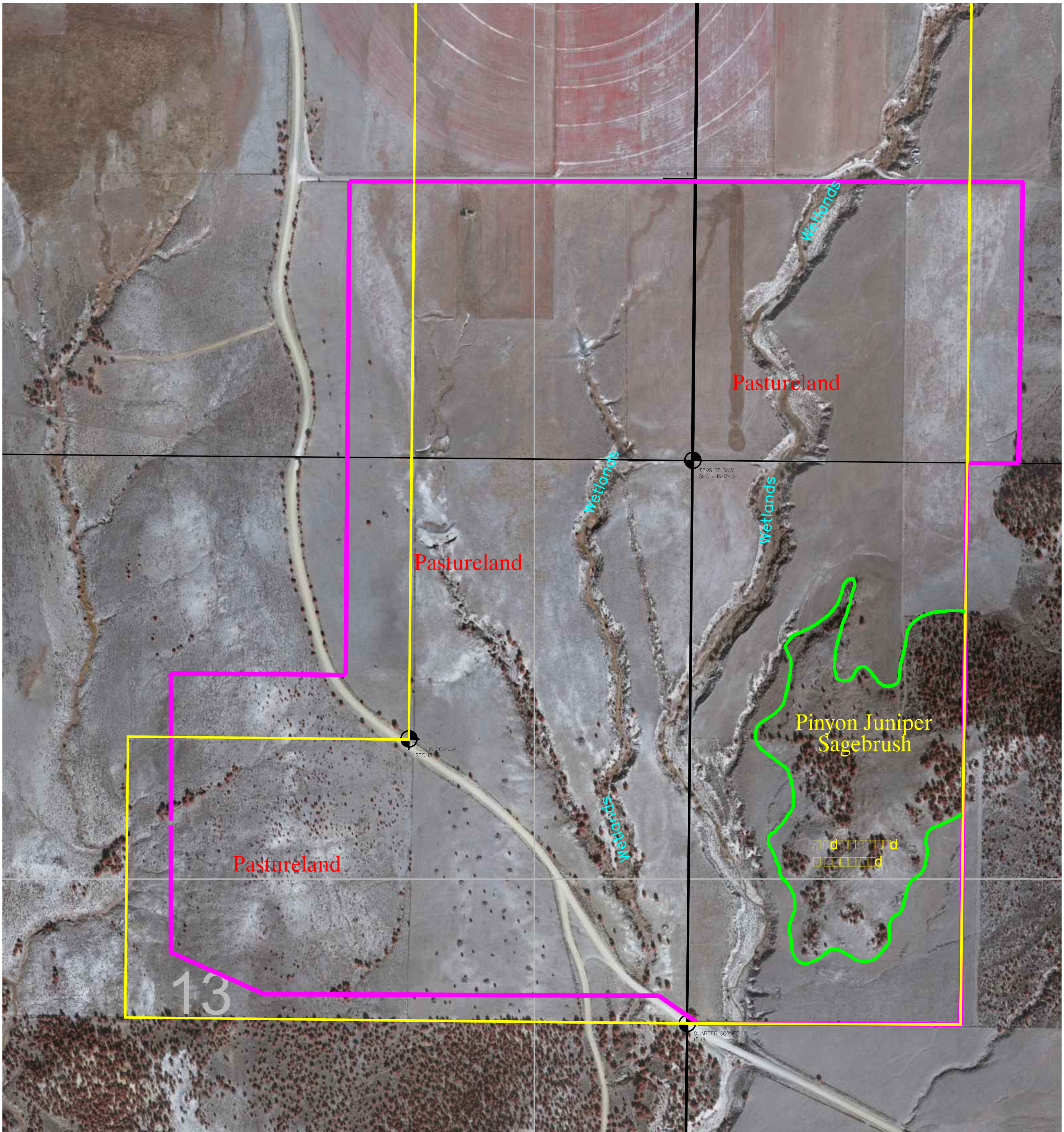
Wildlife habitats within the current mine area are reflected on Drawings 3-2 *through* 3-5. Wildlife habitats for the North Private Lease area are shown on Wildlife Maps 1 *through* 4 in Appendix 3-9 (*Vegetation & Wildlife Habitat of the North Private Lease Area).* Black bear, Rocky Mountain elk, mule deer, and greater sage-grouse are some of the wildlife species that use the lands within the permit area. Land use maps of the current Coal Hollow Mine area and North Private Lease have been provided below.

After reclamation, the mining area and borrow area will be restored to support uses it was capable of supporting prior to mining. Vegetation will be restored to provide habitat and a food source for wildlife. Access roads, fence lines, and supporting structures will be reconstructed pursuant to the wishes of the surface landowners.



Acreage of crop land under production:

Sorensen:	90 acres (approximate)
Johnson:	None currently
Dame:	None currently
Pugh:	None currently



LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING:	DATE:
EXHIBIT 4–2	4/10/15
	SCALE:
	1" = 600'
JOB NUMBER:	SHEET
0001	

REVISIONS

DATE:	BY:
	N
	N

LAND USE MAP - VEGETATION TYPES

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

E HIBIT -

Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

Utility Corridors and Other Right-of-Ways

Kane County maintains a county road, County Road 136, which runs north-south through the western part of the permit areas. This is reflected on Drawing 1-1. Alton Coal Development, under the direction and in corporation with Kane County, plans to temporarily relocate County Road 136 east while mining operations commence to the west. This is reflected on Drawing 5-1 and 5-45. After mining is completed below the now existing road bed, the county road will be moved to its original location and constructed as required by Kane County Road Department.

411.110 Surface Land Status/Mine Plan Area

Ownership of the surface rights within and contiguous to the mine plan and permit area is shown on Drawing 1-3. The surface within the permit area is privately owned and leased by Alton Coal Development, LLC. The contiguous lands, outside the permit area, are administered by Bureau of Land Management, along with other private owners, as reflected on Drawing 1-3.

Alton Coal Development believes that the mining of the permit area will enhance the postmining use of the land. Some gullies and rills will be eliminated. Drainages will be enhanced allowing a better use of land. Wildlife habitat will benefit from the planting and reclamation of lands for that purpose. Reclamation will be constructed to the final landform shown on Drawings 5-37 and 5-37A for the current mine and borrow areas. Reclamation will be constructed to the final landform shown on Drawing 5-74 and 5-75 for the North Private Lease. The alternative highwall mining will reduce surface disturbance. Mining disturbance to the surface will be reduced along with reclamation needs. Surface areas that will not be affected by any mining will remain in the existing pre-mining state.

411.120 Land Capability

The Coal Hollow Project area has several land uses ranging from wildlife habitat to pasture land. Vegetative cover and productivity of the plant communities in the current mine area are shown in Chapter 3 (sections 321.100 *through* 321.200). Vegetative cover and productivity estimates for the North Private Lease are shown in Tables 1 *through* 43 of Appendix 3-9 (*Vegetation & Wildlife Habitat of the North Private Lease Area*). Soil resources information of the permit area is provided in Chapter 2 (sections 222.100 *through* 222.400). Soils information for the North Private Lease can be found in VOLUME 11 (Supplemental Report: *Order 2 Soil Survey for the Proposed North Private Lease Expansion of the Coal Hollow Mine*). Topography of the area is described in several chapters, but specifically in Chapter 6. Current hydrologic conditions of the permit and adjacent areas to the project are provided in Chapter 7.

411.130 Existing Land Uses/Land Use Classifications

Kane County has zoned the area within the permit boundaries and surrounding area as Agriculture.

411.140 Cultural and Historic Resource Information

CURRENT COAL HOLLOW MINE AREA

The current Coal Hollow Mine Area has seen a number of cultural resource inventories and associated projects over the years that have been completed for coal mining and related exploration activities. The first inventory was completed in 1977 by K.K. Pelli under state project number U77-KA-0258b. The project covered a portion of the current Coal Hollow Mine area with no cultural sites reported (Pierson & Pierson 1977).

Table 4-1. Cultural resource projects completed within the current Coal Hollow Mine area

Project Name	Project Number	Author & Year
Cultural Resource Management Investigations in Kane and Carbon Counties for Proposed Coal Leasing on Federal Lands	U77-KA-0258b	Pierson & Pierson 1977
An Archaeological Survey of Proposed Drill Holes, Access Roads and a Sample Test Pit in the Alton Coal Field	U79-NI-0406b	Dosh 1979
An Archaeological Survey and Evaluation of 7325 Acres in the Alton Leasehold, Kane County, Utah	U81-NI-0254b	Halbirt & Gualtieri 1981
Archaeological Survey of 23 Proposed Drill Holes and Access Roads in the Alton Coal Field, Kane County, Utah	U85-NI-0587b	Keller 1985
Archaeological Investigations, Utah International, San Francisco Alton Coal Field Project, Bureau of Land Management Land, Cedar City District, and Private Land, Kane County, Utah	U86-NI-0297b,p	Weaver 1986a
An Archaeological Survey of Auger Borings and Backhoe Test Pits for Utah International, Inc., Alton Coal Field, Kane County, Utah	U87-NI-0856b	Weaver & Hurley 1987
Cultural Resource Inventory of the Coal Hollow Project Coal Seam Drill Sites in the Alton Amphitheater, Kane County, Utah.	U05-MQ-0346b,p	Thornton & Montgomery 2005
Cultural Resource Inventory of Alton Coal Development's Sink Valley-Alton Amphitheater Project Area, Kane County, Utah.	U05-MQ-1567	Stavish 2006
Cultural Resource Inventory of Alton Coal Development's Project Area, Kane County, Utah	U05-MQ-1568b,p	Stavish 2007a
Data Recovery and Research Design for Sites 42KA2068, 42KA6104, 42KA6105, 42KA6106, 42KA6107, and 42KA6108, Kane County, Utah	N/A	Stavish 2007b
Cultural Resource Inventory of Alton Coal Development's Additional Survey of 440 Acres in the Alton Coal Amphitheater, Kane County, Utah	U08-MQ-0539	Stavish 2008a
Data Recovery Plan and Research Design for Site 42KA2044, Kane County, Utah	N/A	Stavish 2008b
Archaeological Data Recovery at Sites 42KA2042, 42KA2044, 42KA2068, 42KA6104, 42KA6105, 42KA6106, 42KA6107, and 42KA6108, Kane County, Utah	U10-MQ-0504(e)	Stavish 2010
Alton Coal Development's Phase I Cultural Resources Treatment Plan for Data Recovery at 42KA6093 and 42KA6505, and Avoidance at 42KA1313, 42KA2041, 42KA2043, 42KA6109, 42KA6110, and 42KA6126, Kane County, Utah	N/A	Clark & Creer 2010

Alton Coal Development's Coal Hollow Mine Project Phase I: Data Recovery Report for 42KA2060 and 42KA6093, Kane County, Utah	U10-ST-0886p(e)	Clark 2011
Treatment Plan for the Portion of 42KA2041 Located on the Coal Hollow Mine	N/A	Cannon & Fenner 2013
Preliminary Report on the Phase I Testing of a Portion of Site 42KA2041, Kane County, Utah	N/A	Gourley 2013
Archaeological Testing of a Portion of Site 42KA2041 within the Coal Hollow Mine in the South Private Lease Area, Kane County, Utah	U13-HO-0650p,(e)	Gourley 2016

In 1979 MNA completed an inventory of 31 exploratory drill holes, 19 access corridors, and a test pit location within the Alton Coal Field under state project number U79-NI-0406. Two of these exploratory sites were located within the current Coal Hollow Mine project area. No cultural sites were reported for those locations (Dosh 1979).

In 1979-1980, MNA completed a survey covering all of the current Coal Hollow Mine project area under state project number U81-NI-0254b. Results of the inventory included documentation of five eligible prehistoric sites (42KA2041-42KA2044 & 42KA2060) and one eligible prehistoric/historic site (42KA2068) within the project area with one additional eligible prehistoric/historic site (42KA2058) recorded immediately adjacent to the mine (Halbirt & Gualtieri 1981).

In 1985, MNA completed a survey of 23 exploratory drill holes and associated access corridors within the Alton Coal Field under state project number U85-NI-0587b. One of these drill holes was within the current Coal Hollow Mine project area. No cultural sites were reported for that location (Keller 1985).

MNA completed another inventory in 1986 for 43 exploratory drill holes and associated access corridors as part of the Alton Coal Project under state project number U86-NI-0297. Six of these exploratory sites were within the current Coal Hollow Mine project area. No cultural sites were reported for those locations (Weaver 1986).

The following year, in 1987, MNA completed another inventory of 22 exploratory auger bores and 27 backhoe test pits within the Alton Coal Field under state project number U87-NI-0856b. Two of these exploratory sites were within the current Coal Hollow Mine project area. No cultural sites were reported for those locations (Weaver & Hurley 1987).

In June and July of 2005, Montgomery Archaeological Consultants, Inc. (MOAC) conducted a cultural resource inventory for Alton Coal Development, LLC that covered most of the permit area totaling approximately 433 acres of private property under state project number U05-MQ-1567p. The additional 85.88 acres of surface, Dame Property (plot 9-5-29-2), added as part of this permit will not be impacted by operations and will not be affected by mining (See Drawing 1-3). This inventory resulted in the identification and documentation of seven new eligible prehistoric sites (42KA6104-42KA6109 & 42KA6126) within the current Coal Hollow Mine area, and updating the recording on five eligible previously recorded prehistoric sites (42KA1313, 42KA2041-42KA2044 & 42KA2068). One additional new eligible prehistoric site (42KA6110) was documented immediately adjacent to the mine (Stavish 2006).

In August 2005, exploration activities resumed with an inventory of six drill sites within the current Coal Hollow Mine project area by MOAC under state project number U05-MQ-0346b,p. No cultural sites were reported for those locations (Thornton & Montgomery 2005).

Later that same year, MOAC completed yet another inventory in 2005 that covered a portion of the current Coal Hollow Mine project area under state project number U05-MQ-1568b,p. One eligible previously recorded historic/prehistoric site (42KA2058) was present just beyond the mine project area and an updated recording was completed (Stavish 2007a).

In 2008, MOAC completed an inventory that covered a portion of the current Coal Hollow Mine project area under state project number U08-MQ-0539. One eligible previously recorded prehistoric site (42KA2060/42KA6505) was present within the mine project area and an updated recording was completed (Stavish 2008a).

Mitigation of adverse effects has been carried out on 11 of the sites within the current Coal Hollow Mine project area through development of several archaeological treatment plans. The first eight sites (42KA2042, 42KA2044, 42KA2068 & 42KA6104-42KA6108) were mitigated in 2010 under two separate treatment plans developed by MOAC (Stavish 2007b & Stavish 2008b) and reported on in 2010 (Stavish 2010). This was followed by mitigation work on two sites (42KA2060 & 42KA6093) in 2010 under a treatment plan developed by SWCA (Clark & Creer 2010) and reported on in 2011 (Clark 2011). A portion of another site (42KA2041) had limited mitigation work carried out on it in 2013 under a treatment plan prepared by SWCA in 2013 (Cannon & Fenner 2013). Reporting on this site included a preliminary letter report (Gourley 2013) and final report in 2016 (Gourley 2016a). Finally, one additional site (42KA2043) inside the borrow area as part of the mine reclamation work was recommended Eligible for the National Record of Historic Places (NRHP) in a 2005 re-inventory report. A treatment plan for this site has been prepared by Bighorn (Gourley 2016b). In a letter dated July 19, 2016 DOGM with concurrence of SHPO, determined No Historic Properties Affected with regard to site 42KA2043. Therefore, as per the treatment plan, only site 42KA1313 will be barricaded and monitored to prevent adverse effect when the Pit 10 borrow plan is implemented. An additional five eligible cultural sites within the current Coal Hollow Mine area and two immediately adjacent to the mine have been avoided. Should mining designs change and adverse effects be necessitated, then development of an appropriate treatment plan will be completed. All new surface disturbances within the mine area have also been monitored per guidelines set forth in the Cultural Resource Management Plan developed by MOAC (Stavish 2008) and the Cultural Resource Discovery Plan developed by SWCA (Bollong & Johnson 2010).

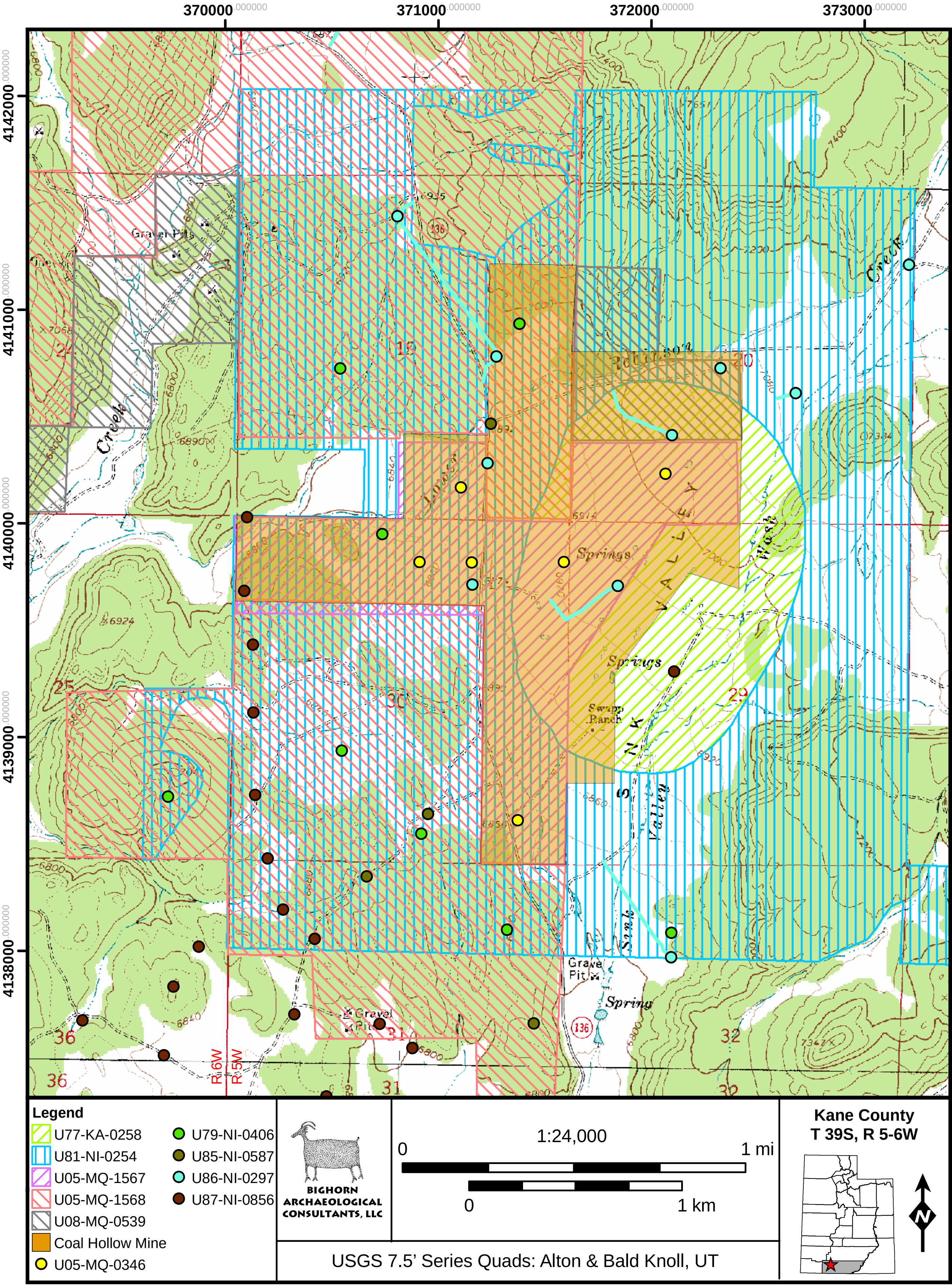


Exhibit 4-3. Cultural inventories complted within the Coal Hollow Mine area

NORTH PRIVATE LEASE AREA

Seven cultural resource inventories have been conducted within the North Private Lease area along with mitigation work on two eligible cultural sites. One additional inventory within the project area will be completed as soon as the weather permits in 2017. The first such inventory project was completed in 1985 by MNA for 23 exploratory drill holes and associated access routes within the Alton Coal Field under state project number U85-NI-0587b. One of these drill holes was within the North Private Lease area. No cultural sites were reported for that location (Keller 1985).

Table 4-2. Cultural resource projects completed within the North Private Lease area

Project Name	Project Number	Author & Year
Archaeological Survey of 23 Proposed Drill Holes and Access Roads in the Alton Coal Field, Kane County, Utah	U85-NI-0587b	Keller 1985
Archaeological Investigations, Utah International, San Francisco Alton Coal Field Project, Bureau of Land Management Land, Cedar City District, and Private Land, Kane County, Utah	U86-NI-0297b,p	Weaver 1986
Alton Coal Project Survey	U86-NI-0487b,s	Keller 1987
Survey and Monitoring, Nine Backhoe Test Pits	U86-NI-0864b	Weaver 1986
Cultural Resource Inventory of Alton Coal Development's Project Area, Kane County, Utah.	U05-MQ-1568b,p	Stavish 2007
A Cultural Resource Inventory of the Alton Town Bypass Route, Kane County, Utah	U11-HO-0623p	Gourley 2011
Archaeological Monitoring & Historic Properties Treatment Plan for the Alton Coal North Private Lease Area, Kane County, Utah	N/A	Gourley 2016a
Preliminary Report on the Tier I Testing of Site 42KA3097 & Historic Road Reconnaissance within the Alton Coal North Private Lease Area, Kane County, Utah	U16-HO-0136p(e)	Gourley 2016b
A Cultural Resource Inventory of the Alton Coal North Private Lease Area Hydrologic Outflows, Kane County, Utah	U16-HO-0742b,p	Gourley 2017a
Preliminary Report on the Tier I Testing of Site 42KA3077 within the Alton Coal North Private Lease Area, Kane County, Utah	U16-HO-0136p(e)	Gourley 2017b

The following year, in 1986, MNA completed another inventory for 43 exploratory drill holes and associated access corridors as part of the Alton Coal Project under state project number U86-NI-0297. One of these exploratory sites was within the North Private Lease area. No cultural sites were reported for this location (Weaver 1986).

Later that same year, in 1986, MNA completed an inventory that covered most of the North Private Lease area as part of the Alton Coal Project Survey under state project number U86-NI-0487b,s. One eligible prehistoric site (42KA3077) and one eligible prehistoric/historic site (42KA3097) were documented within the North Private Lease area (Keller 1987).

An inventory and monitoring of nine backhoe test pits was also completed by MNA in 1986 under state project number U86-NI-0864b. One of these test pits was within the North Private Lease area. No cultural sites were reported for that location (Weaver 1986).

In June and July of 2005, a cultural resource inventory was conducted by MOAC under state project number U-05-1568-b,p that covered both private and BLM lands. The survey covered all of the North Private Lease and adjacent LBA. Updated documentation was completed for one eligible previously recorded prehistoric site (42KA3077) and for one eligible prehistoric/historic site (42KA3097). One new eligible prehistoric site (42KA6080) was also recorded along the southern edge of lease area within what was originally an expanded boundary for site 42KA3077 (Stavish 2007). Appendix 4-1, Cultural Resource Inventory of Alton Coal Developments Sink Valley-Alton Amphitheater Project Area, Kane County, Utah, reflects maps, photographs, and results of the inventory.

In August 2011, an inventory was completed by Bighorn Archaeological Consultants, LLC as part of the proposed Alton bypass road under state project number U11-HO-0623p. This survey covered a small portion of the North Private Lease area. Site 42KA3097 was present within the corridor but no updated site recording was required (Gourley 2011).

In September 2016, an inventory was completed by Bighorn for a number of hydrologic outflows associated with five detention ponds being constructed along drainages within the North Private Lease area. This survey was done under state project number U16-HO-0742b,p. One eligible prehistoric cultural site, 42KA6081, had a site form update completed (Gourley 2017a).

Based on these previous inventories, planned mining operations within the North Private Lease area will result in an adverse effect to two eligible cultural sites, 42KA3077 and 42KA3097. One additional site, 42KA6080 is present along the southern edge of the lease area and can be avoided. A data recovery treatment plan discussing testing and avoidance/monitoring methods has been prepared for these three sites (Gourley 2015) and has been included in Appendix 4-7. As part of this plan, test excavations on the two sites to be adversely effected by the mining operations (42KA3077 and 42KA3097) have been completed. A preliminary letter report detailing the results of the testing for site 42KA3097 has been submitted (Gourley 2016b) and concurrence obtained from DOGM and SHPO indicating that no further data recovery work will be required for that site. A draft preliminary report detailing the testing on site 42KA3077 has also been submitted for review (Gourley 2017b). The third site (42KA6080) that is to be avoided will include avoidance barricading and monitoring to ensure no adverse effect. A final report on the mitigation work on these sites is underway and will be finalized in the next few months.

One final inventory of the North Private Lease area will occur once the weather permits in 2017. This survey will cover all of the project area beyond the 1986 boundaries of sites 42KA3077 and 42KA3097, which were intensively surveyed as part of the migration work on those sites. This survey will be completed to ensure no additional cultural sites have been exposed over the past 12 years since the last inventory of the project area.

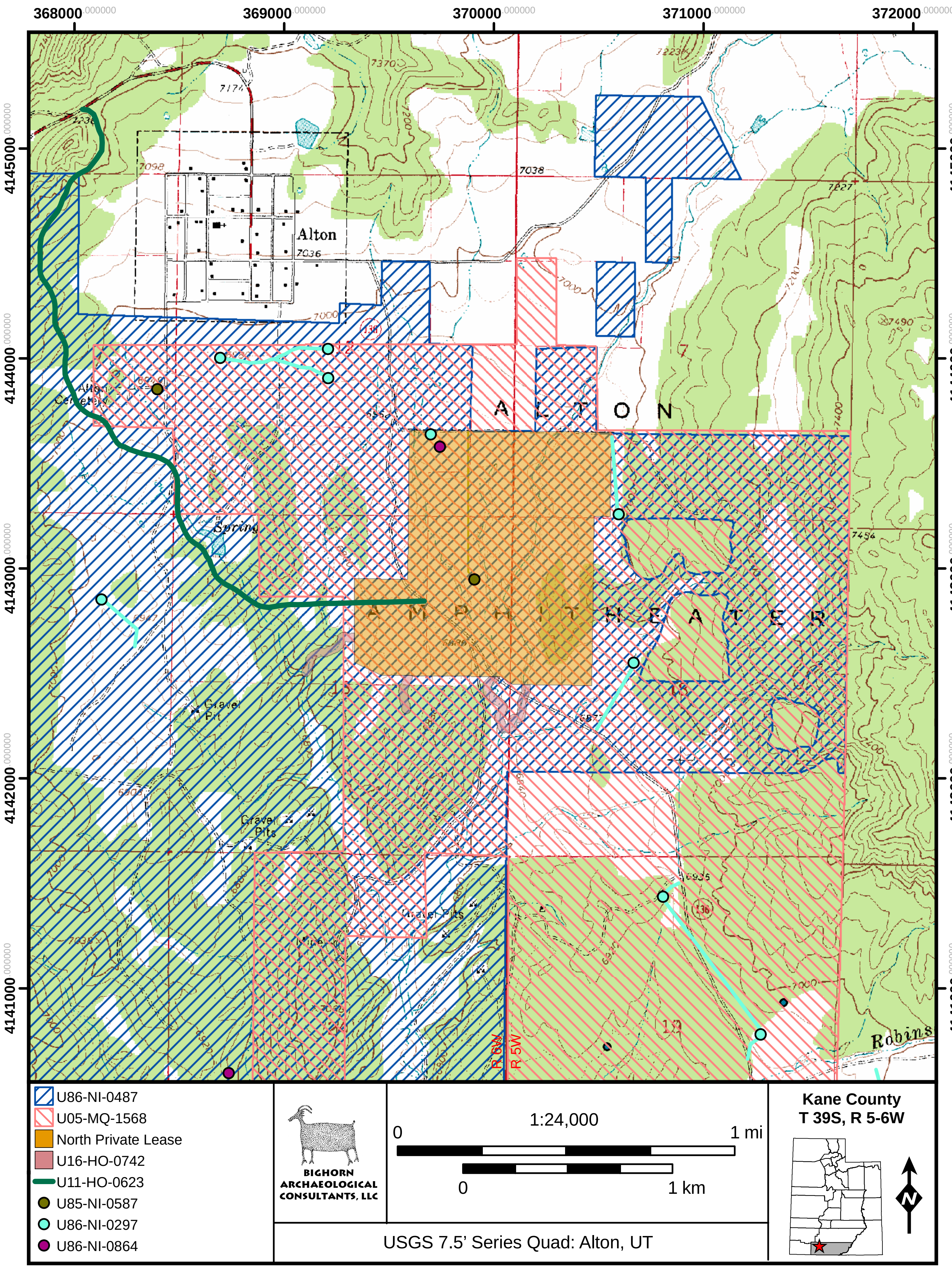


Exhibit 4-4. Cultural inventories completed within the North Private Lease area

Procedures for ground disturbing operations form surface and underground mining activities as described in section 521 and 523 and shown on drawing's 5-10 and 5-53 will follow the "Cultural Resources Discovery Plan for the Alton Coal LLC, Coal Hollow Project in Kane County found in Appendix 4-8.

411.141 Cultural and Historic Resources Maps

Cultural and Historic Resource Maps are included in Appendix 4-1 for the Current Coal Hollow Project and Appendix 4-7 for the North Private Lease expansion.

411.141.1 Boundaries of Public Parks

There are no public parks in the permit area. There are known archeological sites as reflected in the Montgomery survey, Appendix 4-1.

411.141.2 Cemeteries Located within 100 feet

No cemeteries exist within the permit area or within 100 feet of the permit area or within any adjacent area subject to potential impacts.

411.141.3 Trails, Wild and Scenic Rivers System

No trails or wild and scenic rivers or study area rivers exist within the permit area or areas of potential impact.

411.142 Coordination with the State Historic Preservation Officer

Coordination with the State Historic Preservation Officer (SHPO) will take place prior to any mining. Clearances will be obtained through SHPO by means of Phase Testing, a data recovery treatment plan, or other appropriate mitigation processes.

CURRENT COAL HOLLOW MINE AREA

DOGM issued a Notice to Proceed with mining activities on a portion of site 42KA2041 on 4 September 2013. This was provided after completion of formal consultation with PLPCO and SHPO who provided concurrence on such action following Tier I data recovery on the site earlier that year. DOGM also provided notice of site eligibility reassessment for 42KA2043 on 19 July 2016 following concurrence from the SHPO on 11 July 2016. Site 42KA2043 has now been determined non-significant and not eligible for the NRHP.

NORTH PRIVATE LEASE AREA

DOGM initiated eligibility and effects consultation with SHPO in a letter dated 23 July 2015. On 28 July 2015, SHPO provided their concurrence with DOGM's determination of adverse effects to sites 42KA3077 and 42KA3097 in conjunction with proposed mining activities within the boundaries of the North Private Lease area. Following the testing of site 42KA3097, DOGM initiated consultation with SHPO who concurred with DOGM on the adequacy of the site summary report on 8 March 2016, which indicated that no further data recovery work would be required for that site.

411.142.1 Adverse Impacts on Publicly Owned Parks or Places Listed on the National Register of Historic Places

The Permit area is not within any publicly owned parks and there are no places listed on the National Register of Historic Places within either the current Coal Hollow Mine area or the North Private Lease area, however there are a number of eligible cultural sites within each area that are discussed below.

CURRENT COAL HOLLOW MINE AREA

Mitigation of adverse effects has been carried out on 11 of the sites within the current Coal Hollow Mine project area through development of several archaeological treatment plans. Eight sites (42KA2042, 42KA2044, 42KA2068 & 42KA6104-42KA6108) were mitigated in 2010 under two separate treatment plans developed by MOAC (Stavish 2007b & Stavish 2008b) and reported on in 2010 (Stavish 2010). This was followed by mitigation work on two sites (42KA2060 & 42KA6093) in 2010 under a treatment plan developed by SWCA (Clark & Creer 2010) and reported on in 2011 (Clark 2011). Reporting on this site included a preliminary letter report (Gourley 2013) and final report in 2016 (Gourley 2016a). An additional five eligible cultural sites within the current Coal Hollow Mine area and two immediately adjacent to the mine have been avoided. Should mining designs change and adverse effects be necessitated, then development of an appropriate treatment plan will be completed. All new surface disturbances within the mine area have also been monitored by a qualified archaeologist per guidelines set forth in the Cultural Resource Management Plan developed by MOAC (Stavish 2008) and the Cultural Resource Discovery Plan developed by SWCA (Bollong & Johnson 2010).

NORTH PRIVATE LEASE AREA

Mitigation of adverse effects has been conducted on two eligible cultural sites (42KA3077 & 42KA3097) within the North Private Lease area under an archeological testing and data recovery plan developed by Bighorn (Gourley 2015). A preliminary letter report detailing the results of the testing for site 42KA3097 has been submitted (Gourley 2016b) and concurrence obtained from DOGM and SHPO indicating that no further data recovery work will be required for that site. A draft preliminary report detailing the testing on site 42KA3077 has also been submitted for review (Gourley 2017b). A final report on the mitigation work on these sites is underway and will be finalized in the next few months.

411.142.2 Valid Existing Rights / Joint Agency Approval

The Permit area is located on privately owned lands; however one eligible cultural site along the southern edge of the North Private Lease area is located on lands administered by the BLM. This site, 42KA6080, is proposed to be avoided and monitored by a qualified archaeologist during project related activities to ensure no adverse effect (Gourley 2015). No additional coordination with the BLM will be required.

411.143 Mining on Historical Resources

CURRENT COAL HOLLOW MINE AREA

Inventories of the Current Coal Hollow Mine area have identified 18 eligible cultural resource sites within and immediately adjacent to the project area. Eleven of these sites have seen mitigation efforts to offset adverse effects through development of a number of archaeological treatment plans. The remaining eight sites have been avoided by project activities and monitored to ensure no adverse effect.

NORTH PRIVATE LEASE AREA

Inventories of the North Private Lease area have resulted in the identification of three eligible cultural sites within and immediately adjacent to the proposed project area. Proposed mining activities will result in an adverse effect to two of these sites while the third site can be avoided. The two sites to be adversely effected have seen mitigation work completed through a treatment plan which has been developed to offset these adverse effects (Gourley 2015). Monitoring of the third site is also proposed to insure no adverse effect.

411.143.1 Collection of Additional Information

Alton Coal Development will continue to conduct additional field investigations and mitigation of adverse effects within the current Coal Hollow Mine area if mining plans should change and necessitate such actions. Archaeological monitoring will continue within this area per the guidelines set forth in the Cultural Resource Management Plan (Stavish 2008) and the Cultural Resource Discovery Plan (Bollong & Johnson 2010). A map showing the survey area already investigated for archeological importance is included in Appendix 4-1.

Alton Coal Development will also complete additional inventory, treatment of adverse effects, and archaeological monitoring of eligible cultural resource sites identified within the North Private Lease area as determined appropriate through consultation with DOGM and SHPO. A treatment and monitoring plan for this area has been produced (Gourley 2015) and is attached in Appendix 4-7 along with a map showing the survey area already investigated for archeological importance. Archaeological monitoring will be completed within this area as well per the guidelines set forth in the Cultural Resource Management Plan (Stavish 2008) and the Cultural Resource Discovery Plan (Bollong & Johnson 2010).

411.144

Alton Coal Development will continue to follow the process for the development and implementation of appropriate treatment and mitigation plans to address adverse effects within the current Coal Hollow Mine area, should mining plans require such work. Archaeological monitoring will continue within this area per the guidelines set forth in the

Cultural Resource Management Plan (Stavish 2008) and the Cultural Resource Discovery Plan (Bollong & Johnson 2010).

A treatment plan addressing mitigation efforts for proposed adverse effects to cultural sites within the North Private Lease area has been completed and is attached within Appendix 4-7. Alton Coal Development has implemented the mitigation measures within this plan to offset the proposed adverse effects to sites 42KA3077 and 42KA3097, as well as avoidance and monitoring measures for site 42KA6080 to ensure no adverse effect.

411.200 Previous Mining

There has been no mining within the permit area.

412 **RECLAMATION PLAN**

412. <u>Reclamation & Land Use</u>

412.100. <u>Postmining Land Use Plan</u>

A description of the proposed land use following reclamation of the mined areas has been provided in this section of the MRP with a summary in Chapter 3, Section 356.120. The discussions include the utility and capacity of the reclaimed land and the relationship of the proposed uses to existing land use policies and plans, as well as the desires of the current landowners.

412.110. Postmining land use will be achieved by following the detailed reclamation plan included in the MRP. The reclamation plan includes descriptions for structure removal, excess spoil and mine waste disposal, backfilling, compacting, and regrading (Chapter 5); soil handling and stabilization (Chapter 2); revegetation techniques (Chapter 3); measures to control sediments during mining and reclamation activities (Chapter 7).

412.120. <u>Grazing Management Plans</u>

Consultations have been conducted with all surface landowners of the permit area to provide comments in the plan and attain their expectations for the desired postmining land use. According to the landowners, grazing and wildlife habitat would be the desired postmining land use, with emphasis on grazing by domestic livestock in most of the pasture land areas (these areas are shown on Vegetation Map, Drawing 3-l of the MRP and on Vegetation Map 1 in Appendix 3-9 (*Vegetation & Wildlife Habitat of the North Private Lease Area)*. An exception to this plan is that one area in the current mine site that is now pasture land will be reseeded appropriately to provide additional habitat for sage-grouse, a sensitive species in the area. More about this plan is provided below.

A land ownership map of the current Coal Hollow Mine and North Private Lease areas has been provided in the MRP (Drawing 1-3). Descriptions of current management practices as well as future grazing plans for the postmining land use have been provided below.

Property Management Plans

A surface ownership map for the current Coal Hollow Mine area as well as the North Private Lease has been provided in the MRP (Drawing 1-3). Management plans for each property owner is provided below.

CURRENT COAL HOLLOW MINE AREA

Richard Dame Property: The portion of land in the permit area owned by Mr.

Richard Dame currently provides forage for domestic livestock and some wildlife species. This land is comprised mostly of unirrigated pasture land but also supports some native stands of pinyon-juniper and sagebrush communities (see Vegetation Map 3-l).

Mr. Dame has expressed the desire to return his property to pasture land that focuses on domestic livestock, but also wants some plant species for wildlife habitat to be seeded. In doing so, the revegetation seed mix is composed primarily of native and introduced grasses and forbs, with no woody species to be planted (for the seed mixture refer to Chapter 3, Table 3-38).

The livestock currently sustained on Mr. Dame's property are mostly cattle, with some horses. The animals are kept in the pastures from April through November of each year. A management plan to support this same postmining land use has been designed so that the property will adequately support the animals desired by the landowner and will not be over-grazed.

The management plan suggests that 1.125 animals/month/acre could reasonably be sustained on the property. This figure was derived from the *Average Animal Weight Method* (Pratt and Rasmussen) and is based on raising 1 cow weighing 1,000 lbs and her calf on pastures that have an annual biomass productivity of 1,800 lbs/acre. It conservatively estimates that one-half of the production will be consumed ("take half, leave half rationale"). Therefore, the total number of animals allowed on the property in the postmining land use management plan can be calculated by multiplying the estimated number of animals/month/acre by the number of pasture land acres available by the number of months the animals are maintained on a given pasture.

A copy of these management plans signed by the landowners along with their comments are provided in Appendix 4-3 and 4-4 of this chapter of the MRP.

Burton Pugh Property: The land in the permit area owned by Mr. Pugh also provides forage for domestic livestock and wildlife habitat. This land is comprised of unirrigated pasture land, meadows, sagebrush/grass, pinyon-juniper, and oakbrush communities (see Vegetation Map 3-l). The livestock currently sustained on Mr. Pugh's pasture land property are mostly cattle, but sometimes horses are also kept on the property. The animals are supported in the pastures from April through November of the year. A management plan to support a similar postmining land use has been designed so that the property will not be over-grazed, yet support the animals desired by the landowner.

Following mining and reclamation activities, Mr. Pugh has expressed the desire for his land to be returned to its current or better condition for livestock and wildlife habitat. In accomplishing this, the pasture lands will be revegetated to focus on domestic livestock, but the seed mixtures will also include some plant species used by the resident wildlife species. Because it has been postulated that encroachment of juniper trees into the valley in recent years has had a negative effect on the local sage-grouse populations, the revegetation plan for these areas will also focus on other plant species, or species that could have a positive effect on the birds as well as provide good forage for domestic livestock. The revegetation seed mixes for the Pugh property are shown in Chapter 3 and include: the sagebrush/grass (Table 3-37), meadows (Table 3-40), pasture lands (Table 3-38), oakbrush (Table 3-41), and pinyon-juniper communities (Table 3-39).

The management plan for Mr. Pugh suggests that 1.125 animals/month/acre could reasonably be sustained on the property. This figure was derived from the *Average Animal Weight Method* (Pratt and Rasmussen 2001) and is based on raising 1 cow weighing 1,000 lbs and her calf on pastures that have an annual biomass productivity of 1,800 lbs/acre. It conservatively estimates that one-half of the production will be consumed ("take half, leave half rationale”). Therefore, the total number of animals allowed on the property in the postmining land use management plan can be calculated by multiplying the estimated number of animals/monthly acre by the number of pasture land acres available by the number of months the animals are maintained on a given pasture.

There is, however, one area within Mr. Pugh's property that currently supports pasture land, but once it is reclaimed, it will be seeded to a mixture that would be conducive to sage-grouse enhancement. This field can easily be located on Drawing 3-l because it is the only pasture land located west of the county road. This land will be seeded with the sagebrush/grass mixture (Chapter 3, Table 3-37). Also, the areas west of the county road designated for borrow for Pit 10 which supported pinyon/juniper, once reclaimed will have gentler slopes than premining. This borrow area will be reclaimed with the sagebrush/grass mixture (Chapter 3, Table 3-37), substantially increasing the area for sage-grouse enhancement.

A copy of these management plans signed by the landowners along with their comments have been provided in the Appendix 4-3 and 4-4 of this chapter of the MRP.

NORTH PRIVATE LEASE AREA

In the North Private Lease area, current plans have restricted mining to the areas located south of what is called “Farm Road”. This east-west road can be easily identified on Vegetation Map 1, Appendix 3-9 (*Vegetation & Wildlife Habitat of the North Private Lease Area*). It is south of the distinctive center-pivot field. Consequently, more specific land use descriptions and reclamation plans in this section will concentrate more on the areas south of Farm Road.

As mentioned previously, the majority of the area in the North Private Lease, especially those areas south of Farm Road, are comprised of rangelands that have been converted to pasture lands. Based on quantitatively sampling results from the vegetation in both areas, these pasture lands are very similar to those described in the current Coal Hollow Mine area. Consequently, the land use, management and reclamation plans are also very similar. There are, however, incised channels that dissect the North Private Lease. More information about these channels has been provided in the specific parcels of land described below.

Following are descriptions of current management practices for the major landowners as well as future grazing plans for the postmining land uses.

Dean R. Heaton Property: This landowner has 3 parcels south of Farm Road for a total of 45 acres (Drawing 1-3). The lands here are developed rangelands and currently support grass species for domestic livestock grazing. Based on previous studies and information gathered from other landowners with similar pasture lands, a management plan suggests that 1.125 animals/month/acre could reasonably be sustained on the property. As explained before, this figure was derived from the *Average Animal Weight Method* (Pratt and Rasmussen) and is based on raising 1 cow weighing 1,000 lbs and her calf on pastures that have an annual biomass productivity of 1,800 lbs/acre. It conservatively estimates that one-half of the production will be consumed ("take half, leave half rationale"). Therefore, the total number of animals allowed on the property in the postmining land use management plan can be calculated by multiplying the estimated number of animals/month/acre by the number of pasture land acres available by the number of months the animals are maintained on a given pasture.

Unless the landowner specifies a change in the revegetation plans in the future, the pasture will be reclaimed with the existing pasture land species mixture (see Table 3-38).

G. Ferril & Dorothy M. Heaton Property: These landowners have approximately 110 acres of land south of Farm Road. Most of this land is pasture land, but Kanab Creek dissects some of it where its deeply incised channel supports riparian and wetland communities along with adjacent uplands. This stream channel is basically undeveloped rangeland and, other than some grazing pressure and the erosional component so common in the area, the riparian and upland communities are relatively undisturbed. The uplands in the channel are located on the flood plains and stream terraces bordering the riparian zones. The upland communities are primarily dominated by Wyoming big sagebrush and black sagebrush.

Additionally, there was one relatively small area within this property that supported trees and shrubs. The area consists of native, mostly undisturbed, plant communities (or undeveloped rangelands) that are primarily pinyon-juniper and sagebrush. These communities will have little mine-related disturbance to them. However, if the fringes of this area are disturbed, the landowner may likely prefer re-seeding it to increase and blend in with the adjacent pastures and not be restored to trees and shrub-lands. Therefore, the postmining land use will be that of wildlife habitat and domestic livestock grazing. It will most-likely be seeded with the pasture land seed mixture (Table 3-38), but the pinyon-juniper (Table 3-39) mix may also be utilized.

The incised channels of Kanab Creek will not be disturbed by the proposed mining operations and therefore reclamation will not be needed. The current land uses will be continued in the future. The pasture lands within these properties are similar to those described above with respect to current land use and productivity. They will also be reclaimed with the same species list (see Table 3-38).

Heaton Brothers, LLC Property: The Heaton brothers also own a significant portion of the North Private Lease land south of Farm Road, or approximately 150 acres (Drawing 1-3). Like the properties described above, most of this land are pastures. The pasture lands are very similar to those described above, with the same current land uses, reclamation plans and postmining land uses.

The Heaton brothers property also includes some ephemeral drainage channels. They are located west of Kanab Creek. The ephemeral drainages have also been studied extensively and reported in a document called *Wetland & Ordinary High Watermark Idenfications, Private Lease Area* (VOLUME 10, Supplemental Report) and in another study called *Vegetation & Wildlife Habitat of the North Private Lease Area* (VOLUME 12, Supplemental Report).

The channels support some riparian and wetland communities including riparian wet meadows, mixed riparian scrub/shrubs, as well as narrow bands of sagebrush communities on the adjacent upland terraces. The field studies found that the Private North Lease study area supports 9.44 acres of jurisdictional wetlands, most of which were identified in the Kanab Creek drainage. Kanab Creek and the plant communities supported within it will *not* be disturbed by mining activities. The other channels, however, may be disturbed by mining, some of which support wetland and upland communities. The landowner has indicated that the erosional features be eliminated, therefore areas of the channels will be reclaimed and seeded to support pasture land.

Postmining land uses of the Heaton Brothers property will be returned to the current land use – that of grazing in the pastures and wildlife habitat in the drainage channels.

Orval & Greta Palmer Property: There is one relatively small parcel of land, about 10 acres, owned by Orval & Great Palmer. This is a pasture with identical current land uses as described above for other pasture lands. It will also be seeded the same at the time of final reclamation and result in the same postmining land use.

412.130. Postmining Land Use Changes

With the exception of improvement of the current pasture lands, pinyon/juniper borrow area, and the area mentioned above that will be seeded with plant species that enhances sage-grouse habitat, there will be no changes from the pre-mining land use for the postmining land uses.

412.140. Land Use Considerations

Considerations for postmining land uses have been made by consulting with the surface landowners for the pasture lands as well as the native plant communities that will be impacted by the mining activities. The landowners have special concerns regarding plant species for livestock and others for wildlife. Basically, the pasture lands will be planted with grass and forb species good for livestock and wildlife species, and will not include any woody species. At final reclamation, the natural plant communities disturbed by mining will be seeded with native plants, some of which will have special considerations for habitat improvement for the sensitive bird, greater sage-grouse.

Additionally, considerations were made to insure compliance with all state and federal regulations for postmining land use and reclamation. For example, all plant communities that will be impacted by mining have been quantitatively sampled beforehand and compared to similar communities that will not be affected. The unaffected communities will remain undisturbed and will be used as "reference areas", or future standards for revegetation success at the time of final reclamation. Those native plant communities that were disturbed prior to mining (i.e. pasture lands) will not have reference areas for comparison at the time of final reclamation. Instead, revegetation success standards have been developed beforehand and were based on sampling the pasture lands in the area from 2006 to 2012 (see Chapter 3, Section 356.120).

412.200. Land Owner or Surface Manager Comments

The postmining land use plans that have been signed by the landowners and are included in the appendix of this chapter. Also included is a page for "Comments" by the landowners.

412.300. Suitability and Compatibility

All areas utilized for excess spoil will be restored to AOC at final reclamation and are compatible with the natural surroundings and the approved postmining land use. The final landform configuration can be viewed on Drawings 5-37 and 5-37A.

413 **PERFORMANCE STANDARDS**

413.100. Postmining Land Use

All disturbed areas will be restored in a timely manner to conditions that are capable of supporting the uses that were present before any mining occurred. In some cases improvement of the land will be achieved (see Postmining Land Use Plan above and Chapter 3, Section 356.100).

413.200. Determining Pre-Mining Uses of Land

The pre-mining uses of land in which the postmining land use is compared have been previously described (see Postmining Land Use Plan above).

413.300. Criteria for Alternative Postmining Land Uses

Other than improvements to the existing land described above, the land will be returned to its pre-mining conditions.

420 **AIR QUALITY**

421 **CLEAN AIR ACT**

Coal mining and reclamation operations will be conducted in compliance with the requirements for the Clean Air Act and Any other applicable Utah or Federal statutes and regulations containing air quality standards.

422 **UTAH BUREAU OF AIR QUALITY**

For the Coal Hollow Mine, Alton Coal Development, LLC retained JBR Environmental Consultants to prepare a Notice of Intent (NOI) for a new source at the Coal Hollow Project. The original NOI was submitted to the Utah Division of Air Quality (UDAQ) on May 8, 2007. This NOI provided an initial assessment of air emissions for the project based on the MRP prior to being determined Administratively Complete. JBR coordinated preparation of the original NOI with Tom Bradley and Jon Black of the UDAQ. In September 2008, JBR began development of a revised NOI to include air dispersion modeling. This air dispersion modeling was coordinated with Dave Prey of UDAQ. A conference call was conducted with representatives of UDAQ, JBR and Alton Coal on December 8th, 2008 to discuss modeling inputs, background emissions and preliminary modeling results. The revised NOI was submitted on April 20, 2009. UDAQ responded to the NOI on June 23, 2009 by asking for additional information. The Fugitive Dust Control Plan is provided as Appendix 4-5. Alton Coal was issued by the Executive Secretary of the Utah Air Quality Board Approval Order DAQE-AN0140470002-10 for a new source on November 10, 2010. After consultation with Jon Black, an NOI dated August 22, 2013 was submitted to UDAQ, Alton Coal requested addition of a highwall miner to list of mobile equipment in use at the Coal Hollow Mine. On November 12, 2014 prior to beginning underground operations, Jon Black of the UDAQ was consulted with the proposed underground plans. An NOI was sent to UDEQ on November 17, 2014 listing the additional equipment and increase in pollutants anticipated with the operation of the underground mine. The revised Air Approval Order including the underground was received April 21,2015.

For the North Private Lease, Alton Coal development began coordination preparation of the NOI with Jon Black of UDAQ on June 4, 2015. The North Private Lease will be an amendment to the Coal Hollow Mine Approval Order and will require dispersion modeling. Ramboll Environ has completed the dispersion modeling in coordination with UDAQ. The final NOI and dispersion model was submitted to UDAQ on September 9, 2015 with the model being accepted September 24, 2015 and the engineering review approved September 25, 2015. Public Notice was advertised in the Southern Utah News October 1, 2015. The revised Air Approval Order including all of the North Private Lease was received November 10, 2015 (DAQE-AN140470005-15)

423.100- 200 **AIR POLLUTION CONTROL PLAN**

Production rates at the Coal Hollow Mine are expected to exceed 1,000,000 tons of coal per year. Appendix 4-5 provides a Fugitive Dust Control Plan (FDCP). This plan includes controls and monitoring measures that will be taken to minimize air pollution related specifically to fugitive dust.

Production rates at the North Private Lease of the Coal Hollow Mine are expected to exceed 1,000,000 tons of coal per year. Appendix 4-6 provides a Fugitive Dust Control Plan (FDCP). This plan includes controls and monitoring measures that will be taken to minimize air pollution related specifically to fugitive dust.

424 **PLAN FOR FUGITIVE DUST CONTROL PRACTICES**

Proposed mining will exceed 1,000,000 tons annually. A Fugitive Dust Control Plan is provided as Appendix 4-5 for the Coal Hollow Mine and in Appendix 4-6 for the North Private Lease.

CHAPTER 5

R645-301-500. ENGINEERING

510. **INTRODUCTION**.

The engineering section of the Mining and Reclamation Plan (MRP) is divided into the operation plan, reclamation plan, design criteria, and performance standards. All of the activities associated with the coal mining and reclamation operations are designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plan.

511. **GENERAL REQUIREMENTS**

511.100 - 511.300. Contents

The operation and reclamation permit application includes descriptions of the coal mining and reclamation operations with attendant Drawings, plans, and cross sections. and its potential impacts to the environment as well as methods and calculations utilized to achieve compliance with design criteria.

All this information can be viewed in this section, Drawings 5-1 through 5-44 and Appendices 5-1 through 5-10 and 5-13 for the existing Coal Hollow Mine and on Drawings 5-45 through 5-78 and Appendices 5-11, 5-12, 5-12A, and 5-14 for the North Private Lease.

512. **CERTIFICATIONS**

512.100. Cross Sections and Drawings.

All cross sections and Drawings required under applicable portions of sections 512.100 through 512.150 have been prepared by, or under the direction of, and certified by: a qualified, registered, professional engineer; a professional geologist; or a qualified, registered, professional land surveyor, with assistance from experts in related fields such as hydrology, geology and landscape architecture.

Compliance with this section has been completed and certifications are available on all cross sections and Drawings.

512.200. Plans and Engineering Designs.

All plans for excess spoil, durable rock fills, coal mine waste, impoundments, primary roads and variances from approximate original contour will be certified by a qualified registered professional engineer.

Plans for excess spoil, sediment impoundments, and primary roads have been certified by a qualified registered professional engineer. These certifications can be viewed on Drawings 5-22 through 5-37 for the existing Coal Hollow Mine and on Drawings 5-51A & 5-58 through 5-75 for the North Private Lease. No coal mine waste or durable rock fills are planned.

512.210 Excess Spoil Disposal Areas

A professional engineer experienced in the design and construction of earth and rock fills will certify the design of Excess Spoil Disposal Areas according to 535.100.

A professional engineer with experience in design and construction of earth and rock fills has certified the design of the Excess Spoil Disposal for the existing Coal Hollow Mine and of the Temporary Excess Spoil Pile for the North Private Lease according to 535.100. An expert in the field of slope stability and geotechnical analysis has provided a thorough review of the designs. These analyses can be viewed in Appendix 5-1 for the Coal Hollow Mine and in Appendix 5-11 for the North Private Lease.

512.220 - 230 Durable Rock Fills and Coal Mine Waste Structures

The MRP does not contemplate the construction of any permanent Durable Rock Fills or Coal Mine Waste structures. If such structures become part of the plan, a professional engineer experienced in the design of earth and rock fills and or disposal facilities will certify the design according to R645-301-535.100 - 536.

512.240. Impoundments.

A professional engineer experienced in the design and construction of impoundments will use current, prudent, engineering practices and will certify the design of the impoundment according to R645-301-743.

A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments. The plans have been certified and a detailed geotechnical analysis has been provided. The detailed investigation for impoundments 5 through 9 and T1 found soils to be representative of the Coal Hollow Mine, thus additional geotechnical analysis, specific stability analysis for the Coal Hollow Mine apply to the impoundments at the North Private Lease. The certifications and drawings can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2 for the existing Coal Hollow Mine and on Drawings 5-65 through 5-73 and Appendix 5-11, 5-12, and 5-12A for the North Private Lease. ~~Although i~~Investigation and analysis have been performed for all impoundments of the North Private Lease~~, only those structures in Permit Area 1 are currently proposed (Ponds 5, 6 and T1 and Ditches 5 through 11 and T1-01 through T1-02) while the structures in Permit Areas 2 and 3 remain under review.~~. This includes ponds 5 through 9 and T1 as well as ditches 5 through 20, T1-01 and T1-02.

512.250. Primary Roads.

A professional engineer will certify the design and construction or reconstruction of primary roads as meeting the requirements of 742.420.

Designs of primary roads have been certified as meeting the requirements of 742.420.

512.260. Variance From Approximate Original Contour.

In areas of the MRP where a variance from the approximate original contour is required, a professional engineer will certify the design for the proposed variance from the approximate original contour, as described under 270, in conformance with professional standards established to assure the stability, drainage and configuration necessary for the intended use of the site.

The MRP does not contemplate any variances from Approximate Original Contour for the Coal Hollow Mine or the North Private Lease.

513. **COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS.**

513.100. Coal Processing Waste Dams and Embankments

The MRP does not contemplate the construction of any coal processing waste dams and embankments.

513.200. Impoundments and Sedimentation Ponds

Impoundments and sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) will comply with the requirements of MSHA, 30 CFR 77.216 (see R645-301-533.600, R645-301-742.222, and R645- 301-742.223).

No impoundments or sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) exist or are planned within the proposed Mine Permit Area. Should impoundments and sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) become necessary, compliance with the requirements of MSHA, 30 CFR 77.216 will be met.

513.300. Disposal of Underground Development Waste, Coal Processing Waste and Excess Spoil in underground mine workings.

The MRP does not contemplate any underground development waste, coal processing waste, or excess spoil being disposed of in underground mine workings.

513.400. Refuse Piles

The MRP does not contemplate the construction of any refuse piles.

513.500. Capping, Sealing and Backfilling Openings to the Surface from the Underground.

Each shaft, drift, adit, tunnel, exploratory hole, entryway or other opening to the surface from the underground will be capped, sealed, backfilled or otherwise properly managed consistent with MSHA, 30 CFR 75.1711 (see R645-301-551).

Underground mine portals are located in the bottom of the Coal Hollow Pit 10, and will ultimately be reclaimed and sealed by the backfilling of the pit to a vertical depth of approximately 112 feet (as shown on Drawing 5-37A) when no longer required.

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Figure 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

513.600. <u>Discharges into an underground mine</u>

The MRP does not contemplate discharges into an underground mine.

513.700. <u>Surface Mining Closer than 500 Feet to an Active Underground Mine</u>

The MRP does not contemplate mining within 500 feet of an active underground mine.

513.800. <u>Coal Mine Waste Fires</u>

The MRP does not contemplate the generation of any coal mine waste.

514. **INSPECTIONS**

*All engineering inspections, excepting those described under R645-301-514.320, will be conducted by a qualified registered professional engineer or other qualified professional specialist under the direction of the professional engineer.*514.100 <u>Excess Spoil</u>.

The professional engineer or specialist will be experienced in the construction of earth and rock fills and will periodically inspect the fill during construction. Regular inspections will also be conducted during placement and compaction of fill materials.

The construction method for the excess soil specified in 528.310 is expected to meet the 85% compaction standard. As verification, the fill compaction will be periodically field tested using method(s) as directed by the qualified registered professional engineer. A description of the test method and the test results will be provided to the Division as part of the quarterly inspection reports.

514.110. *Such inspections will be made at least quarterly throughout construction and during critical construction periods. Critical construction periods will include at minimum:*

514.111. *Foundation preparation, including the removal of all organic material and topsoil;*

514.112. *Placement of underdrains and protective filter systems.*

No underdrains or protective filter systems are planned as part of the excess spoil.

514.113. *Installation of final surface drain systems; and*

514.114. *The final graded and revegetated fill.*

514.120. *The qualified registered professional engineer will provide a certified report to the Division promptly after each inspection that the fill has been constructed and maintained as designed and in accordance with the approved plan and the R645-301 and*

R645-302 Rules. The report will include appearances of instability, structural weakness, and other hazardous conditions.

514.200 - 250. Refuse Piles.

The MRP does not contemplate the construction of any refuse piles.

514.300. Impoundments.

514.310 - 313. Certified Inspection.

A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments. Inspections will be made regularly during construction, upon completion of construction, and at least yearly until removal of the structure or release of the performance bond. The qualified registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. A copy of the report will be retained at or near the mine site.

514.320. Inspection Standard and Frequency

Impoundments meeting the NRCS Class B or C criteria for dams in TR-60, or the size or other criteria of 30 CFR Sec. 77.216 must be examined in accordance with 30 CFR Sec. 77.216-3. Impoundments not meeting the NRCS Class B or C Criteria for dams in TR-60, or subject to 30 CFR Sec. 77.216, shall be examined at least quarterly. A qualified person designated by the operator shall examine impoundments for the appearance of structural weakness and other hazardous conditions.

The MRP does not contemplate construction of any impoundments meeting the NRCS Class B or C criteria for dams in TR-60, or the size or other criteria of 30 CFR Sec. 77.216. If such impoundments become necessary, they will be examined in accordance with 30 CFR Sec. 77.216-3. Impoundments not meeting the NRCS Class B or C Criteria for dams in TR-60, or subject to 30 CFR Sec. 77.216, will be examined at least quarterly. A qualified person designated by Alton Coal Development LLC will examine impoundments for the appearance of structural weakness and other hazardous conditions.

515. **REPORTING AND EMERGENCY PROCEDURES**

515.100. Slides

Any time a slide occurs which may have a potential adverse effect on public, property, health, safety, or the environment, Alton Coal Development LLC will notify the Division by the fastest available means and comply with any remedial measures required by the Division.

515.200. Impoundment Hazards.

If any examination or inspection of an impoundment discloses that a potential hazard exists, the person who examined the impoundment will promptly inform the Division of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented, the Division will be notified immediately.

515.300. Temporary Cessation

515.311

During a temporary cessation of the Underground operations, surface access openings to underground operations and facilities in areas in which there are no current operations, but in which operations are to be resumed under an approved permit will be effectively maintained secured. Portal access will be controlled by security personnel, signage, temporary fencing and/or other means as determined appropriate by the company and MSHA. Portal access will be provided as required. Any facilities or equipment required to protect the underground workings, i.e. fans, pumps, etc., will be maintained and operated during this time. Since the portal area is graded to drain to a collection sump, any surface runoff will be collected there and will be utilized for dust control during operations and temporary cessation.

515.312.

During a temporary cessation, surface facilities in areas in which there are no current operations, but in which operations are to be resumed under an approved permit will be effectively secured.

For the North Private Lease, the temporary excess spoil pile is expected to be in place for less than 6 months. Should a temporary cessation occur and cause the pile to remain longer than 6 months, erosion control measures such as a tackifier will be applied to the pile to minimize damage and ensure stability.

515.321.

Before temporary cessation of coal mining and reclamation operations for a period of 30 days or more, or as soon as it is known that a temporary cessation will extend beyond 30 days, a notice of intention to cease or abandon operations will be submitted to the division. This notice will include:

- A statement of the exact number of surface acres and the horizontal and vertical extent of subsurface strata which have been in the permit area prior to cessation or abandonment,,
- The extent and kind of reclamation of those areas which has been accomplished, and
- Identification of the backfilling, regrading, revegetation, environmental monitoring, and water treatment activities that will continue during the temporary cessation.

515.322.

Before temporary cessation of coal mining and reclamation operations for a period of 30 days or more, or as soon as it is known that a temporary cessation will extend beyond 30 days, a notice of intention to cease or abandon operations will be submitted to the division. This notice will include:

- A statement of the exact number of acres which have been affected in the permit area prior to such temporary cessation,
- The extent and kind of reclamation of those areas which has been accomplished, and
- Identification of the backfilling, regrading, revegetation, environmental monitoring, and water treatment activities that will continue during the temporary cessation.

516. **PREVENTION OF SLIDES**

The moderate topography in the area of the planned Coal Hollow Mine will minimize the potential for unplanned slides. A natural barrier will, however, be left undisturbed except as necessary for roads, sedimentation control, temporary topsoil and spoil storage and similar features, beginning at the elevation of the coal seam and extending from the outslope for a distance of at least 50 ft. The barrier will be retained in place to prevent slides and erosion.

520. **OPERATION PLAN.**

521. **GENERAL.**

The plan, with Drawings, cross sections, narrative, descriptions, and calculations indicates how the relevant requirements will be met. The lands subject to coal mining and reclamation operations over the estimated life of the operations are identified and briefly described. All appropriate information for the Coal Hollow Mine is located in the subsequent sections and Drawings 5-1 through 5-44 and Appendices 5-1 through 5-10 and Appendix 5-13. Topsoil piles and removal sequencing is shown on Drawing 2-2. All appropriate information for the North Private Lease is located in the subsequent sections and Drawings 5-45 through 5-79 and Appendices 5-11, 5-12, 5-12A, and 5-14. Topsoil piles and removal sequencing is shown on Drawing 2-4.

The Coal Hollow Mine is located approximately 2.5 miles south of Alton, Utah. The North Private Lease is located approximately 0.8 miles south of Alton, Utah. In order to maximize the use and conservation of the coal resource, coal will be recovered using large hydraulic excavators, front end loaders, off-road trucks, underground continuous miner and a highwall auger miner (See Chapter 9 which addresses R645-302 regulations). Mined coal will be hauled to a central coal area for crushing and placement into a stockpile. Coal from the stockpile will be transferred into a bin and loaded into over-the-road trucks for transport. Section 523 of this chapter provides detailed production, sequence, and timing information. Drawings 5-2 and 5-46 show the disturbance sequence for the Coal Hollow and North Lease permit areas, respectively.

521.100. Cross Sections and Drawings.

The application includes cross sections, Drawings and plans showing all the relevant information required by the Division. Appropriate information is provided in Drawings and cross sections 5-1 through 5-44 for the existing Coal Hollow Mine and on Drawings and cross sections 5-45 through 5-79 for the North Private Lease.

521.110. Previously Mined Areas.

Historically, there has been some underground mining of coal within the Alton Amphitheater. The following underground mines are known to have historically existed within the Amphitheater:

- Seaman Mine
- Smirl Mine
- Alton Mine
- Johnson Mine
- Silver Mine

There are not any known mines that existed or currently exist within the permit areas or the adjacent area as defined in R645-100-200. There is also not any active coal mining operations in the area.

521.120. Existing Surface and Subsurface Facilities and Features.

521.121. Buildings

The location of all buildings in and within 1,000 feet of the proposed permit area, with identification of the current use of the buildings is shown on Drawings 1-5 and 1-6 for the Coal Hollow Mine. There are no buildings in or within 1,000 feet of the permit area for the North Private Lease.

521.122. Surface and Subsurface Man-Made Features

The only known surface and subsurface manmade features that exist within the existing and proposed permit areas are:

- County Road 136 (locations shown on Drawing 5-3 and Drawing 5-47)
- Alton Coal Mine Road (location shown on Drawing 5-47)
- Water pipeline to Pond 20-1 (location shown on Drawing 7-7)
- Water pipelines for agricultural uses in the North Private Lease (locations shown on Drawing 7-7)

521.123. Public Roads

Two Class B public roads, Kane County Road 136 (K3900) and Alton Coal Mine Road (K3100), are located in or within 100 feet of the permit areas and are shown on Drawing 5-3 and Drawing 5-47. Drawing 5-48 also shows County Road 136 in relation to the North Private Lease Permit Area 1. While the bypass around the North Private Lease for County Road 136 is being constructed, mining operations will commence in Area 1. During this time, traffic on County Road 136 will continuously have unimpeded access and will not require escort through the mine permit area. Until the bypass road is complete, the mining area will be barricaded and fenced along County Road 136 and access will be limited to four (4) temporary gates.

In addition, Kane County has recently made a claim on the two-track road located adjacent to Lower Robinson Creek which is also located within the permit boundary. This road has mostly been closed to the public since it crosses private land and ACD has worked with Kane County to develop an access agreement which includes access through the permit area by mine personnel escort only. This agreement is included as Appendix 1-8 in Chapter 1. The County has named this Class D public road K3993.

521.124. Existing areas of spoil, waste, coal development waste, and noncoal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities.

There are three impoundments currently located within the existing Coal Hollow Mine permit area which are Pond 20-1, Pond 29-3 and Pond 29-5 shown on Drawing 7-7. The area of these impoundments are approximately 3,400, 10,500 and 6,963 square feet respectively. There are four impoundments located within the North Private Lease permit area, Ponds 12-1 thru 12-3 and Pond 13-1 shown on Drawing 7-7. The area of these impoundments are approximately 823, 3,853, 8,319 and 33,525square feet, respectively.

These stock ponds identified on Drawing 7-7 within the center and western drainages existing prior to mining will be eliminated per the landowner request. This requires coordination with the USACOE for the elimination of wet lands (final landform shown on Drawings 5-74 and 5-75) identified in the Preliminary Jurisdictional Determination SPK-2011-01248 November of 2012 and updated September 2015 (MRP, Volume 10, NPL Wetland Study Report Final). Disturbances within the identified wetlands will not occur until approval of the 404 permit. The 404 permit will allow for take of the wetlands within the center drainage with wetlands being replaced in offsite mitigation under USCOE jurisdiction.

There are no other areas of existing spoils, waste, coal development waste, and noncoal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities within the permit area.

521.125. Ponds and Other Impoundments

The MRP does not contemplate construction of any permanent water impoundments; coal processing waste banks and coal processing waste dams or embankments. The planned location of each sedimentation pond is shown on Drawing 5-3 for the Coal Hollow Mine and Drawing 5-47 for the North Private Lease. Appendix 5-12 and Drawing 5-79 detail the post-mining surface hydrology of the North Private Lease

521.130. Landowners and Right of Entry and Public Interest Drawings.

All boundaries of lands and the names of present owners of record of both surface and subsurface within the Mine Permit Area are shown on Drawing 1-3 (Surface) and Drawing 1-4 (Subsurface).

521.132. Permit Boundary

The boundaries of land within the proposed permit area are shown on all applicable Drawings.

521.133. Public Roads

Limited mining or reclamation operations are planned within 100 ft. of an operating public road. Operations adjacent to County Road 136 will occur during construction of the bypass road around the North Private Lease, and mine vehicles may cross the right-of-way of Kane County Road 136 for a short period early in the operation's life. Any mine traffic crossing the county road will be required to stop and yield to any County Road 136 traffic before proceeding. Other appropriate measures, including signage and mine operating practices and training will be implemented to protect the public. Appendix 1-11 includes an easement and agreement with Kane County to construct the North Private Lease bypass road and to safely conduct mining operations adjacent to the current county road concurrent with construction activities.

521.133.2 Relocating a Public Road:

The design of any relocated road will be approved by Kane County authorities, or such other authorities as have jurisdiction. Appropriate measures will be taken to prevent entrance into the mining area via the pre-existing road, and appropriate signage and barriers will be installed to protect the public.

County Road 136 (K3900) and Alton Coal Mine Road (K3100) will be temporarily relocated outside the permit areas concurrent with the beginning of mining for both the existing Coal Hollow Mine and the North Private Lease until mining is complete and then reconstructed. The relocation of County Road 136 for both the Coal Hollow Mine and the North Private Lease will require construction of temporary bypass roads. The locations of these bypass roads are shown in Drawings 5-3 and 5-45 for the Coal Hollow Mine and North Private Lease respectively. Plans and details for these roads are shown in Appendix 1-7 and 1-11. Each bypass road will be constructed, inspected, certified and available for public use prior to closure of the associated section of impacted County Road 136. The Alton Coal Mine Road (K3100) will not require a significant bypass, but will be accessed via a new intersection with the North Private Lease bypass road approximately 500 ft. south of the current intersection with County Road 136.

Drawing 5-48 shows County Road 136 in relation to the North Private Lease Permit Area 1. While the bypass around the North Private Lease for County Road 136 is being constructed, mining operations will commence in Area 1. During this time, traffic on County Road 136 will continuously have unimpeded access and will not require escort through the mine permit area. Until the bypass road is complete, the mining area will be barricaded and fenced along County Road 136 and access will be limited to four (4) temporary gates.

Upon completion of mining and reclamation activities in each permit area, the aforementioned pre-mining roads will be reestablished to their pre-mining state or better. The details for reestablishing road K3900 within the Coal Hollow Mine are shown on Drawings 5-22E, 5-22F and 5-22H. The details for reestablishing roads K3900 and K3100 within the North Private Lease are shown on Drawings 5-61 thru 5-63. The details related to reestablishing K3993 following mining are shown on Drawing 5-22C.

It is expected that County Road 136 will be diverted around the Coal Hollow Mine for approximately 5 years, and diverted around the North Private Lease for approximately 6 years.

521.140. Mine Drawings and Permit Area Drawings.

521.141 *The boundaries of all areas proposed to be affected over the estimated total life of the coal mining and reclamation operations, with a description of size, sequence and timing of the mining, the coal mining and reclamation operations to be conducted, the lands to be affected throughout the operation, and changes in facilities or features to be caused by the proposed operations;*

These items are depicted on Drawings 5-1 through 5-44 for the Coal Hollow Mine and on Drawings 5-45 through 5-79 for the North Private Lease.

Current land disturbance for the Coal Hollow Mine is shown on Drawing 5-2, while the expected land disturbance sequence for the North Private Lease is shown on Drawing 5-46. Total disturbance for the Coal Hollow mine is 372.5 acres. Total disturbance for the North Private Lease is expected to reach a maximum of 224.8 acres over a 6.5 year period, with 69.8 acres in Area 1 of operations, 97.8 acres in Area 2, and 57.2 acres in Area 3. ~~Area 1 is currently proposed for inclusion in the MRP while Areas 2 and 3 remain under review.~~

Due to bond requirements and the scarcity of open space with relation to the soil and spoil stockpiles in the North Private Lease Permit Area 1, development of the mining pits must follow a rigid sequence. Bond increments typically include a release component and a posting component as described in Chapter 8 and depicted in Appendix 8-2. The first increment of bonding in Permit Area 1 covers all of Area 1's Phase 2, Phase 3, and Facilities costs while only allowing Phase 1 (excavation) cost for Pit 1. Therefore, as shown in Drawing 5-48, the first stage of mining activity involves construction of the South Haul Road, Ponds 5 and 6, Ditches 5 through 11, and the temporary topsoil, subsoil and spoil stockpiles. To construct each of these facilities, ground cover, topsoil, and subsoil must be removed and stockpiled according to the plan and methods set out in

Chapter 2 section 231 and section 523 of this chapter and also shown on Drawing 2-4. Once these facilities have been constructed, excavation of Pit 1 will commence. The second North Private Lease bond increment will then allow continued excavation of Pits 2-6 to the initial Permit Area 1 boundary. During mining and backfill of Pits 5 and 6, the third North Private Lease bond increment will allow construction of the Permit Area 1 extension facilities and structures shown on Drawing 5-48A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 may be limited (as shown in Drawing 5-57) by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. As long as Areas 2 and 3 are available, the third bond increment through the fourth, fifth and sixth will also allow for steady state mining and backfill from Pit 7 through Pit 21. Then, during mining and backfill of Pits 20 and 21 the seventh North Private Lease bond increment will be posted to allow construction of the Permit Area 3 facilities and structures shown on Drawing 5-50. The seventh bond increment also allows for mining and backfill of both of the Highwall trench pits in Permit Area 3. ~~Following Pit 9, further disturbance and excavation requires the approval of Permit Areas 2 and 3 which currently remain under review.~~

Overburden mining for the Coal Hollow Mine and North Private Lease is depicted on Drawing 5-16 and Drawing 5-57 respectively, according to the methods and schedules detailed in section 523 Mining Methods of this chapter.

Coal mining for the Coal Hollow Mine and North Private Lease is depicted on Drawings 5-9 & 5-10 and Drawings 5-52 & 5-53 respectively, according to the methods and schedules detailed in section 522 Coal Recovery of this chapter.

A layout of facilities, structures, and features for the Coal Hollow Mine and North Private lease is shown on Drawing 5-3 and Drawing 5-47 respectively. Sections 521.160, 521.170, and 521.180 of this chapter describe these features and their construction and use.

Post-mining topography and cross-sections of the reclamation plans of the Coal Hollow Mine permit area are provided in Drawings 5-37 and 5-37A. This reclamation requires rehandling much of the fill above original contour to fill in the final pits, except Pits 9-C and 10 which will remain open until the closure of underground operations. Pits 9-C and 10 will then require additional borrow (apx. 1.5 Million C.Y.) from the areas outlined in Drawings 5-19, 5-37 and 5-37A . In preparation for this final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled (as detailed in sections 523 and 553 of this chapter) to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-36. Upon completion of underground mining, Pit 10 will then be backfilled from the Borrow Area and all ground will be returned to the final landform shown in Drawings 5-37 and 5-37A.. This rehandle and additional borrow will bring all disturbed ground back to Approximate Original Contour (AOC). All post-mining landforms, drainage, and slopes will be consistent with pre-mining conditions and regional trends. A detailed description of the reclamation scenario is provided in Section 528.200 Overburden and 553 Backfilling and Grading of this Chapter. The Coal Hollow Mine requires 239.5 acres of Phase 1 reclamation, 372.5 acres of Phase 2, and 372.5 acres of Phase 3.

Reclamation plans for the North Private Lease area are provided in Drawings 5-74 thru 5-76B and Drawing 5-79. These plans include restoration of all disturbed ground to AOC with only slight variation in landform, most notably a material void on the east of Kanab Creek which will result in a net increase of land available for agriculture and elimination of the center and western drainages east of Kanab Creek. All post-mining landforms, drainage, and slopes will be consistent with pre-mining conditions and regional trends. A detailed description of the reclamation scenario is provided in Section 528.200 Overburden and 553 Backfilling and Grading of this Chapter. The North Private Lease requires 178.4 acres of Phase 1 reclamation, 224.9 acres of Phase 2, and 224.9 acres of Phase 3.

Underground mining is also permitted for the Coal Hollow Mine. Mine portals will be within an existing pit and coal will be loaded within the pit and hauled in the same manner as with the surface mining. Underground mining plans are shown in Drawings 5-3, 5-3B, 5-9 and 5-10.

521.142

Drawing 5-10 shows the underground workings. All underground coal mining will be first mining only. Subsidence will be prevented by following the recommendations provided in the Norwest Corporation letter report found in Appendix 5-9.

521.143 The proposed disposal sites for placing excess spoil generated at surface areas affected by surface operations, underground operations and facilities for the purposes COAL MINING and RECLAMATION ACTIVITIES according to:

- *R645-301-211: The applicant will present a description of the premining soil resources as specified under R645-301-221. Topsoil and subsoil to be saved under R645-301-232 will be separately removed and segregated from other material.*

  The soil resources for the excess spoil disposal area in the Coal Hollow Mine are described in Appendix 2-1. A plan has been developed for removal of topsoil and suitable subsoil based on the soil descriptions in this appendix. The handling plan can be viewed on Drawing 2-2. Topsoil and acceptable subsoil will be separately removed and segregated from other material prior to placement of any spoil.

The soil resources for the North Private Lease temporary excess spoil disposal area are described in Volume 11. A plan has been developed for removal of topsoil and suitable subsoil based on the soil descriptions in this appendix. The handling plan can be viewed on Drawing 2-4 and is described in Chapter 2 Section 231 and Section 523 of this Chapter. Topsoil and acceptable subsoil will be separately removed and segregated from other material prior to placement of any spoil.

- *R645-301-212: After removal, topsoil will be immediately redistributed in accordance with R645-301-242, stockpiled pending redistribution under R645-301-234, or if demonstrated that an alternative procedure will provide equal or more protection for the topsoil, the Division may, on a case-by case basis, approve an alternative;*

  Excess spoil will have topsoil and subsoil redistributed in an approximately uniform, stable thickness with the approved post mining land use, contours and surface water drainage systems. Material handling practices will prevent excess compaction of these materials. Handling practices will also protect the materials from wind and water erosion before and after seeding and planting.

- *R645-301-412.300: Criteria for Alternative Postmining Land Uses.*

  The MRP does not contemplate alternative postmining land uses.

- *R645-301-512.210: Excess Spoil. The professional engineer experienced in the design of earth and rock fills will certify the design according to R645-301-535.100.*

  A professional engineer experienced in the design of earth and rock fills with assistance from a geotechnical expert has certified the design according to R645-301-535.100. These certifications can be viewed on Drawings 5-37, 5-37A and 5-17 for the Coal Hollow Mine and Drawing 5-51A for the North Private Lease.

- *R645-301-512.220: Durable Rock Fills*

  No durable rock fills are planned.

- *R645-301-514.100: Excess Spoil. The professional engineer or specialist will be experienced in the construction of earth and rock fills and will periodically inspect the fill during construction. Regular inspections will also be conducted during placement and compaction of fill materials.*

  A professional engineer or specialist that is experienced in the construction of earth and rock fills will inspect the fill during construction and regular inspections will also be conducted during placement and compaction of fill materials.

- *R645-301-528.310: Excess spoil will be placed in designated disposal areas within the permit area, in a controllable manner to ensure mass stability and prevent mass movement during and after construction. Excess spoil will meet the design criteria of R645-301-535. For the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the permit application must include a description of the proposed disposal site and the design of the spoil disposal structures according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.100, R645-301-745.300, and R645-301-745.400.*

  Excess spoil will be placed in the area designated on Drawing 5-3 and 5-37 for the Coal Hollow Mine and on Drawing 5-47 and 5-51A for the North Private Lease. This fill will be placed in lifts not to exceed 4 feet. The material will be transported from the overburden removal area to the fill by end dump haul trucks and a dozer(s) will spread the spoil to this lift thickness. The fill will meet at minimum 85% compaction as related to the standard Procter. Final slopes will be regraded to a maximum slope of 3h:1v. The top of the fill will be sloped to approximately 2% to prevent pooling of water and to reestablish drainage similar to original flow patterns.

  The excess spoil placed on the non-mined areas of the Coal Hollow Mine is approximately 32 acres and varies in height from 35 to 110 feet. Design and the geotechnical study for this fill can be viewed in Appendix 5-1. Due to actual swell factors of overburden material differing from swell factors used in initial planning, the size and configuration of the excess spoils has varied greatly from what was originally analyzed in Appendix 5-1. It is now anticipated that the excess spoil pile will be completely rehandled as pit backfill.

  The temporary excess spoil placed on the subsequent pit areas of the North Private Lease is approximately 9 acres and varies in height from 23 to 59 feet. Design of this temporary fill can be viewed in Drawing 5-51A and the geotechnical study can be viewed in Appendix 5-11.

- *R645-301-535.100 through R645-301-130: Disposal of Excess Spoil*

  A geotechnical analysis of the Coal Hollow Mine long term excess spoil structure design has been completed by an expert in this field. The long term static safety factor for this structure design is estimated at 1.6 to 1.7. Lifts will be placed in thicknesses not to exceed 4 feet. The lifts will meet 85% compaction by the standard Procter. The fill will be graded to allow for drainage similar to original patterns and to prevent excessive infiltration of water. Fill will then be rehandled as pit backfill prior to final reclamation while the remaining landform shown in Drawing 5-37 will be covered with subsoil and topsoil as specified in Chapter 2 to provide conditions suitable for revegetation of the area. The geotechnical study can be viewed in Appendix 5-1.

A geotechnical analysis of the North Private Lease temporary excess spoil structure design has also been completed by an expert in this field. The long term static safety factor for this structure design is estimated at 1.6 to 1.7. Lifts will be placed in thicknesses not to exceed 4 feet. The lifts will meet 85% compaction by the standard Procter. The fill will be graded to allow for drainage similar to original patterns and to prevent excessive infiltration of water. As this excess spoil structure will be rehandled to backfill the open pit in a short time frame (less than 6 months), it is not anticipated that this fill will be covered with subsoil and topsoil. The geotechnical study can be viewed in Appendix 5-11.

- *R645-301-535.300 through R645-301-535.500: Disposal of Excess - Spoil Durable Rock Fills.*

  No durable rock fills are planned.

- *R645-301-536.300: Disposal of Coal Mine Waste in Excess Spoil*

  No coal mine waste is planned in the excess spoil area.

- *R645-301-542.720: Excess spoil will be placed in designated disposal areas within the permit area, in a controlled manner to ensure that the final fill is suitable for reclamation and revegetation compatible with the natural surroundings and the approved postmining land use. Excess spoil that is combustible will be adequately covered with noncombustible material to prevent sustained combustion. The reclamation of excess spoil will comply with the design criteria under R645-301-553.240.*

  The Coal Hollow Mine long term excess spoil will be completely rehandled as pit backfill as shown in Drawing 5-37 and 5-37A. The remaining landform will be suitable to the surrounding area and for the postmining land use of primarily grazing. No combustible excess spoil will be placed in the proposed structure. The reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v.

  The North Private Lease temporary excess spoil will be rehandled and used as backfill in a short time frame (less than 6 months) and will not require any reclamation measures.

- *R645-301-553.240: The final fill configuration of the fill (excess spoil) will be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The grade of the outslope between terrace benches will not be steeper than 2h:1v (50 percent).*

The Coal Hollow Mine long term excess spoil will be completely rehandled as pit backfill as shown in Drawings 5-37 and 5-37A. The remaining landform will be suitable to the surrounding area and for the postmining land use of primarily grazing. The reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v. The long term static safety factor for these slopes is estimated to be 1.6 to 1.7.

The North Private Lease temporary excess spoil will be rehandled and used as backfill in a short time frame (less than 6 months). The spoil will not include any terraces and the slopes will be maintained at no less than an overall 3h:1v. The static safety factor for these temporary slopes is estimated to be 1.6 to 1.7.

- *R645-301-745.100: General Requirements.*

745.110: Excess Spoil will be placed in designated disposal areas within the permit area, in a controlled manner to:

745.111: Minimize the adverse effects of leaching and surface water runoff from the fill on surface and underground water;

Reclamation of the final landform following rehandle of the Coal Hollow Mine excess spoil will include topsoil and a subsoil layer. Infiltration through the reclamation is expected to be minimal based on the high clay content of these soils. The North Private Lease temporary excess spoil will be in use for such a short period of time and will be comprised entirely of high-clay tropic shale such that infiltration is also expected to be negligible. In addition, laboratory data located in Appendix 7-16 for the overburden shows that there is minimal potential for leaching of pollutants should infiltration rates become higher than expected.

The foundations of both of the excess spoil areas also have high clay content with minimal potential for infiltration. This will provide an additional, natural barrier to protect ground water present beneath the proposed structures.

745.112: Ensure permanent impoundments are not located on the completed fill. Small depressions may be allowed by the Division if they are needed to retain moisture or minimize erosion, create and enhance wildlife habitat or assist revegetation, and if they are not incompatible with the stability of the fill; and

Permanent impoundments are not planned on either of the excess spoil areas. Small depressions may be constructed as allowed by the Division to retain moisture, minimize erosion, create and enhance wildlife habitat or assist revegetation.

745.113: Adequately cover or treat the excess spoil that is acid- and toxic forming with nonacid nontoxic material to control the impact on the surface and *ground water in accordance with R645-301-731.300 and to minimize adverse effects on plant growth and approved postmining land use.*

Laboratory data located in Appendix 7-16 representative of the overburden planned for disposal in the excess spoil areas does not show acid- and toxic forming characteristics.

745.120: Drainage Control. If the disposal area contains springs, natural or manmade water courses, or wet weather seeps, the fill design will include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill and ensure stability.

A spring and seep survey available in Chapter 7 has identified no springs or wet weather seeps in the proposed excess spoil areas. The final surface of the landform underneath the Coal Hollow Mine excess spoil will be regraded to a contour that will route water from snowmelt and rainfall to natural drainages as shown on the final contours Drawing 5-37. There are no manmade water courses present in the excess spoil areas. No underdrains are planned for the excess spoil structures.

745.121: Diversions will comply with the requirements of R645-301-742.300

No diversions are planned in the excess spoil areas.

745.122 : Underdrains

No underdrains are planned in the excess spoil areas.

745.300: Durable Rock Fills

No durable rock fills are planned in the excess spoil areas.

745.400: Preexisting Benches

Excess spoil will not be disposed of through placement on preexisting benches.

521.150. Land Surface Configuration Drawings.

Surface contours representing the existing land surface configuration of the Coal Hollow Mine permit area are shown on Drawing 5-1 and the post mining land configuration is shown on 5-37. Cross sections with both these landforms are shown on Drawing 5-37A.

Surface contours representing the existing land surface configuration of the proposed North Private Lease permit area are shown on Drawing 5-45 and the post mining land configuration is shown on 5-74. Cross sections with these landforms are shown on Drawing 5-75. Post mining land configuration is also shown for each of the individual

Permit Areas on Drawings 5-74A through 5-74C. ~~On the North Private Lease area, reclamation plans are proposed for Area 1, while Areas 2 and 3 remain under review. The surface contour maps are limited accordingly.~~

521.151 Slope Measurements or Surface Contours:

For both the Coal Hollow Mine and the North Private Lease, Drawings 5-1, 5-37 & 5-37A and Drawings 5-45, 5-74 & 5-75 respectively use topographical contours to represent the surface configuration for pre- and –post mining scenarios. The contours for the Coal Hollow Mine drawings occur at 2 ft. elevation intervals, with index contours occurring at 10 ft. elevation intervals. The contours for the North Private Lease drawings occur at 4 ft. elevation intervals, with index contours occurring at 20 ft. elevation intervals. Each Drawing has been certified according to R645-301-512.

521.152 Previously Mined Areas:

Neither the Coal Hollow Mine nor the North Private Lease propose activities on areas that have been previously mined.

521.160. Maps and Cross sections of the Proposed Features for the Proposed Permit Area. These maps and cross sections will clearly show:

521.161 Buildings, utility corridors, and facilities to be used:

These items are shown on Drawings 5-3 through 5-8C for the Coal Hollow Mine and on Drawing 5-47 for the North Private Lease.

521.162 The area of land to be affected within the proposed permit area, according to the sequence of mining and reclamation:

A yearly and overall disturbance sequence for the permit area is provided on Drawing 5-2 for the Coal Hollow Mine and on Drawing 5-46 for the North Private Lease.

521.163 Each area of land for which a performance bond or other equivalent guarantee will be posted under R645-301-512;

The area of land that will have a performance bond posted in the Coal Hollow Mine is shown on Drawing 5-3. Drawing 5-3 was reconfigured in December of 2014 prior to phased bond release to remove performance bond from areas that are no-longer within the MRP planed disturbance (not disturbed by mining), thus removing the need to include in bond release. The total disturbance area is also broken up into discrete bond polygons on Drawing 5-19.

The area of land that will have a performance bond posted in the North Private Lease is shown on Drawing 5-47. The lease boundary encompasses three Permit Areas~~, of which Area 1 is currently proposed for inclusion in the MRP and Areas 2 and 3 remain under~~

~~review~~. Due to bond requirements and the scarcity of open space with relation to the soil and spoil stockpiles in Permit Area 1, development of the mining pits must follow a rigid sequence. As depicted in Appendix 8-2, the first increment of bonding in Permit Area 1 covers all of Area 1's Phase 2, Phase 3, and Facilities costs while only allowing Phase 1 (excavation) cost for Pit 1. Therefore, as shown in Drawing 5-48, the first stage of mining activity involves construction of the South Haul Road, Ponds 5 and 6, Ditches 5 through 11, and the temporary topsoil, subsoil and spoil stockpiles. To construct each of these facilities, ground cover, topsoil, and subsoil must be removed and stockpiled according to the plan and methods set out in Chapter 2 section 231 and section 523 of this chapter and also shown on Drawing 2-4. Once these facilities have been constructed, excavation of Pit 1 will commence. The second North Private Lease bond increment will then allow continued excavation of Pits 2-6 to the Permit Area 1 boundary. During mining and backfill of Pits 5 and 6, the third North Private Lease bond increment will allow construction of the Permit Area 1 extension facilities and structures shown on Drawing 5-48A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. As long as Areas 2 and 3 are available, the third bond increment through the fourth, fifth and sixth will also allow for steady state mining and backfill from Pit 7 through Pit 21. Then, during mining and backfill of Pits 20 and 21 the seventh North Private Lease bond increment will be posted to allow construction of the Permit Area 3 facilities and structures shown on Drawing 5-50. The seventh bond increment also allows for mining and backfill of both of the Highwall trench pits in Permit Area 3. ~~Following Pit 9, further disturbance and excavation requires the approval of Permit Areas 2 and 3 which currently remain under review.~~

521.164 Each coal storage, cleaning and loading area. The map will be prepared and certified according to R645-301-512;

These facilities can be viewed on Drawings 5-3 through 5-5 for the Coal Hollow Mine and on Drawing 5-47 through 5-51A for the North Private Lease. Note that coal loading will occur within the active pit~~s~~ excavation and backfill crest on the North Private Lease area, and the mine will not use a designated coal loading or stockpile area.

521.165 Each topsoil, spoil, coal preparation waste, underground development waste, and noncoal waste storage area. The maps will be prepared and certified according to R645-301-512;

For the Coal Hollow Mine, topsoil storage areas and handling can be viewed on Drawing 2-2. Spoil placement and the excess spoil structure can be viewed on Drawings 5-3, 5-17, 5-37 and 5-37A.

For the North Private Lease, prime farmland soils and topsoil storage areas and handling can be viewed on Drawings 2-4 and 5-51B. Temporary spoils placement can be viewed on Drawing 5-47 through 5-51A.

521.166 Each source of waste and each waste disposal area relating to coal processing or pollution control;

Only sizing of the coal is proposed. This process will not produce any waste.

521.167 Each explosive storage and handling facility;

Need for these facilities are not anticipated at this time. Instead, blasting will be contracted out to a local blasting company who is licensed to transport explosives. The blasting contractor will transport all explosives material needed for the shot into the mine for use, and take any remaining explosives inventory for storage offsite after each shot is completed. While onsite, all explosive materials will be handled solely by the licensed contractor. These activities will follow the blasting plan as outlined in Appendix 5-4. Should these facilities become necessary, appropriate drawings will be provided to the Division.

521.168 For the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, each air pollution collection and control facility; and

There are no specific air pollution collection or control facilities proposed.

521.169 Each proposed coal processing waste bank, dam or embankment. The map will be prepared and certified according to R645-301-512.

The MRP does not contemplate processing of coal that will produce waste.

521.170. Transportation Facilities Drawings.

Transportation facilities for the Coal Hollow Mine include eight primary roads, a conveyor system, and miscellaneous ancillary/temporary roads. Numerous drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: Three primary mine haul roads are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to the pits (pits shown on Drawing 5-10). This road will be approximately 1,400 feet in length and will be utilized throughout mining. There will be three culverts installed along this road all sized for a 100 year, 24 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower

Robinson Creek watershed. This analysis can be viewed in Appendix A5-3. The third culvert is crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

The second road extends from the first road and proceeds southwest to join and run along a 1,200’ section of the rebuilt County Road 136. This section of road will be single lane travel only for all production equipment. The road then continues to the southwest to provide access to Pit B-1. This road is approximately 4,750 feet in total length. There are two culvert crossings along the County Road 136 portion of this road that are placed to match the original county specifications. These culverts will be 18 inch culverts sized to match the County Road 136 culverts originally in place.

The following specifications apply to these Primary mine haul roads:

1) Roads will be approximately 80’ in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18” of crushed rock or gravel for road surfacing, except for the section of the Pit B-1 access extending from County Road 136 to the pit. This section of road will utilize approximately 6” of crushed rock or gravel for road surfacing. This shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during a short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.
5) Cut and fill slopes of 1.5 h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The underground mine portal access and haul road in Pit 10 will also be a primary road. This road is accessed from the main haul road from the coal unloading area. The underground access/haul road will be constructed to the same specifications for the haul roads above, except that the road may be narrowed to a 40 foot width. Drawing 5-22I provides the as-built plan and profile for the underground access road.

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width. A typical cross section for the ancillary roads can be viewed on Drawing 5-24.

The location and details for Primary Mine Haul roads can be viewed on Drawings 5-3 and 5-22 and 5-23.

In addition to the three primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road is referred to as "Facilities Roadway" and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

In addition to the primary roads that will be present during active mining, four additional roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- Road to Water Well with details shown on Drawing 5-22D
- Road to east C. Burton Pugh property (K3993) with details shown on Drawing 5-22C. Kane County has claimed this road as County Road K3993.
- County Road 136 (K3900) with details on Drawing 5-22E, 5-22F and 5-22H. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final phase of reclamation as scheduled on Drawing 5-38 and is expected to be completed by 2017.
- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawing 5-37 along with the post mining topography.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

Other temporary ancillary roads (such as the Pond 3 access road shown on Drawing 5-3) outside the mining area may be necessary from time to time to access facilities or impoundments during the life of operations. These roads will typically only comprise a single lane access approximately 14 feet wide that would see minimal use. Any surface flow on these roadways would not be highly erosive along generally gentle road gradients. Any flow on these roads will be controlled using minor berms or ditches, and in each case would be fully contained within the watershed of, and would report to the impoundments that they provide access for. These roads will not remain post-mining and also will not be individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

- Conveyors: A conveyor system will be used to stockpile coal and to load highway approved haul trucks for transportation to market. The first conveyor is mainly a stacker system for the coal stockpile which will be located at the coal unloading area and will be approximately 451' in length. This conveyor is estimated to be a 48" solid frame system.

The second conveyor is a coal reclaim belt that will be loaded by an above ground reclaim feeder from the coal stockpile and will convey coal to the loadout chute which will load the highway approved coal haulage trucks. This section will be approximately 290’ in length. Similar to the first section, this conveyor is estimated to be a 48” solid frame system.

An additional stacking conveyor will be installed to transfer coal from the underground conveyor system to stockpile from which trucks will be loaded. The stacking conveyor will be a 48” wide, wheel-mounted system, approximately 125’ in length.

Drawings of these systems can be viewed on Drawings 5-3 through 5-5.

Transportation facilities for the North Private Lease will consist of two primary roads, and miscellaneous ancillary/temporary roads. Drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: A primary haul road shown in Drawings 5-47, 5-58 and 5-59 will extend from the entrance of the permit area to the Western end of Pit 19. This road is approximately 3,540 feet in length. This road is referred as the “Northern Haul Road”. A second primary haul road shown in Drawings 5-47 and 5-60, the “Southern Haul Road” extends from the South end of Pit 1 on the West, to the South end of the Highwall Trench on the East. This road is approximately 2,980 feet in length. There are three culvert crossings along this road as shown in Drawing 5-60 including a substantial culvert to cross Kanab Creek. Culvert 1 (C-1) is sized at 24 inches. C-2 is sized at 36 inches to match the current culvert under County Road 136, and C-3 is sized at 144 inches for maximum anticipated flows in Kanab Creek. Final design of this culvert will be in conjunction with approvals and oversight from the Army Corps of Engineers. Culvert sizing calculations can be found in Appendix 5-12.

  The following specifications apply to this Primary mine haul roads:

  1) Roads will be approximately 80’ in width
  2) Approximately a 2% crown
  3) Approximately one foot deep cut ditches along shoulders for controlling storm water
  4) 18” of crushed rock or gravel for road surfacing
  5) Cut and fill slopes of 1.5 h: 1v
  6) Berms placed as necessary along fills

  The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations. On the North Private Lease area, topsoil and approved subsoil will be removed and salvaged for all surface mining areas and roadways as they are developed according to the plan and methods described in Chapter 2 Section 231 and Section 523 of this chapter and shown on Drawing 2-4.

521.180. Support facilities.

Description of the support facilities is provided in Section 526.220. Drawings 5-3, 5-3B, 5-4, 5-5, 5-6, 5-7, 5-8, 5-8A, 5-8B, 5-8C, and 5-47, provide the maps, appropriate cross-sections, design drawings and specifications to demonstrate compliance with R645-301-526.220 through R645-301-526.222 for each facility.

521.200. Signs and Markers Specifications.

Signs and markers will be posted, maintained, and removed by Alton Coal Development LLC. Signs and markers will be a uniform design that can be easily seen and read; made of durable material; conform to local laws and regulations, and be maintained during all activities to which they pertain;

521.240. Mine and Permit Identification Signs.

Identification signs showing the name, business address, and telephone number of Alton Coal Development LLC and the identification number of the permanent program permit authorizing coal mining and reclamation operations will be displayed at each point of access to the permit area from public roads, and will be retained and maintained until after the release of all bonds for the permit area;

521.250. Perimeter Markers.

The perimeter of a permit area will be clearly marked with fencing before the beginning of surface mining activities. The perimeter of all permitted and bonded surface disturbance areas will also be clearly marked with ~~fencing or~~ signage stating “disturbance boundary.”

The perimeter of the surface disturbance associated with Pit B-1 will be clearly marked prior to disturbance activities. Additionally, cultural resource sites will be demarcated, monitored and barricaded according to the practices detailed in chapter 4.

521.260. Buffer Zone Markers.

Buffer zones will be marked along their boundaries as required under 731.600

521.270. Topsoil Markers.

Markers will be erected to mark where topsoil or other vegetation - supporting material is physically segregated and stockpiled.

522. **COAL RECOVERY**.

The MRP is designed to maximize recovery of the coal resource within technological, safety and legal limitations. Coal will be recovered from the Smirl Seam which ranges in thickness from 11.0 to 18.5 feet averaging approximately 16 feet in the planned mining area. The Smirl Seam is the only surface mineable seam in the permit area. Isopach maps of the coal thickness and strip ratio can be viewed on Drawings 5-13 and 5-14 for the Coal Hollow Mine and Drawings 5-54 and 5-55 for the North Private Lease.

Some coal along the boundaries of the mine area will not be recovered in conjunction with the proposed operation. This includes coal underlying the pit highwalls and areas where drainage or sedimentation control structures (diversions, ditches, ponds, etc) are located. The mine is designed to minimize such losses by locating haulage ramps in the spoil rather than on the pit wall, by oversteepening the coal face at the pit edges, and by minimizing the use of out of pit ancillary roads. Coal which is left in place in these areas may be recovered in the future when adjacent property rights are secured. Current plans are for a planned maximum mining depth of approximately 200 ft. and a strip ratio of 10:1; however, the ultimate mining depth will depend on cost related factors.

Additional coal (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will also be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. This coal will be surface mined. Coal mined in Pit B-1 will be extracted to an extent that protects eventual regrading and reclamation efforts in the Borrow Area from potential oxidation, heating, or spontaneous combustion.

A detailed mine plan has been developed for the proposed permit area and the following tables for each area along with Drawing 5-9 for the Coal Hollow Mine and Drawing 5-52 for the North Private lease summarize the coal extraction for the permit area for the open pit mining, highwall mining and underground mining:

Existing Coal Hollow Mine

Description	Extraction Status	Average Coal Thickness (ft)	Average Strip Ratio* (yd^3/Ton)	Quantity (**Ton)
Total Coal within Permit Boundary	N/A	16.3	7.7	12,092,000
High Strip Ratio Area (NE corner of permit area)	Not Mined	16.0	13.5	2,812,000
Coal under highwalls and sedimentation structures	Not Mined	17.2	4.8	2,305,000

Coal under Robinson Creek Diversion	Not Mined	15.5	3.9	172,000
Highwall & Underground	Not Mined	16.0	0	2,460,000
Recoverable Coal (Surface)	Mined	16.3	6.4	3,416,000
Recoverable Coal (Underground)	Mined	16.0	0	927,000

*All strip ratios are bank cubic yards of overburden to tons of coal
**All coal tons are based on a 95% recovery factor for open pit mining and 45% for highwall mining and the underground mining.

North Private Lease

Description	Extraction Status	Average Coal Thickness (ft)	Average Strip Ratio* (yd^3/Ton)	Quantity (**Ton)
Total Fee Coal within Permit Boundary	N/A	15.4	4.5:1	7,127,300
Coal under highwalls and sedimentation structures	Not Mined	15.1	10.1:1	2,197,300
Highwall	Not Mined	15.2	0	1,528,100
Highwall	Mined	15.2	0	785,700
Open Pit	Mined	15.6	6.0:1	2,616,200
Total Recoverable Coal (Surface)	Mined	15.5	4.6:1	3,401,900

*All strip ratios are bank cubic yards of overburden to tons of coal
**All coal tons are based on a 95% recovery factor for open pit mining and 35% for highwall mining.
Once approval is received to progress with mining on the adjacent federal coal reserves, an additional 57% of the coal under the highwalls will be recovered as part of the progression into these adjacent reserves.

With open pit mining, the application of highly flexible, open pit truck/shovel techniques will minimize losses of coal due to pit geometry or spoil support requirements, allowing the maximum possible exposure of the coal resource. The full seam section will be loaded primarily using large hydraulic backhoes. The backhoes, which can work from the top of the seam, provide the ability to efficiently and cleanly excavate the lower part of the coal seam without disturbing the pit floor. This, along with the machine's high degree of bucket horizon control will minimize floor losses. The backhoes can also work safely from the top of the seam to over steepen the loading face along the pit walls, thus recovering the maximum amount of coal.

Where pit geometry or operational factors preclude the use of backhoes for loading, a large rubber tire front end loader will be used. These machines provide similar horizon control, can operate on the floor of the pit or on an intermediate bench, and can recover coal from confined areas such as the ends of the pits.

With the highwall miner (See Chapter 9 which addresses R645-302 regulations), the application of a highwall mining system will be employed to recover coal from the exposed face. In this method of mining, an unmanned cutter module is driven underground and operated in front of the highwall. The highwall mining machine stands on the pit floor or on a bench, directly in front of the exposed seam and makes long parallel rectangular drives into the coal seam. A remote-operated cutter module is pushed into the seam by a string of push beams (unmanned coal-conveying elements) that transport the mined coal back to the entry of the drive onto a stockpile.

The underground mining will utilize standard extraction methods. These will include a continuous miner, shuttle cars and a conveyor system to the surface. The mine plan calls for first mining only to prevent subsidence. Coal brought to the surface will flow to a stacking conveyor and stockpile as shown on Drawing 5-3B.

The limited extraction, first-mining only and compliance with the recommendations in the Norwest Report (Appendix 5-9) will ensure access in the event the portals should need to remain open for future underground operations.

For the Coal Hollow Mine, rear dump haul trucks, loaded by the backhoes or front end loader, will be used to move the coal from the pit via inpit roads and the primary haulroad to the crusher and stockpile. The trucks will be equipped with “combo” beds suitable for hauling both coal and overburden, and configured to minimize coal spillage. For the North private Lease, over-the-road trucks, loaded by the backhoes or front end loader, will be used to move the coal from the pit via inpit roads and the primary haulroad to the Coal Hollow Mine crushing facility. For the initial cut, coal waste will be temporarily pushed into a pile on top of unmined coal until enough coal has been removed to place the coal waste on the floor of the pit.

A net recovery of 95% (including the effects of in-pit coal losses and out-of-seam dilution) of the coal exposed in the open pit is anticipated. A net recovery of 45% of the coal mined by the highwall system (See Chapter 9 which addresses R645-302 regulations) as well as the underground mining is anticipated. Normal coal losses are expected due to cleaning of the top of the seam, loading losses at the seam floor, and coal oxidation near the outcrop.

No coal washing is contemplated at this time, thus there will be no coal processing losses.

Maps and cross sections providing detailed information related to coal recovery activities can be viewed on Drawings 5-9 through 5-14 for the Coal Hollow and on Drawings 5-52 through 5-55 for coal recoveries at the North Private Lease.

523. **MINING METHOD(s).**

The Coal Hollow Mine will be a combination coal mining operation, utilizing open pit mining, highwall mining (See Chapter 9 which addresses R645-302 regulations) and underground mining methods. Primary mining equipment will include hydraulic excavators, a highwall miner, standard underground mining equipment including a continuous miner, shuttle cars and conveyor system, and end-dump mining trucks. The coal will be crushed at the mine site, and hauled to market in over-the-road coal trucks.

The Coal Hollow Mine is planned to produce approximately 3.6 million tons of coal over a life of approximately 7 years. The estimated production schedule is summarized below:

Production Schedule		
		Tons Produced
Year		(000)
2011		405
2012		578
2013		741
2014		534
2015		326
2016 - Surf		118
2016 – UG		362
2017 – UG		565
Total		3,629

Initial mine development will involve removal and storage of topsoil from mine infrastructure locations. Facilities for equipment maintenance/warehouse, coal handling, and offices will be constructed. During the development and initial mining period, facilities temporary in nature may be used until permanent facilities can be built. Construction of sedimentation ponds, diversion ditches, and mine roads accessing the initial mining areas will also be ongoing.

Mining will employ typical open pit methods using truck/loader type equipment to remove overburden and recover the coal. Mining will advance across the property in successive cuts approximately 250 ft. in width and 800 to 1,300 ft. long (generally equal to the width of the property less property barriers). Layout of these pits can be viewed on Drawing 5-10. Drawing 5-10 has been modified from the original layout to accommodate modifications to the plan for highwall mining, underground mining and anomalies encountered in the coal (large sand channels), thus the non-sequential numbering of the pits. The overburden will be removed in layers or lifts approximately 20 to 40 feet deep. In practice, these overburden lifts are mined in a stairstep fashion ahead of the coal removal operation to provide adequate working room for the equipment and stable advancing slopes. Once mining is complete, excavated overburden (spoil) from a successive cut is used to backfill the excavation. General cross sections of this process can be viewed on Drawings 5-11 and 5-12.

Prior to beginning mining, the area will be cleared of vegetation, and the topsoil will be recovered and either stockpiled or live hauled to regraded areas. It is not anticipated that blasting of the overburden will be necessary based on drilling data. Should this process become necessary, this is the phase where it would be implemented. Overburden will then be removed using large hydraulic excavator(s) or front end loaders and off-road trucks which will haul the spoil and place it in parts of the pit where the coal has been removed, or in the excess spoil area shown on Drawing 5-3. Overburden is removed in successively deeper benches until the coal seam is exposed. Some overburden in lower lifts may be moved by direct dozing into the mined out pit by large bulldozers.

When overburden removal is finished in a particular pit, the top of the coal will be cleaned (removal of any roof rock or other non-coal material on top of the seam) using a motor grader, dozer or front end loader. The material removed will be placed in the adjacent mined out pit. For the open pit mined coal, if necessary, the coal seam will be loosened by drilling and blasting or ripping prior to loading. Drilling and blasting of the coal is not expected to be necessary. The cleaned, exposed coal is then excavated by backhoe or front end loader and placed into off-road rear dump trucks. Coal mined with a highwall miner would not require blasting.

Once the coal is removed, the pit will be backfilled by spoil from adjacent mine pits. Spoil will be placed in lifts and spread with a dozer. Once the pit is backfilled to the planned final surface contour, suitable topsoil and subsoil will be replaced, and the area reseeded. Revegetation work will proceed seasonally as appropriate for planting.

Overburden excavation and coal mining at Coal Hollow will begin near the subcrop of the coal seam at the western end of the permit area in the NW ¼ NE ¼ of Section 30, T39S, R5W. Topsoil will be removed and stored separately in topsoil stockpiles as shown on Map 2-2. Overburden from the initial pits will be hauled to the excess spoil pile east of the mining area. Once the initial pits are established, as much spoil as possible will be placed directly in the pit backfill, allowing reclamation to closely follow mining. This initial phase includes pits 1 through 9 as shown on Drawing 5-10.

From the initial mining area, operations will proceed from the southeast ¼ of Section 30, beginning with pit 28 and proceeding north to pit 22. Pit 9 will not be backfilled at this stage; it has been left open for placement of the highwall miner to recover coal from panels 1-3. In hole 27 of Pit 9 Panel 3, the highwall miner head became lodged. Another head was leased in order to continue highwall mining in pits 22 and 23 while a recover plan was approved to mine Pit 10 and recover the lodged miner head. Pit 21 was then mined along the highwall panels in 21, then Pit10. Pit 10 will remain open for development of the underground portals and remain open until all underground coal is mined. Surface mining will continue with mining of Highwall Trench (HWT) 1 continuing south to HWT 3.

The last pit of coal (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. This resource is estimated at 118,000 tons and is expected to be fully mined and immediately backfilled (to the intermediate landform shown in Drawings 5-35 and 5-36) in 2016. The coal will be surface mined utilizing the same equipment and methods as the previous pits and will be extracted to an extent that protects eventual regrading and reclamation efforts in the Borrow Area from potential oxidation, heating, or spontaneous combustion. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36.

The North Private Lease will be a combination coal mining operation, utilizing open pit mining, and highwall mining. Primary mining equipment will include hydraulic excavators, a highwall miner, and end-dump mining trucks. The raw coal will be mined from the open pits and loaded to over-the-road coal trucks and delivered to the Coal Hollow Mine for crushing then hauled to market in over-the-road coal trucks.

The North Private Lease is planned to produce approximately 3.4 million tons of coal over a life of approximately 6 years. The estimated production schedule is summarized below:

Production Schedule		
		Tons Produced
Year		(000)
1		585
2		857
3		600
4		735
5		281
6		237
7		108
Total		3,402

Initial mine development will involve removal and storage of topsoil from mine infrastructure locations. Construction of sedimentation ponds, diversion ditches, and mine roads accessing the initial mining areas will also be ongoing. See chapter 2, section 231.100 and Drawing 2-4 for topsoil handling methods, quantities, and plans. For the North Private Lease prior to mining Pit 1 the following steps will be followed:

1. The A horizon (topsoil) will be salvaged along with B horizon (subsoil) to a depth of 14 inches (1.2 feet) from all active mining areas (pits, ponds, roadways,

haul roads, storage and repair yards, etc.). The only exception is that topsoil can remain under topsoil storage piles.

2. For the area inside the excavation perimeter of Pit 1, Pond 5 and Pond 6, the remaining subsoil (the B & C horizon above lithic contact, approximately 2.6 feet) will also be removed and stockpiled in a subsoil stockpile. This means that roadways and the subsoil and spoil piles depicted in Drawing 2-4 will be placed on top of native subsoil. This native subsoil will be protected in place beneath the spoil stockpile by using a marker fence to delineate the subsoil surface on 100 ft. centers and by using a gps survey grid of the topography of the subsoil surface layer. The native subsoil will be protected in place on any roadway receiving surface treatment (ie. Gravel, additional fill) by placing marker fence along the roadway centerline. The native subsoil will then be recovered as part of the subsequent mining sequence and placed directly over regraded backfill to the cover depth required in section 232.

4. A soil scientist will monitor the topsoil and subsoil removal and placement of geomarker.

5. A surveyor will map the surface elevation of the subsoil being protected in place.

Area 1 expanded increases Area 1 by 17.89 acres, all topsoil and subsoil will be salvaged and stockpiled as mining of Pits 7, 8 and 9 progress. Stockpile locations are shown and volumes tabulated for on Drawing 2-4. These stockpiles will remain and be utilized for final reclamation of the last pits mined.

As with the Coal Hollow Mine, topsoil and subsoil will be removed with dozers and/or scrapers to a depth determined by the soil scientist.
Mining will employ typical open pit methods using truck/loader type equipment to remove overburden and recover the coal. Mining will advance across the property in successive cuts approximately 200 ft. in width and 500 to 1,300 ft. long. Layout of these pits can be viewed on Drawing 5-52. The overburden will be removed in layers or lifts approximately 20 to 40 feet deep. In practice, these overburden lifts are mined in a stair step fashion ahead of the coal removal operation to provide adequate working room for the equipment and stable advancing slopes. Once mining is complete, excavated overburden (spoil) from a successive cut is used to backfill the excavation. General cross sections of this process can be viewed on Drawings 5-11 and 5-12.

Following initial construction and prior to beginning mining of each pit, the area will be cleared of vegetation, and the topsoil will be recovered and either stockpiled or live hauled to regraded areas. Blasting of the overburden will then be performed according the plan and methods outlined in Section 524 of this chapter and Appendix 5-4. Overburden will then be removed using large hydraulic excavator(s) or front end loaders and off-road trucks which will haul the spoil and place it in parts of the pit where the coal has been removed, or in the temporary spoil area shown on Drawing 5-47. Overburden is removed in successively deeper benches until the coal seam is exposed. Some overburden may be moved by direct dozing into the mined out pit by large bulldozers.

When overburden removal is finished in a particular pit, the top of the coal will be cleaned (removal of any roof rock or other non-coal material on top of the seam) using a motor grader, trackhoe, dozer or front end loader. The material removed will be placed in the adjacent mined out pit. For the open pit mined coal, if necessary, the coal seam will be loosened by drilling and blasting or ripping prior to loading. Drilling and blasting of the coal is not expected to be necessary. The cleaned, exposed coal is then excavated by backhoe or front end loader and placed into over-the-road trucks. Coal mined with a highwall miner would not require blasting.

Once the coal is removed, the pit will be backfilled by spoil from adjacent mine pits. Spoil will be placed in lifts and spread with a dozer. Once the pit is backfilled to the planned final surface contour, suitable topsoil and subsoil will be replaced, and the area reseeded. Revegetation work will proceed seasonally as appropriate for planting.

Overburden excavation and coal mining at the North Private Lease will begin near the subcrop of the coal seam at the southwestern end of the permit area in the SW ¼ NW ¼ of Section 13, T39S, R5W. Topsoil will be removed and stored separately in topsoil stockpiles as shown on Map 2-4. Overburden from the initial pit 1 and southern half of 2 will be hauled to the temporary excess spoil pile located on the future pits 3, 4 and 5. Once the initial pit is established, as much spoil as possible will be placed directly in the pit backfill, allowing reclamation to closely follow mining. As mining progresses to Pit 3, material from the temporary excess spoil pile can be rehandled to be placed in the mined out void. As mining proceeds from pit 5 to pit 10 all spoils mined is placed into pit backfill. This initial phase includes pits 1 through 10 as shown on Drawing 5-53. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 (which contains Pits 7, 8 and 9) may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. Once these approvals are obtained, the Area 2 facilities will be constructed and Pond T1 and the other Area 1 extension facilities will be mined out by advancing pits.

From the initial mining area, operations will proceed to the North from Pit 11 to Pit 21. All spoils are placed in the proceeding void. Once coal is removed from Pit 21, overburden from the development of the highwall trench will be used to backfill the remaining Pit 21.

The final mining area will be developed on the East side of Kanab Creek. Overburden from Highwall Trench 1 will proceed north in the trench with overburden being placed into the previously mined out area. Backfill for the final Highwall Trench will come from the temporary overburden stockpiles.

Alton Coal Development, LLC is currently in the process of an Environmental Impact Study for Federal Reserve's adjacent to the private mining areas known as the LBA. It is expected that these rights will be acquired prior to the completion of the final phase in the proposed Permit Area. Also, if acquired, Pit 10 along with the underground portals will remain open to access underground coal within the LBA. The final landform for Coal Hollow Mine is shown on Drawings 5-37 and 5-37A. The final landform for the North Private Lease is shown on Drawings 5-74 and 5-75.

An estimate of the primary mining equipment planned for use at the Coal Hollow Mine and North Private Lease is listed below:

Diesel - Hydraulic Excavators (15 to 38 cu. yd. capacity)
Highwall Mining System (CAT HW300 or equivalent)
Rubber Tired Front End Loaders (8 to 20 cu. yd. capacity)
End Dump Trucks (100 to 240 ton capacity class)
Track Dozers (Caterpillar D7 through D11 Class)
Motor Graders (Caterpillar 16H to 24H Class)
Water Trucks (8,000 to 20,000 Gallon Class)
Underground miner and associated equipment

A variety of other equipment will also be used to support the mining operation.

Proposed engineering techniques for meeting the proposed mining methods will include:

- Design support for roads, pits, sediment impoundments etc…
- Field staking of designs utilizing high precision GPS survey systems.
- Weekly field engineering support to view and provide guidance related to designs and environmental controls.
- Ongoing geotechnical support for ensuring highwall stability
- As additional information becomes available, update geological models to ensure full recovery of resource.
- Weekly mine plans that specify appropriate engineering and environmental specifications.

There are no known underground mines within 500 feet of the permit boundary. No surface mining or reclamation activities are proposed to take place within 500 feet of the underground mine.

524. **BLASTING AND EXPLOSIVES**

Explosives will be utilized as necessary at Coal Hollow Mine and the North Private Lease to break the overburden over the coal and may be used to break the coal for loading if necessary. In accordance with the requirements of this section, a blasting plan is provided to the Division in Appendix 5-4. Blasts that use more than five pounds of explosives or blasting agents will be conducted according to the schedule provided in R645-301-524..

524.100 Blaster Certification

Alton Coal Development, LLC (ACD) will, prior to conducting any surface blasting operations, ensure that all surface blasting incident to surface mining in Utah is conducted under the direction of a Utah Certified Blaster. Blaster certifications will be carried on the person of the Certified Blaster and copies of the Blasting license(s) will be on file at the mine. A blaster and at least one other person will be present at the firing of a blast.

The Certified Blaster will be responsible for blasting operations at the blasting site, will be familiar with the blasting plan and site-specific performance standards, and give on-the-job training to persons who are not certified and who are assigned to the blasting crew or assist in the use of explosives.

524.200 Blast Design

There are no dwellings, public buildings, schools, churches, or community or institutional building within 1,000 feet of the planned blasting area for either the Coal Hollow Mine or the North Private Lease. There are also no historic underground mines within 500 feet of either of the permit areas.

Overburden shot size is generally 450x200 ft or 200,000 cubic yards. A typical overburden blast design has a burden and spacing of 18x18ft at a depth of 60ft. Stemming height is typically 13 ft. Shots will be loaded with Ammonium Nitrate Fuel Oil (ANFO) in dry holes, and packaged emulsion on wet holes. Average pounds per hole will be 833 lbs. Powder Factors can range from .4 lbs/cyd to 1.25 lbs/cyd depending on geology. Each hole will have at least one booster (0.75 lb or 1 lb) and a 25/500ms nonel cap, as shown in Figure 1 of Appendix 5-4.

Timing will typically be 25 ms between holes with 84 ms between rows, and follow the pattern shown in Figure 2 of Appendix 5-4.

The closest structure to any blast pattern for the Coal Hollow Mine is the Richard Dame (Swapp Ranch) property at 1,585 ft. from the closest blast pattern. For the North Private Lease, the nearest structures (a pole barn and a fish pond with an earthen dam) are located on property owned by Heaton Brothers LLC, at least 2032 ft. away (See Drawing 1-7 for measured distances). The required scaled distance is 55 for Coal Hollow Mine and 55 for the North Private Lease per 524.640 – 662. Based on these scaled distances, the maximum pounds of explosives per 8 ms delay is 2,066 lbs for the Coal Hollow Mine and North Private Lease respectively.

The above blast design, loading, and timing are general designs for the mine and may be altered due to geology, mine design, production needs, and blast optimization.

Blasts conducted within 1000 ft. of a dwelling, public building, school, church, or community or institutional building will be submitted for Division and MSHA approval, prior to blasting. The blast design and shot report will contain sketches of the drill and delay patterns, decking, type and amount of explosives required per blast, critical dimensions, design factors utilized to protect the public, general location drawings of protected structures, which meet the applicable airblast, flyrock, and ground vibration standards in 524.600.

The blast design and shot report will be prepared and signed by a Utah certified blaster. Records documenting blasting operations will be maintained at the mine site for at least three years and upon request will be made available to the Division upon request. These records will include all information as required in R645-301-524.700. The contractor will also keep blasting records for at least 3 years at the contractors' site office. See Appendix 5-4 Section 4 for a blank shot report and Section 1H for a typical blast design.

524.300 - 350 <u>Preblasting Survey</u>

A preblasting survey will be conducted prior to commencement of blasting operations. As part of the preblasting survey Alton Coal Development LLC will:

- Notify, in writing, all residents or owners of dwellings or other structures located within one-half mile of the permit area how to request a preblasting survey at least 30 days before initiation of blasting.
- Prepare a written report of any preblasting survey. A resident or owner of a dwelling or structure within one-half mile of any part of the permit area may request a preblasting survey. This request will be made, in writing, directly to Alton Coal Development LLC or to the Division, who will promptly notify Alton Coal Development LLC. Alton Coal Development LLC will promptly conduct a preblasting survey of the dwelling or structure and promptly prepare the written report. An updated survey of any additions, modifications, or renovation will be performed by Alton Coal Development LLC if requested by the resident or owner.
- Determine the condition of the dwelling or structure and will document any preblasting damage and other physical factors that could reasonably be affected by the blasting. Structures such as pipelines, cables, transmission lines, and cisterns, wells, and other water systems warrant special attention; however, the assessment of these structures may be limited to surface conditions and other readily available data.
- Require the written report of the survey be signed by the person who conducted the survey. Copies of the report will be promptly provided to the Division and to the person requesting the survey. If the person requesting the survey disagrees with the contents and/or recommendations contained therein, he or she may submit to both Alton Coal Development LLC and the Division a detailed description of the specific areas of disagreement.

- Complete any survey requested more than ten days before the planned initiation of blasting, before blasting occurs.

Preblasting surveys were conducted for the Swapp Ranch and the Darlynn Sorensen residence on August 23, 2011 for the Coal Hollow Mine.

There are no residences within ½ mile of the North Private Lease requiring a preblasting survey. However, a preblasting survey will be offered to each of the owners of the five land parcels with structures in Alton Town that are nearest to the Northwest corner of the lease boundary ~~once approval of the North Private Lease Permit Area 2 has been obtained~~. These parcels and ownership are depicted on Drawing 1-7 along with measured distances. Also shown on Drawing 1-7, there are two structures, a Pole Barn and a Fish Pond with an earthen dam, located on property owned by Heaton Brothers LLC that are both within the ½ mile limit of Permit Area 1. Preblasting surveys will be offered and conducted for each of these structures prior to any blasting operations for Permit Area 1.

524.400 Blasting Schedule

Blasting will typically take place approximately once every 1.5 weeks, with adjustments made for production, weather, and the mine's or contractor's schedule.

524.410. Unscheduled Blasts

Unscheduled blasts will be conducted only where public or operator health and safety so requires and for emergency blasting actions. When an unscheduled surface blast incidental to coal mining and reclamation operations is conducted, Alton Coal Development LLC, using audible signals (see section 524.500-532 for blasting signals), will notify residents within one-half mile of the blasting site and document the reason on the shot report in accordance with 524.760

Also, for unscheduled blast in the Coal Hollow Mine, Darlynn Sorensen, and Richard Dame will be notified. Within the North Private Lease there are no residents within a ½ mile radius that require notification.

524.420. Timing of Blasting

All blasting will be conducted between sunrise and sunset unless nighttime blasting is approved by the Division. Alton Coal Development LLC will conduct blasting operations at times approved by the Division and announced in the blasting schedule.

524.450 - 453. Blasting Schedule Publication and Distribution.

Alton Coal Development, LLC will:

- Publish the blasting schedule in a newspaper of general circulation in the locality of the blasting site at least ten days, but not more than 30 days, before beginning a blasting program;
- Distribute copies of the schedule to local governments and public utilities and to each local residence within one-half mile of the proposed blasting site described in the schedule; and
- Republish and redistribute the schedule at least every 12 months and revise and republish the schedule at least ten days, but not more than 30 days, before blasting whenever the area covered by the schedule changes or actual time periods for blasting significantly differ from the prior announcement.

A copy of the public notice is included in Appendix 5-4 as Exhibit 1

524.460 - 465. Blasting Schedule Contents.

The blasting schedule will contain, at a minimum:

- Name, address, and telephone number of operator;
- Identification of the specific areas in which blasting will take place;
- Dates and time periods when explosives are to be detonated;
- Methods to be used to control access to the blasting area; and
- Type and patterns of audible warning and all-clear signals to be used before and after blasting.

A copy of the public notice is included in Appendix 5-4 as Exhibit 1

524.500 - 532 Blasting and Warning Signs, Access Control

Blasting signs will read **“Blasting Area”** and be conspicuously placed along the edge of any blasting area that comes within 100 feet of any public right-of-way, and at the point where any other road provides access to the blasting area. At all entrances to the mine permit area from public roads or highways, signs will be conspicuously placed which read **“Warning! Explosives in Use”**, clearly list and describe the meaning of the audible blast warning and all-clear signals in use, and explain the identification of blasting areas where charged holes await firing at the blasting site in the mine permit area.

Warning and all-clear signals of different character or pattern that are audible within a range of one-half mile from the point of the blast will be given. Each person within the permit area and each person who resides or works regularly within one-half mile of the blast site in the mine permit area will be notified of the meaning of the signals in the blasting schedule and notification.

Prior to blasting, all persons will be evacuated from the blasting zone and guards will be posted at the entrance of the blasting area. When blasting in the North

Private Lease, blockers will also be placed on County Road 136 (K3900) west of the permit boundary at least 1000 feet from the nearest blast hole to restrict public access into the blasting zone. The exact blocker location will be determined by the blaster at the pre blast safety meeting. A typical blast sequence will be the following:

- 30 minute warning – Blast announced over all Coal Hollow Mine or North Private Lease radio channels.
- 15 minute warning – Blast once again announced over all Coal Hollow Mine or North Private Lease radio channels. Guards are placed at the entrance of the blasting area and the pit is cleared.
- 5 minute warning – Guards blocking all access, pit cleared, access to the blasting area blocked, radio silence required and siren activated. Siren will be three prolonged wales.
- 1 minute warning – A series of short siren wales
- Countdown to ignition @ 5,4,3,2,1 – Announced across Coal Hollow Mine or North Private Lease radio channels
- All clear signal – One prolonged siren wale

A post blast inspection will be conducted by the qualified blaster and/or foreman prior to clearing the area. All guards will remain at their assigned positions until the blast area has been cleared by the qualified person.

The post blast inspection will include an examination of faces and/or muck piles associated with the blasting operation.

Access within the blasting areas will be controlled to prevent presence of livestock or unauthorized persons during blasting and until the Certified Blaster has reasonably determined that no unusual hazards exist, such as imminent slides or un-detonated charges; and access to and travel within the blasting area can be safely resumed.

524.600 - 610 Adverse Effects Of Blasting

Blasting will be conducted to prevent injury to persons, damage to public or private property outside the mine permit area, and changes in the course, channels, or availability of surface or ground water outside the mine permit area by following industry best practices, limits, and regulations

524.620 Airblast Limits

Airblast will not exceed the maximum limits listed below at the location of any dwelling, public building, school, church, or community or institutional building outside the mine permit area, except for those structures and facilities owned by Alton Coal Development LLC as approved by the Division. Maximum airblast limits are as follows:

Lower Frequency Limit of Measuring System, HZ (+3dB)		Maximum Level dB
2 Hz or lower – flat response		133 peak

(1)

524.630. Monitoring:

Periodic monitoring will be conducted once per quarter, unless there are no blasts, to ensure compliance with the airblast standards. Airblast measurements will be taken as required by the Division at locations specified by the Division. The measuring system used will have an upper-end flat frequency response of at least 125 Hz.

The first blast in the North Private Lease will be monitored from the earthen dam of the pond located to the west of the lease on Heaton Brothers LLC property and from a location approximately 2500’ away from the blast along County Road 136 (K3900). The Division will be notified prior to the first blast taking place to provide the Division with their own opportunity to conduct monitoring activities. Following the first blast, each of the subsequent blasts in Permit Area 1 will be monitored from the earthen dam of the pond mentioned above until blasting activities are no longer within ½ mile of the structure. Periodic (quarterly) monitoring will then continue through Permit Area 2 until mining commences in Pit 20 (Shown in Drawing 5-57). Each blast in Pits 20 and 21 will be monitored from the nearest Alton Town structure located on Parcel A-B-23-2 (Shown on Drawing 1-7). Subsequent blasting activities in Permit Area 3 will be monitored periodically (quarterly).

524.633. Flyrock:

Flyrock traveling in the air or along the ground will not be cast from the blasting site more than one-half the distance to the nearest dwelling or other occupied structure; beyond the area of blasting access control or beyond the mine permit area boundary. Each shot will be recorded to ensure flyrock falls within the limits described above. If flyrock occurs, it will be documented on the shot report in the comments section.

524.640 - 662. Ground Vibration.

In all blasting operations, except as otherwise authorized by the Division, the maximum ground vibration will not exceed the values approved by the Division. The maximum ground vibration for protected structures will be in accordance with the maximum peak-particle velocity limits. All other structures in the vicinity of the blasting area such as water towers, pipelines and other utilities, tunnels, dams, impoundments, and underground mines will be protected from damage by establishment of a maximum allowable limit on the ground vibration. These limits will be submitted by Alton Coal Development LLC and approved by the Division prior to blasting. A seismographic record will be provided for each blast if protected structures are within 2500 ft of the blast. If no protected structures are within the 2500 ft limit, periodic monitoring will be conducted once per quarter, unless there are no blasts, to ensure compliance with the ground vibration limits. In the event a scaled distance less than 55 or PPV greater than 1.00 in/s is anticipated in the blast design, Maximum Peak Particle Velocity Method and Scaled Distance Equation Method will be used to monitor.

The first blast in the North Private Lease will be monitored for ground vibration from the earthen dam of the pond located to the west of the lease on Heaton Brothers LLC property and from a location approximately 2500' away from the blast along County Road 136 (K3900). The Division will be notified prior to the first blast taking place to provide the Division with their own opportunity to conduct monitoring activities. Following the first blast, each of the subsequent blasts in Permit Area 1 will be monitored from the earthen dam of the pond mentioned above until blasting activities are no longer within ½ mile of the structure. Periodic (quarterly) monitoring will then continue through Permit Area 2 until mining commences in Pit 20 (Shown in Drawing 5-57). Each blast in Pits 20 and 21 will be monitored from the nearest Alton Town structure located on Parcel A-B-23-2 (Shown on Drawing 1-7). Subsequent blasting activities in Permit Area 3 will be monitored periodically (quarterly).

Maximum Peak-Particle Velocity Method: The maximum ground vibration will not exceed the following limits at the location of any dwelling, public building, school, church, or community or institutional building outside the mine permit area in accordance with the following:

Distance (D) from Blast Site in feet	Maximum allowable Particle Velocity (Vmax) for ground vibration, in inches/second (1)	Scaled distance factor to be applied without seismic monitoring (Ds) (2)
0 to 300	1.25	50
301 to 5,000	1.00	55
5,001 and beyond	0.75	65

(1) Ground vibration will be measured as the particle velocity. Particle velocity will be recorded in three mutually perpendicular directions. The maximum allowable peak particle velocity will apply to each of the three measurements.
(2) Applicable in the scale-distance equation of 524.651.

For the North Private Lease, as no structure resides within 300 feet of any planned blasting activity, all blasts will be designed and monitored to a threshold Peak-Particle Velocity of 1.00 inches/second.

524.690. <u>Standards not Applicable</u>

The maximum airblast and ground-vibration standards of 524.620 through 524.632 and 524.640 through 524.680 will not apply at the following locations: At structures owned by Alton Coal Development LLC and not leased to another person; and at structures owned by Alton Coal Development LLC and leased to another person, if a written waiver by the lessee is submitted to the Division before blasting.

524.700 Records of Blasting Operations**:**

Blasting records will be maintained at the mine site for at least three years and upon request, records will be available for inspection by the Division or the public. A blasting record will contain the name of Alton Coal Development LLC; location, date, and time of the blast; name, signature, and Utah certification number of the blaster conducting the blast. It will also include the identification, direction, and distance, in feet, from the nearest blast hole to the nearest dwelling, public building, school, church, community or institutional building outside the permit area, except those described in 524.690 and weather conditions, including those which may cause possible adverse blasting effects.

The blasting record will include: The type of material blasted; sketches of the blast pattern including number of holes, burden, spacing, decks, and delay pattern; diameter and depth of holes; types of explosives used; total weight of explosives detonated in an eight-millisecond period; initiation system; type and length of stemming; and mats or other protection used.

If protected structures are within 2500 ft of the blast or it is periodic monitoring as outlined in sections 524.620 through 524.690, a record of seismographic and airblast information will include: type of instrument, sensitivity, and calibration signal or certification of annual calibration; exact location of instrument and the date, time, and distance from the blast; name of the person and firm analyzing the seismographic record; and the vibration and/or airblast level recorded; and the reasons and conditions for each unscheduled blast.

See Appendix 5-4 for example shot report.

524.800 Use of Explosives:

Alton Coal Development LLC will comply with all appropriate Utah and federal laws and regulations in the use of explosives.

525. SUBSIDENCE CONTROL PLAN

The proposed underground mining is first-mining only and is planned for limited extraction with no subsidence. Refer to Appendix 5-9 (Norwest Report) for geotechnical and design information. Due to the design and mining method of underground mining in this plan, no subsidence is projected and no monitoring is planned. As requested by the Division, however, the company will conduct surface observation walkovers of each of the 4 developed panel areas in this proposed plan within 60 days of completion of mining in those areas. Two additional observation walkovers will be made at approximately 1 year intervals following the initial walkover. If the observations determine that no affects or voids have developed to the surface, it will be documented and forwarded to the Division. If surface cracking, sinkholes or other surface impacts are noted during the walkovers, they will be documented, located on a surface topographic map, reported to the Division, photographed and repaired after approval by the Division. If the observation indicates no deformation is occurring, no further walkovers are proposed to be conducted on the respective panel areas.

It should be noted that, in addition to the larger pillar sizing near the portals (Appendix 5-9), the portal entries will be lined with arches and/or crossbars in areas of less than 120' of cover, per recommendations in the Norwest Report (Appendix 5-9), to further reduce the possibility of subsidence or failure in that low cover area.

Highwall mining or Auger mining, as defined in the definitions in R645-100-200 is Surface Mining, thus Underground regulations do not apply. Therefore, highwall mining in this plan have been addressed using the regulations contained in R645-302-240, Special Categories of Mining (See Chapter 9). The alternate highwall option has limited extraction with no subsidence. Refer to Appendix 5-8 (Feasibility of highwall mining the Smirl seam) for geotechnical and design information. Du~~eo~~e to the design and mining method of highwall mining in this plan, no subsidence is projected and no monitoring is planned. Appendix 1-2 Right of Entry, Exhibit 5 contains the New Dame Lease. In this document, under Article 7 Section 7.03, provisions have been made if there is material damage as a result of subsidence.

526. **MINE FACILITIES**:

The area of land that will have a performance bond posted in the North Private Lease is shown on Drawing 5-47. The lease boundary encompasses three Permit Areas~~, of which Area 1 is currently proposed for inclusion in the MRP and Areas 2 and 3 remain under review~~. Due to bond requirements and the scarcity of open space with relation to the soil and spoil stockpiles in Permit Area 1, construction of facilities and development of the mining pits must follow a rigid sequence. As depicted in Appendix 8-2, the first increment of bonding in Permit Area 1 covers all of Area 1's Phase 2, Phase 3, and Facilities costs while only allowing Phase 1 (excavation) cost for Pit 1. Therefore, as shown in Drawing 5-48, the first stage of mining activity involves construction of the South Haul Road, Ponds 5 and 6, Ditches 5 through 11, and the temporary topsoil, subsoil and spoil stockpiles. To construct each of these facilities, ground cover, topsoil, and subsoil must be removed and stockpiled according to the plan and methods set out in Chapter 2 section 231 and section 523 of this chapter and also shown on Drawing 2-4. Once these facilities have been constructed, excavation of Pit 1 will commence. The second North Private Lease bond increment will then allow continued excavation of Pits 2-6 to the Permit Area 1 boundary. During mining and backfill of Pits 5 and 6, the third North Private Lease bond increment will allow construction of the Permit Area 1 extension facilities and structures shown on Drawing 5-48A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. As long as Areas 2 and 3 are available, the third bond increment through the fourth, fifth and sixth will also allow for steady state mining and backfill from Pit 7 through Pit 21. Then, during mining and backfill of Pits 20 and 21 the seventh North Private Lease bond increment will allow construction of the Permit Area 3 facilities and structures shown on Drawing 5-50. The seventh bond increment also allows for mining and backfill of both of the Highwall trench pits in Permit Area 3.~~Following Pit 6, further disturbance and excavation requires the approval of Permit Areas 2 and 3 which currently remain under review.~~

526.110-115 Existing Structures.

There are no existing structures within the permit areas~~.~~ that will be utilized for the purposes of coal mining or reclamation.

526.116. Public Roads:

526.116.1. Operations Within 100 ft. of a Public Road

Initial mining operations at the Coal Hollow Mine will be on the western edge of the property, and will require rerouting Kane County Road #136 (K3900) so that operations do not come within 100 feet of this road. During the initial development phase (topsoil removal, diversion construction, etc.), equipment traffic may cross the county road right-of-way to access the necessary area, see Drawing 5-3. Details related to the road relocation and reestablishment can be viewed on Drawings 5-3, 5-22E, 5-22F, 5-22H and in Appendix 1-7.

In addition, the road adjacent to Lower Robinson Creek (K3993) has been claimed by Kane County as a public road. An agreement has been developed with the County to restrict access on this road to escort by mine personnel only. Details for the reestablishment of this road following mining are provided on Drawing 5-22C.

Initial mining operations at the North Private Lease will be on the western edge of the property, and will require rerouting Kane County Road #136 (K3900) and placing the intersection with the Alton Coal Mine Road (K3100) outside of the mine boundary. Concurrent with and during construction of the bypass road, mining or reclamation operations are planned within 100 ft. of County Road 136 and mine vehicles may cross the right-of-way of Kane County Road 136 for a short period early in the operation's life. Any mine traffic crossing the county road will be required to stop and yield to any County Road 136 traffic before proceeding. Other appropriate measures, including signage and mine operating practices and training will be implemented to protect the public. Appendix 1-11 includes an easement and agreement with Kane County to construct the North Private Lease bypass road and to safely conduct mining operations adjacent to the current county road concurrent with construction activities. Details related to the road relocation and reestablishment can be viewed on Drawings 5-47, 5-48, 5-61, through 5-63 and in Appendix 1-11.

Drawing 5-48 specifically shows County Road 136 in relation to the North Private Lease Permit Area 1. While the bypass around the North Private Lease for County Road 136 is being constructed, mining operations will commence in Area 1. During this time, traffic on County Road 136 will continuously have unimpeded access and will not require escort through the mine permit area. Until the bypass road is complete, the mining area will be barricaded and fenced along County Road 136 and access will be limited to four (4) temporary gates.

526.116.2 Relocating a Public Road:

For the Coal Hollow Mine, following the initial development period, Kane County will temporarily relocate County Road #136 (K3900) to federal lands located west of the permit area which are managed by the BLM. This relocation will bypass the permit area for the duration of mining operations and is shown on Drawing 5-3. Details of agreements and appropriate approvals for this road relocation are located in Appendix 1-7. The relocated road is not within 100 ft. of mining or reclamation operations. The design and route of the relocated road has been approved by Kane County authorities and the BLM. Kane County will continue to have sole jurisdiction and will maintain it as a public road. Following completion of mining operations within the permit area, Kane County will reestablish the road to the approximate original location and will also reclaim the temporary road as required by the BLM. The existing road from the north relocation diversion point to the permit boundary will also continue to be maintained as a public road by Kane County. Once the road intersects the permit boundary, appropriate signs and barricades will be installed to protect the public. This road will be reestablished following mining as provided in the agreements in Appendix 1-7 and shown on Drawings 5-22E, 5-22F and 5-22H.

For the North Private Lease, Kane County will temporarily relocate County Road #136 (K3900) and the intersection with the Alton Coal Mine Road (K3100) to Private lands located west and south of the permit area which are leased by ACD. This relocation will bypass the permit area for the duration of mining operations and is shown on Drawing 5-47. Details of agreements and appropriate approvals for these road relocations are located in Appendix 1-11. The relocated road is within 100 ft. of mining or reclamation operations. The design and route of the relocated road has been approved by Kane County authorities and the property owner. Kane County will continue to have sole jurisdiction and will maintain it as a public road. Following completion of mining operations within the permit area, Kane County will reestablish the road to the approximate original location and will also reclaim the temporary road as required by the BLM. A fence will be installed on the mine boundary between the public road and the active mine. Appropriate signs and barricades will be installed to protect the public.

This road will be reestablished following mining as provided in the agreements in Appendix 1-11 and shown on Drawings 5-61 through 5-63.

526.200 Utility Installation and Support Facilities

526.210 Existing Utilities.

There are no known oil, gas, and water wells; oil, gas, and coal-slurry pipelines, railroads; electric and telephone lines; and water and sewage lines passing over, under, or through the permit areas. Should such facilities be installed, mining and reclamation operations will be conducted in a manner that minimizes damage, destruction, or disruption of services provided by such facilities unless otherwise approved by the owner of those facilities and the Division.

526.220 Support Facilities

The primary mine support facilities will include an office, shop, wash bay, oil containment, fuel containment, coal stacking system, coal loadout system and an equipment parking area These facilities will be constructed on an isolated section of the Coal Hollow Mine permit area that is approximately 34 acres. This area is located immediately north of Lower Robinson Creek, in Township 39 South, Range 5 West, Section 19. A diversion ditch will route water from the upgradient area immediately east of the area around the facilities and into a tributary of Lower Robinson Creek as shown on Drawing 5-3. Storm water and snow melt that occurs within the facilities area will be routed to an impoundment that will contain sediment. This impoundment will have a drop-pipe spillway installed that will allow removal of any oil sheens that may result from parking lots or maintenance activities by using absorbent materials to remove the sheen. In addition to this pond, an additional small impoundment will also be located in the southwest corner of the facilities area to control drainage from the mine access road. Details for these impoundments can be viewed on Drawings 5-28 and 5-28B.

No additional support facilities are proposed for the North Private Lease permit area. Operations occurring within the North Private Lease will continue to utilize the Coal Hollow Mine support facilities as currently constituted.

The following is a detailed description of each proposed facility and a reference to where detailed drawings can be found:

- Office: The office will be located on the northwest corner of the facilities area, immediately adjacent to the facilities access road. This building will be a steel structure with concrete footers. This structure will be 150 feet long by 100 feet wide and will be two stories in height. The office will provide working space for administrative and technical personnel. Details for the office can be viewed of Drawings 5-3 and 5-6.
- Shop: The shop will be located on the northeast side of the facilities area. This building will be a steel structure with concrete floors and foundation. The structure

will be approximately 200 feet long by 100 feet wide and 50 feet high. This building will be used for maintenance of equipment, parts storage, tool storage, and office space for maintenance personnel. Details for this building can be viewed on Drawings 5-3 and 5-7.

- Wash Bay: The wash bay will be located immediately east of the shop. This building will be a steel structure with a concrete foundation. The structure will be 50 feet long by 60 feet wide and 50 feet high. Included will be a closed circuit water recycle system. This system will eliminate and store water impurities and reroute water back through the wash bay for cleaning equipment. Details for this structure can be viewed on Drawings 5-3, 5-8, and 5-8A.
- Oil and Fuel Containments: The oil and fuel containments will be concrete structures appropriately sized for containing metal tanks. The oil containment will contain 55 gallon barrels and up to 2,000 gallon totes. This containment will be 80 feet long by 30 feet wide and 3 feet deep. The fuel containment will store 3 fuel tanks. Included will be a 4,000 gallon unleaded fuel tank and two 12,000 gallon diesel tanks. This structure will 50 feet long by 30 feet wide and 3 feet deep. Details for this structure can be viewed on Drawings 5-3 and 5-8.
- Coal Stacking System: The coal stacking system will be located in the central part of the facilities area. This system will include a coal hopper, coal feeder breaker, feed conveyor, crusher, and an inclined conveyor belt. Trucks will dump coal into the coal hopper which will funnel coal through the feeder breaker onto a short feed conveyor belt. This conveyor belt will transport the coal approximately 195 feet to a crusher that will size the coal appropriately for market. Once the coal is sized through the crusher it will enter an inclined stacker conveyor belt that is angled at approximately 16 degrees and is 186 feet long. This system will be a radial conveyor which will feed a coal stock pile with a live storage of approximately 50,000 tons. This system can be viewed on Drawings 5-3 through 5-5.
- Coal Loadout System: The coal loadout system will be located in the central part of the facilities area. This system will include an above ground reclaim feeder, a coal reclaim conveyor and an inclined conveyor. The reclaim feeder will be loaded by a dozer pushing the coal onto the feeder. One inclined conveyor that is approximately 290 feet in length will convey the coal from the feeder to the loadout hopper. This loadout hopper will load highway approved haul trucks that transport coal to market.
- Minor Facilities: The minor facilities will include a septic vault at the office (Drawing 5-6), a power washing and water recycle system in the Wash Bay (Drawing 5-8A), conduit with electrical lines running from generators to various facilities (Drawing 5-8B), Water System (Drawing 5-8C), an Equipment Hotstart Area (Drawing 5-3, 5-8B) and a Field Hydrant (Drawing 5-4, 5-5, 5-8B).
- Electrical System: The electrical system for the facilities at Coal Hollow will consist of two diesel fuel powered generators. One generator is a 750 KVA unit that will provide electricity to all the buildings. The other generator is a 1200 KVA unit that will be used to supply electricity to the coal conveying, sizing, stockpiling and loading system. The anticipated layout of the electrical system is shown on Drawing 5-8B.
- Dust Control Structures: A water system will be constructed to provide water for non-potable uses at the facilities and also for fugitive dust control measures. This

system will consist of a water well, 6” water transport pipe, and two 16,000 gallon water tanks. These two tanks are located at the facilities area to provide a water supply to the facilities for non-potable uses (cleaning equipment, restrooms, etc…) and to load the water truck which will spray water on the active roads for dust control. The pipeline connecting the tanks to the well will be buried (3,578 ft). The tanks are portable units with its own elevated base, no base is required. These tanks supply water to the crusher through a buried pipe (869 ft.) A third tank is located east of the underground portals in Pit 10 and will supply water for dust control underground and other non-potable uses. The pipe line connecting the tank to the well will be above ground (996 ft.). This tank is also a portable unit with its own elevated base, no other base is required. It supplies water to the Underground facilities through a pipeline above ground (413 ft.). Further details related to this water system can be viewed on Drawing 5-8C.

- Underground Mining Facilities: Multiple facilities are required to provide air, water, and electricity to the underground operations as well as supporting coal handling functions. Air is provided by a 6 ft 150 hp Spendrup Mine fan. The mine fan is a single unit that is mounted, but easily removed. Electricity is produced by a 2,000 kVA primary portable generator/power supply, and a secondary portable generator/power supply as needed. Water is supplied to the underground operations via the water supply system described above. Water is also supplied from the same tank and supply line to the underground mine office and the underground bath house. Wastewater from the underground mine office is piped to a buried wastewater holding tank and periodically pumped out. Greywater from the bath house is piped to a buried septic vault and drain field. No wastewater is produced at the bath house. Coal is transported by belt from the underground and transferred to the stacking conveyor at the portal of underground Entry #3. Coal is loaded and hauled from the stockpile beneath the stacking conveyor to the loadout facilities described above. The generator and stacker are mobile and considered temporary. All of these facilities are in an existing pit, and shown on Drawing 5-3B.

During mine development and the initial mining period, some facilities of a temporary nature such as mobile buildings and crusher/stacking conveyors may be utilized.

Support facilities to provide lighting at night will be kept to a minimum but will need to be sufficient enough to provide safe operating conditions in the dark. The following lighting equipment is anticipated to be used to provide safe working conditions:

- Two to three mobile light plants: Each light plant will have up to four 1,000 watt lights.
- Four to six exterior lights at the facilities area for lighting walkways and miscellaneous work areas: Each of these is expected to be 250 watt lights.
- Lights on mobile mining equipment, support vehicles and building lights

The support facilities will be located, maintained, and used in a manner that prevent or control erosion and siltation, water pollution, and damage to public or private property; and to the extent possible use the best technology currently available to minimize damage to fish, wildlife, and related environmental values; and minimize additional contributions of suspended solids to stream flow or runoff outside the mine permit area. Any such contributions will not be in excess of limitations of Utah or Federal law.

The facilities will be fully reclaimed at the end of mining operations with the exception of the water well. The final contour for this area can be viewed on Drawing 5-37 and an anticipated timetable is shown on Drawing 5-38.

526.300 Water Pollution Control Facilities:

Water pollution associated with mining and reclamation activities within the permit areas will be controlled by:

- Construction of berms and/or diversion ditches to control runoff from all facilities areas.
- Roads will be constructed with ditches to capture runoff
- Diversion ditches will be constructed as necessary around active mining and reclamation areas to capture runoff from those areas.
- Sedimentation impoundments will be constructed to control discharges
- In areas where impoundments or diversions are not suitable to the surrounding terrain, silt fence or other appropriate structures will be utilized to control sediment discharge from the permit area.

In order to accomplish these objectives for the Coal Hollow Mine, watershed analysis of the permit and adjacent areas has been completed and specific designs are established for each water pollution control structure. Primary control structures include five sediment impoundments, four diversion ditches and miscellaneous berms. The locations of these structures can be viewed on Drawing 5-3. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-25 through 5-34. In addition, a geotechnical analysis of the impoundments to ensure stability can be viewed in Appendix 5-1. The watershed and structure sizing analysis can be viewed in Appendix 5-2. An evaluation of the possible addition of underground mine water pumped to Sediment Pond 3 is included as Appendix 5-13. Additionally, any stormwater produced within Pit 10 and surrounding the underground facilities is routed to the same sump used to pump water to Pond 3. The sump, ditches, culverts and flow paths for this area are shown on Drawing 5-3B.

In addition to these primary structures, temporary diversions and impoundments may also be implemented, as necessary, in mining areas to further enhance pollution controls.

All these facilities will be reclaimed to approximate original contour. The reclamation sequence and final landform can be viewed on Drawings 5-37 and 5-38.

In order to accomplish these objectives for the North Private Lease, watershed analysis of the permit and adjacent areas has been completed and specific designs are established for each water pollution control structure. Primary control structures include six sediment impoundments, eighteen diversion ditches, a temporary 18” culvert directing undisturbed runoff beneath Pond T1, a temporary engineered mobile pump and pipeline system from Pond T1 to Pond 6, and miscellaneous berms. The locations of these structures can be viewed on Drawings 5-48 to 5-50, 5-65 and 5-65A. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-67 through 5-73. In addition, a geotechnical analysis of the impoundments to ensure stability can be viewed in Appendix 5-11. The watershed and structure sizing analysis can be viewed in Appendices 5-12 and 5-12A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 (which contains Pits 7, 8 and 9) may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Temporary Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. Once these approvals are obtained, the Area 2 facilities will be constructed and Pond T1 and the other Area 1 extension temporary facilities will be removed or mined out by advancing pits.

In addition to these primary structures, temporary diversions and impoundments may also be implemented, as necessary, in mining areas to further enhance pollution controls.

All these facilities, except for the previously removed temporary structures in the extension of Area 1, will be reclaimed to approximate original contour. The reclamation sequence and final landform can be viewed on Drawings 5-74 through 5-76B.

ACD has obtained a Nationwide Permit through the US Army Corps of Engineers (SPK 2011-01248) for the crossing of Culvert C-2. ACD will send the Division a copy of the mitigation completion report for this permit along with the Division's annual report in the year which the mitigation is completed. ACD will also notify the Division of completion and approval by the Corp of ACD's application for an Individual Section 404 permit under the same number. This notification will include a copy of the approval letter and reference to USACOE's public archive for viewing of the permit documents.

526.400 Air Pollution Control Facilities:

Air pollution (fugitive dust) emissions from mining and reclamation operations in the permit area will be controlled by a number of means, including:

- Haul roads will be maintained and will have water or other dust suppressants applied as appropriate.
- Road surfaces will be graded to stabilize/remove dust-forming debris as required.
- Areas adjoining primary roads will be stabilized and vegetated as required.
- Mobile equipment speeds will be controlled to minimize dusting conditions.
- Cleared vegetation debris within the mine area will be disposed of by placement in pit backfills.

A water system will be constructed to provide water for non-potable uses at the facilities and also for fugitive dust control measures. This system will consist of a water well, 6" water transport pipe, and three 16,000 gallon water tanks. Two of these are placed along the coal haul road near the crushing area and will be used specifically to load the water truck which will spray water on the active roads within the permit area to control dust and provide water for dust suppression at the crushing facilities as needed. The third tank is located above the underground facilities area to provide a water supply to the facilities for non-potable uses (cleaning equipment, restrooms, etc…). Further details related to this water system can be viewed on Drawing 5-8C.

Due to the close proximity between permit areas, aside from the addition (in correlation with the Division of Air Quality) of monitoring stations, proposed activities at the North Private Lease permit area will continue to utilize the air pollution control facilities as currently constituted at the Coal Hollow Mine.

For details related to air pollution control and monitoring, refer to Chapter 4 and Appendix 4-5 and 4-6 or additionally Air Approval Order DAQE-AN140470005-15 found at http://www.deq.utah.gov/Permits/air/index.htm.

527. **TRANSPORTATION FACILITIES**

527.100 Classification of Roads

Primary roads are any road that is used to transport coal or spoil and is frequently used for access or other purposes for a period in excess of six months; or is to be retained for an approved postmining land use. The following are the roads that meet the classification of a primary road based on this standard:

Roads used to transport coal or spoil in excess of six months

There are three roads in the Coal Hollow mine that will be used to transport coal or spoil in excess of six months and are referred to as “Facilities Access Haul Road” and “Pit B-1 Access Haul Road”, and the Underground Portal Access/Haul Road. The two main haul roads will be the main accesses for the pits throughout the life of the mine. Details for these roads are provided in Section 527.200 and on Drawings 5-22 and 5-23. An as-built plan & profile of the Underground Portal Access is also provided in Drawing 5-22I. In addition to these roads, the road located within the facilities area is also classified as a primary road. This road is referred to as “Facilities Roadway” and details are described in 527.200 along with Drawings 5-22A and 5-22B.

There are two roads in the North Private Lease that will be used to transport coal or spoil in excess of six months and are referred to as “Northern Haul Road” and “Southern Haul Road”. Details for these roads are provided in Section 527.200 and on Drawings 5-58, 5-59 and 5-60. These roads and the North Private Lease will be accessed via an approximate 50 foot driveway from County Road 136 (K3900) as depicted on Drawings 5-47 and 5-48.

Roads retained for an approved postmining land use

Roads retained for an approved postmining land use include the following: Access to East Pugh Property (K3993), County Road 136 (K3900), Alton Coal Mine Road (K3100), Access to Water Well and Road to Swapp Ranch. Details and locations for these roads are shown on Drawings 5-61through 5-63 5-35, 5-37, 5-22A, 5-22B, 5-22C, 5-22D, 5-22E, 5-22F and 5-22H.

All other roads planned for construction within the permit area will be classified as ancillary. These will include temporary ramps, benches and equipment travel paths within the active mining area.

527.200 Description of Roads

Transportation facilities for the Coal Hollow Mine include eight primary roads, 2 stacking conveyors, a conveyor system, and miscellaneous ancillary/temporary roads. Numerous drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: Two primary mine haul roads are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to the pits (pits shown on Drawing 5-10). This road will be approximately 2,800 feet in length and will be utilized throughout mining. There will be three culverts installed along this road all sized for a 100 year, 24 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower Robinson Creek watershed. This analysis can be viewed in Appendix A5-3. The third culvert is crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

  The second road extends from the first road and proceeds southwest to join and run along a 1,200' section of the rebuilt County Road 136. This section of road will be single lane travel only for all production equipment. The road then continues to the southwest to provide access to Pit B-1. This road is approximately 4,750 feet in total length. There are two culvert crossings along the County Road 136 portion of this road that are placed to match the original county specifications. These culverts will be 18 inch culverts sized to match the County Road 136 culverts originally in place.

  The following specifications apply to these Primary mine haul roads:

  1) Roads will be approximately 80' in width

2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18” of crushed rock or gravel for road surfacing, except for the section of the Pit B-1 access extending from County Road 136 to the pit. This section of road will utilize approximately 6” of crushed rock or gravel for road surfacing. This shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during a short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.
5) Cut and fill slopes of 1.5 h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The underground mine portal access and haul road in Pit 10 will also be a primary road. This road is accessed from the main haul road from the coal unloading area. The underground access road will be approximately 1,500’ in length and will be constructed to the same specifications for the haul roads above, except that the road may be narrowed to a 40 foot width. A plan & profile of the as-built configuration for the underground access road is provided in Drawing 5-22I.

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width. A typical cross section for the ancillary roads can be viewed on Drawing 5-24.

The location and details for Primary Mine Haul roads can be viewed on Drawings 5-3 and 5-22 and 5-23.

In addition to the three roads primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road is referred to as “Facilities Roadway” and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

In addition to the primary roads that will be present during active mining, four additional roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- Road to Water Well with details shown on Drawing 5-22D
- Road to east C. Burton Pugh property (K3993) with details shown on Drawing 5-22C
- County Road 136 (K3900) with details on Drawing 5-22E, 5-22F and 5-22G. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final

stage of reclamation as scheduled on Drawing 5-38 and is expected to be completed by the end of Year 4.

- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawing5-37 along with the post mining topography.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations. Other temporary ancillary roads (such as the Pond 3 access road shown on Drawing 5-3) outside the mining area may be necessary from time to time to access facilities or impoundments during the life of operations. These roads will typically only comprise a single lane access approximately 14 feet wide that would see minimal use. Any surface flow on these roadways would not be highly erosive along generally gentle road gradients. Any flow on these roads will be controlled using minor berms or ditches, and in each case would be fully contained within the watershed of, and would report to the impoundments that they provide access for. These roads will not remain post-mining and also will not be individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

- Conveyors: A conveyor system will be used to stockpile coal and to load highway approved haul trucks for transportation to market. The first conveyor is mainly a stacker system for the coal stockpile which will be located at the coal unloading area and will be approximately 451' in length. This conveyor is estimated to be a 48" solid frame system.

  The second conveyor is a coal reclaim belt that will be loaded by an above ground reclaim feeder from the coal stockpile and will convey coal to the loadout chute which will load the highway approved coal haulage trucks. This section will be approximately 290' in length. Similar to the first section, this conveyor is estimated to be a 48" solid frame system.

  An additional stacking conveyor will be installed to transfer coal from the underground conveyor system to a stockpile from which trucks will be loaded. The stacking conveyor will be a 48'wide, wheel-mounted system, approximately 250' in length.

  Drawings of these systems can be viewed on Drawings 5-3 through 5-5.

Transportation facilities for the North Private Lease will consist of two primary roads, and miscellaneous ancillary/temporary roads. Drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: A primary haul road shown in Drawings 5-47, 5-58 and 5-59 will extend from the entrance of the permit area to the Western end of Pit 19. This road is approximately 3,540 feet in length. This road is referred as the "Northern Haul Road". A second primary haul road shown in Drawings 5-47 and 5-60, the "Southern Haul Road" extends from the South end of Pit 1 on the West, to the South end of the Highwall Trench on the East. This road is approximately 2,980 feet in length. A portion of this road will be constructed in designated wet meadow under Army Corps of Engineers permit NWP-14. Alton submitted pre-construction notification SPK 2011-001248 describing the disturbance and mitigation. These roads and the North Private Lease will be accessed via an approximate 50 foot driveway from County Road 136 (K3900) as depicted on Drawings 5-47 and 5-48.
- There are three culvert crossings along this road as shown in Drawing 5-58 including a substantial culvert to cross Kanab Creek. Culvert 1 (C-1) is sized at 24 inches. C-2 is sized at 36 inches to match the current culvert under County Road 136. Culvert C-3 is sized at 144 inches for maximum anticipated flows in Kanab Creek. Final design of this culvert will be in conjunction with approvals and oversight from the Army Corps of Engineers. Culvert sizing calculations can be found in Appendix 5-12.

The following specifications apply to these Primary mine haul roads:

1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing
5) Cut and fill slopes of 1.5 h:1v
6) Berms placed as necessary along fills

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width. A typical cross section for the ancillary roads can be viewed on Drawing 5-24.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

527.220 Alteration or Relocation of Natural Drainageways.

As currently planned, no natural drainageways will be altered or relocated due to road construction, though a temporary diversion of Lower Robinson Creek will be constructed to allow for maximum recovery of coal. This temporary diversion of Lower Robinson Creek is not being constructed to facilitate road construction. If any other alterations or relocations are necessary, appropriate measures will be taken to obtain Division approval for such alterations or relocations. All culverts placed in natural drainageways for the North Private Lease have been described in Appendix 5-12 and shown on Drawing 5-47.

Reclamation of these culverts is also described in the same Appendix and shown on Drawing 5-79. ACD has obtained a Nationwide Permit through the US Army Corps of Engineers (SPK 2011-01248) for the crossing of Culvert C-2. ACD will send the Division a copy of the mitigation completion report for this permit along with the Division's annual report in the year which the mitigation is completed. ACD will also notify the Division of completion and approval by the Corp of ACD's application for an Individual Section 404 permit under the same number. This notification will include a copy of the approval letter and reference to USACOE's public archive for viewing of the permit documents.

Mine development work will include a temporary diversion of Lower Robinson Creek away from the mining area. This diversion has been designed for a flow capacity of a 100 year, 24 hour storm event. The sides will be graded to a 3h:1v slope and rip-rap will be appropriately placed to minimize erosion of the channel beyond current channel conditions. All specifications required to meet the requirements for such a diversion have been included in this diversion design. Appendix 5-2 details the analysis/specifications for this diversion and Drawings 5-20 and 5-21 show the details of this design.

As part of the reclamation process, Lower Robinson Creek will be reconstructed to its approximate original location. The design for this reconstruction is shown on Drawings 5-20A and 5-21A. This design includes considerable improvements to the channel compared to the channel's current condition. The current condition is such that less than 25% of the channel within the disturbed area has a flood plain present and most of the slopes are near the angle of repose with fair to poor vegetative cover. The reconstructed channel includes stable slope angles that will be revegetated with a flood plain on both sides of the channel for the entire length reconstructed. Sharp corners in the original alignment have been rounded to sinuous curve shapes and rip-rap will be installed in the bottom section of the channel to minimize erosion. The flood plain will seeded and covered with erosion matting to control erosion until a natural vegetative condition can be attained.

527.230 Road Maintenance

All roads will be maintained on an as needed basis using motor graders, water trucks for dust suppression, and other equipment as necessary. Crushed stone and/or gravel will be used as a surface course for primary roads outside the active mining area, and may be used as needed for ramps and travelways within the pit. Should the roads be damaged by a catastrophic event, such as an earthquake or a flood, repairs will be made as soon as possible after the damage has occurred or the road will be closed and reclaimed.

527.250. Geotechnical Analysis

No alternative specifications or steep cut slopes associated with roads are anticipated outside the active mine area. A report of appropriate geotechnical analysis will be provided should such alternative specifications or steep cut slopes where approval of the Division is required, become necessary.

528. **HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE:**

528.100. Coal removal, handling, storage, cleaning, and transportation areas and structures;

Coal handling activities are confined to the active pit and underground portal areas, and the coal sizing/loading areas located north of Pit 10 at the Coal Hollow Mine. For the North Private Lease, coal handling activities will be isolated to the active mining pit backfill and excavation crest. Temporary stockpiling of coal will only occur within the active pit backfill and excavation crest. Coal will then be transported in over-the-road trucks from the North Private Lease active pit to the loadout at Coal Hollow Mine for sizing and final loading. All areas and facilities will be designed and constructed, utilized and maintained in conformance with industry standards and all applicable regulations. At the conclusion of mining, the facilities will be removed as part of final mine reclamation activities. Material from coal stockpile areas, and other areas of potential coal accumulation will be excavated and the excavated material placed in the final mined out pit.

528.200. Overburden;

Overburden will be excavated after the removal of topsoil and subsoil as defined in Chapter 2. The overburden excavation will be accomplished by utilizing hydraulic excavators with end dump haul trucks and dozers. This process will include excavating this material in a stairstep fashion that will include benches approximately every 40 feet in depth. These benches are planned to be approximately 40 feet in width and will create an overall 2h:1v slope for the highwalls to create a stable and safe working area. This is a conservative approach for initial mining and once mining begins, ongoing geotechnical studies and monitoring will be used to further define the proper slope angle to ensure slope stability while maximizing resource recovery.

For the Coal Hollow Mine, based on the overburden isopach map (Drawing 5-15), the overburden removal has been separated into three major stages. The first stage of overburden removal is the initial mining area, Pits 1-9. These pits have a relatively low strip ratio, approximately 4.3:1 (refer to Drawing 5-13). In order to efficiently remove overburden for this phase, spoil from the first three pits will be placed in an excess spoil area. This excess spoil structure will hold approximately 2.7 million loose cubic yards (LCY) of material. Once the excess spoil pile is filled, overburden from the next 5 pits can then be used as pit backfill as the mining progresses through Pit 9.

As is depicted, each Pit/Highwall Trench consists of Panels, each panel consisting of 10 holes. The spacing between the holes and the spacing between the panels are dictated by the amount of overburden over the panels. Highwall mining (See Chapter 9 which addresses R645-302 regulations) is designed such that subsidence does not occur to the surface with nonyieldable webs and barriers. Specific information concerning these design are found in Appendix 5-8. Highwall mining will have only the disturbance associated with the pit/trench for placement of the highwall miner and will have no impact on the surface above the highwall panels.

During the course of mining, some additional excavated overburden may be placed temporarily on mined over and backfilled areas due to operational considerations. This material will be re-excavated and moved to a final placement location as operations allow.

Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016.

The last pit of coal (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. This resource is estimated at 118,000 tons and is expected to be fully mined and immediately backfilled (to the intermediate landform shown in Drawings 5-35 and 5-36) in 2016. The coal will be surface mined utilizing the same equipment and methods as the previous pits and will be extracted to an extent that protects eventual regrading and reclamation efforts in the Borrow Area from potential oxidation, heating, or spontaneous combustion. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36. This backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pit 10.

The underground mining will be accessed through portals in an existing pit. There will be no additional overburden removal associated with the underground mining; however, cross sections of the portal area are shown on Drawing 5-3B. Cover or overburden depths for the underground mining are described in Section 627. Following the completion of underground mining, backfill of Pit 10 will be completed utilizing borrow from the areas delineated in Drawings 5-19 and 5-37. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC.

All maps related to the overburden removal process can be viewed on Drawings 5-15 through 5-17.

The following table summarizes overburden movement for the Coal Hollow Mine.

Coal Hollow Mine Overburden Summary	
2011	3,511,849 CY
2012	2,135,022 CY
2013	3,090,547 CY
2014	3,423,635 CY
2015	2,375,581 CY
2016	277,000 CY
Borrow	1, 516,200 CY
Total	16,329,834 CY

For the North Private Lease, the lease boundary encompasses three Permit Areas~~, of which Area 1 is currently proposed for inclusion in the MRP and Areas 2 and 3 remain under review~~. Due to bond requirements and the scarcity of open space with relation to the soil and spoil stockpiles in Permit Area 1, development of the mining pits must follow a rigid sequence. Bond increments typically include a release component and a posting component, as depicted in Chapter 8 and Appendix 8-2, the first increment of bonding in Permit Area 1 covers all of Area 1's Phase 2, Phase 3, and Facilities costs while only allowing Phase 1 (excavation) cost for Pit 1. Therefore, as shown in Drawing 5-48, the first stage of mining activity involves construction of the South Haul Road, Ponds 5 and 6, Ditches 5 through 11, and the temporary topsoil, subsoil and spoil stockpiles. To construct each of these facilities, ground cover, topsoil, and subsoil must be removed and stockpiled according to the plan and methods set out in Chapter 2 section 231 and section 523 of this chapter and also shown on Drawing 2-4. Once these facilities have been constructed, excavation of Pit 1 will commence. The second North Private Lease bond increment will then allow continued excavation of Pits 2-6 to the Permit Area 1 boundary. During mining and backfill of Pits 5 and 6, the third North Private Lease bond increment will allow construction of the Permit Area 1 extension facilities and structures shown on Drawing 5-48A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. As long as Areas 2 and 3 are available, the third bond increment through the fourth, fifth and sixth will also allow for steady state mining and backfill from Pit 7 through Pit 21. Then, during mining and backfill of Pits 20 and 21 the seventh North Private Lease bond increment will allow construction of the Permit Area 3 facilities and structures shown on Drawing 5-50. The seventh bond increment also allows for mining and backfill of both of the Highwall trench pits in Permit Area 3.~~. Following Pit 9, further disturbance and excavation requires the approval of Permit Areas 2 and 3 which currently remain under review.~~

Based on the overburden isopach map (Drawing 5-56), the overburden removal has been separated into three major stages. The initial area of overburden removal is the mining area, Pits 1-10. These pits have a relatively low strip ratio, approximately 4.6:1 (refer to Drawing 5-52). In order to efficiently remove overburden for this phase, spoil from pit 1and pit 2 will be placed in a temporary excess spoil area on the area of pits 5 and 6. This excess spoil structure will hold approximately 505,866 loose cubic yards (LCY) of material. Once the excess spoil pile is filled, overburden from the remaining pits can then be used as pit backfill as the mining progresses through Pit 10, also as pit 4 is completed, material from the temporary spoils pile can be placed in pit backfill.

In the North Private Lease permit area, coal will be loaded directly into over-the-road trucks at the pit floor. To the extent it is needed, a coal surge pile will be located on the pit floor or within the active pit backfill and excavation crest. Coal waste from cleaning the exposed seam will be retained in the pit. For the initial cut, coal waste will be temporarily pushed into a pile on top of unmined coal until enough coal has been removed to place the coal waste on the floor of the pit.

From the initial mining area, operations will proceed North from pit 11to Pit 21. These pits have a strip ratio increasing from 4.7:1 to 9.6:1. All spoils are placed in the preceding void. Once coal is removed from Pit 21, overburden from the development of the highwall trench in the eastern side of Kanab Creek will be used to backfill the remaining Pit 21.

The final mining area will be developed on the East side of Kanab Creek. Overburden removal from Highwall Trench 1 will proceed north in the trench with overburden being placed into the previously mined out area of Pit 21 until it reaches AOC. After Pit 21 is filled, material mined from the highwall trench will be placed directly as backfill in the same highwall trench, progressing from South to North.

The following table summarizes overburden movement for the North Private Lease.

North Private Lease Overburden Summary	
Year 1	2,094,000 CY
Year 2	2,972,900 CY
Year 3	3,535,700 CY
Year 4	3,449,100 CY
Year 5	2,790,200 CY
Year 6	2,780,700 CY
Year 7	977,200 CY
Total	18,599,800 CY

528.300. Spoil, coal processing waste, mine development waste, and noncoal waste removal, handling, storage, transportation, and disposal areas and structures;

528.310. Excess Spoil. Excess spoil will be placed in designated disposal areas within the permit areas, in a controllable manner to ensure mass stability and prevent mass movement during and after construction. Excess spoil will meet the design criteria of R645-301-535. For the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the permit application must include a description of the proposed disposal site and the design of the spoil disposal structures according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.100, R645-301-745.300, and R645-301-745.400.

Excess spoil will be placed in the areas designated on Drawing 5-3 for the Coal Hollow Mine and on 5-47 & 5-51A for the North Private Lease. This fill will be placed in lifts not to exceed 4 feet in thickness. The material will be transported from the overburden removal area to the fill by end dump haul trucks and a dozer(s) will spread the spoil to this lift thickness. The fill will meet at minimum 85% compaction as related to the standard Procter. Final slopes will be regraded to a maximum slope of 3h:1v. The top of the fill will be sloped to approximately 2% to prevent pooling of water and to reestablish drainage similar to original flow patterns. The excess spoil placed on the non-mined areas at the Coal Hollow Mine is approximately 32 acres and varies in height from 35 to 120 feet. The excess spoil pile will be completely rehandled as pit backfill prior to final reclamation. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Design and the geotechnical study of this long-term fill can be viewed in Appendix 5-1. The report provided in Appendix 5-11 lists the spoil geotechnical characteristics for the North Private Lease.

- *R645-301-211: The applicant will present a description of the premining soil resources as specified under R645-301-221. Topsoil and subsoil to be saved under R645-301-232 will be separately removed and segregated from other material.*

  The soil resources for the proposed long-term excess spoil disposal area in the Coal Hollow Mine are described in Appendix 2-1. The soil resources for the North Private Lease temporary spoil disposal area are described in Volume 11. A plan has been developed for removal of topsoil and suitable subsoil based on the soil descriptions in these appendices. The handling plan can be viewed on Drawings 2-2 and 2-4. Topsoil and acceptable subsoil will be separately removed and segregated from other material prior to placement of any spoil.

- *R645-301-212: After removal, topsoil will be immediately redistributed in accordance with R645-301-242, stockpiled pending redistribution under R645-301-234, or if demonstrated that an alternative procedure will provide equal or* *more protection for the topsoil, the Division may, on a case-by case basis, approve an alternative;*

Excess spoil will have topsoil and subsoil redistributed in an approximately uniform, stable thickness with the approved post mining land use, contours and surface water drainage systems. Material handling practices will prevent excess compaction of these materials. Handling practices will also protect the materials from wind and water erosion before and after seeding and planting. These practices include seeding and grading stockpiles that will exist for more than year to stabilize the soil.

- *R645-301-412.300: Criteria for Alternative Postmining Land Uses.*

  The MRP does not contemplate Alternative Postmining Land Uses.

- *R645-301-512.210: Excess Spoil. The professional engineer experienced in the design of earth and rock fills will certify the design according to R645-301-535.100.*

  A professional engineer experienced in the design of earth and rock fills with assistance from a geotechnical expert has certified the design according to R645-301-535.100. These certifications can be viewed on Drawings 5-37, 5-37A and 5-17 for the Coal Hollow Mine and on Drawing 5-47 & 5-51A for the North Private Lease.

- *R645-301-512.220: Durable Rock Fills*

  No durable rock fills are planned.

- *R645-301-514.100: Excess Spoil. The professional engineer or specialist will be experienced in the construction of earth and rock fills and will periodically inspect the fill during construction. Regular inspections will also be conducted during placement and compaction of fill materials.*

  A professional engineer or specialist that is experienced in the construction of earth and rock fills will inspect the fill during construction and regular inspections will also be conducted during placement and compaction of fill materials.

- *R645-301-535.100 through R645-301-130: Disposal of Excess Spoil*

  A geotechnical analysis of the excess spoil structure designs has been completed by an expert in this field. The long term static safety factor for these structure designs are estimated at 1.6 to 1.7. Lifts will be placed in thicknesses not to exceed 4 feet. The lifts will meet 85% compaction by the standard Procter. The fill will be graded to allow for drainage similar to original patterns and to prevent excessive infiltration of water. For the Coal Hollow Mine, fill will be covered with subsoil and topsoil as specified in Chapter 2 to provide conditions suitable for revegetation of the area. The excess spoil pile will be completely rehandled as pit backfill prior to final reclamation. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Design and the geotechnical study of this long-term fill can be viewed in Appendix 5-1. The geotechnical studies for both permit areas can be viewed in Appendix 5-1for the Coal Hollow Mine and 5-11 for the North Private Lease.

- *R645-301-535.300 through R645-301-535.500: Disposal of Excess - Spoil Durable Rock Fills.*

  No durable rock fills are planned.

- *R645-301-536.300: Disposal of Coal Mine Waste in Excess Spoil*

  No coal mine waste is planned in the excess spoil area.

- *R645-301-542.720: Excess spoil will be placed in designated disposal areas within the permit area, in a controlled manner to ensure that the final fill is suitable for reclamation and revegetation compatible with the natural surroundings and the approved postmining land use. Excess spoil that is combustible will be adequately covered with noncombustible material to prevent sustained combustion. The reclamation of excess spoil will comply with the design criteria under R645-301-553.240.*

  The landform underneath the Coal Hollow Mine long-term excess spoil as shown in Drawing 5-37 and 5-37A will be suitable to the surrounding area and for the postmining land use of primarily grazing. No combustible excess spoil will be placed in the proposed structure. The final reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v.

  The North Private Lease temporary spoil pile will be in place for less than 6 months before being rehandled as pit backfill. Therefore, no postmining land use has been considered.

- *R645-301-553.240: The final fill configuration of the fill (excess spoil) will be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The grade of the outslope between terrace benches will not be steeper than 2h:1v (50 percent).*

  The landform underneath the Coal Hollow long-term excess spoil as shown in Drawings 5-37 and 5-37A will be suitable to the surrounding area and for the postmining land use of primarily grazing. The reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v. The long term static safety factor for these slopes is estimated to be 1.6 to 1.7.

- *R645-301-745.100: General Requirements.*

745.110: Excess Spoil will be placed in designated disposal areas within the permit area, in a controlled manner to:

745.111: Minimize the adverse effects of leaching and surface water runoff from the fill on surface and underground water;

Reclamation of the landform underneath the Coal Hollow long-term excess spoil will include a topsoil cover and subsoil layer. Infiltration through the reclamation is expected to be minimal based on the high clay content of these soils. The North Private Lease temporary excess spoil will be in use for such a short period of time and will be comprised entirely of high-clay tropic shale such that infiltration is also expected to be negligible. In addition, laboratory data found at Appendix 7-16, page 20, for the overburden shows that there is minimal potential for leaching of pollutants should infiltration rates become higher than expected.

The foundations of these excess spoil areas also has high clay content with minimal potential for infiltration. This will provide an additional, natural barrier to protect ground water present beneath the proposed structure.

745.112: Ensure permanent impoundments are not located on the completed fill. Small depressions may be allowed by the Division if they are needed to retain moisture or minimize erosion, create and enhance wildlife habitat or assist revegetation, and if they are not incompatible with the stability of the fill; and

Permanent impoundments are not planned on the excess spoil areas. Small depressions may be constructed as allowed by the Division to retain moisture, minimize erosion, create and enhance wildlife habitat or assist revegetation.

745.113: Adequately cover or treat the excess spoil that is acid- and toxic forming with nonacid nontoxic material to control the impact on the surface and ground water in accordance with R645-301-731.300 and to minimize adverse effects on plant growth and approved postmining land use.

Laboratory data discussed at Appendix 7-16, pages 26-27, and representative of the overburden planned for disposal in the excess spoil areas does not show acid- and toxic forming characteristics.

745.120: Drainage Control. If the disposal area contains springs, natural or manmade water courses, or wet weather seeps, the fill design will include *diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill and ensure stability.*

A spring and seep survey available in Chapter 7 has identified no springs or wet weather seeps in the proposed excess spoil areas. The final surfaces will be regraded to a contour that will route water from snowmelt and rainfall around the excess spoil as shown on the final contours Drawing 5-37 and 5-74. There are no manmade water courses present in the excess spoil area. No underdrains are planned for the excess spoil structure.

745.121: Diversions will comply with the requirements of R645-301-742.300

No diversions are planned in the excess spoil area.

745.122 : Underdrains

No underdrains are planned in the excess spoil area.

745.300: Durable Rock Fills

No durable rock fills are planned.

745.400: Preexisting Benches

The MRP does not contemplate disposal of excess spoil on preexisting benches.

528.320. Coal Mine Waste.

The MRP does not contemplate processing coal that would produce coal mine waste.

528.321 Coal Processing Waste

The MRP does not contemplate processing coal that would produce coal processing waste that would be returned to the Underground workings.

528.322. Refuse Piles.

The MRP does not contemplate the construction of any refuse piles,

528.323. Burning and Burned Waste Utilization.

The MRP does not contemplate processing coal that would produce coal mine waste, eliminating the any potential for coal mine waste fires.

528.330. Noncoal Mine Waste.

Noncoal mine wastes including, but not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber and other combustible materials generated during mining activities will be temporarily stored in appropriate containers and removed from the permit area and will be properly disposed of according to applicable State and Federal regulations.

528.332.

Final disposal of noncoal mine wastes will be in a State-approved solid waste disposal site not located within the permit area. Exceptions to the removal of all noncoal mine waste from the permit area is concrete pads for the generator and fan utilized in the underground operation will remain and will be covered with approximately 120' of overburden.

528.333.

At no time will any noncoal mine waste be deposited in a refuse pile or impounding structure, nor will any excavation for a noncoal mine waste disposal site be located within eight feet of any coal outcrop or coal storage area.

528.334.

Notwithstanding any other provision to the R645 Rules, any noncoal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580, as amended) and 40 CFR Part 261 will be handled in accordance with the requirements of Subtitle C of RCRA and any implementing regulations.

528.340

As development of the Underground workings originates in the existing Surface mining Pit, development wastes have been stored in the excess spoils pile. Once all mining is complete spoils will be returned to the mined out Pit following the surface mining regulations.

528.350. Acid-Forming and Toxic Materials

If coal, having qualities that make it unmarketable, are to be left in the pit backfill in quantities greater than 5,000 tons: a minimum of 1 composite sample per 5,000 Tons of coal will be analyzed for the parameters list in Table 3 and 7 of the "Soil and Overburden Guidelines". A record of the volume of coal remaining and laboratory analytical results will be kept onsite.   Debris, acid-forming, toxic-forming materials and materials constituting a fire hazard will be identified and disposed of in accordance with R645-301-528.330, R645-301-537.200, R645-301-542.740, R645-301-553.100 through R645-301-553.600, R645-301-553.900, and R645-301-747. Appropriate measures will be implemented to preclude sustained combustion of such materials; and

528.400. Dams, embankments and other impoundments.

Plans do not include using dams, embankments or other impoundments for disposal of coal, overburden, excess spoil or coal mine waste

529. **MANAGEMENT OF MINE OPENINGS**.

When no longer required, underground mine openings will be closed in accordance with R645-301-513, R645-301-529, R645-301-551 and MSHA approved requirements and backfilled. Each entry to the Underground mine if temporarily inactive, but having further projected useful service will be secured by barricades or other covering devices and posted with signs, to prevent access into the entry and identify the hazardous nature of the openings.

Highwall mining (See Chapter 9 which addresses R645-302 regulations) will produce openings (holes) in the coal at the bottom of trenches specifically constructed for highwall mining. Trench depth to the holes range from 60 feet to 200 feet. After highwall mining is completed in a given trench, that trench will be completely backfilled, burying any openings made by highwall mining.

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the proposed Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

530 OPERATIONAL DESIGN CRITERIA AND PLANS:

531 GENERAL:

There are five sediment impoundments for the Coal Hollow Mine permit area and six sediment impoundments for the North Private Lease. These structures will be constructed using a combination of dozers and backhoes. The structures have been designed to contain the required storm events as specified in Appendix 5-2 for the Coal Hollow Mine and Appendices 5-12 and 5-12A for the North Private Lease. The structures will have sediment removed as necessary to ensure the required capacities. Details for these structures can be viewed on Drawings 5-25, 5-26 and 5-28 through 5-32 with calculations and supporting text in Appendix 5-2 for the Coal Hollow Mine. An evaluation of the possible addition of underground mine water pumped to Sediment Pond 3 is included as Appendix 5-13. Details for the North Private Lease sediment impoundments are on drawings 5-67 through 5-71A with calculations and supporting text in Appendices 5-12 and 5-12A.

There are no other coal processing waste banks, dams or embankments proposed within the permit areas.

Underground mining has begun within the Coal Hollow Mine permit area, but none of the planned underground workings are closer than 900 ft. from the nearest sediment impoundment as shown by comparing Drawing 5-3 to Drawing 5-10. Also, all underground mining has been planned as "first mining" only, which means that underground workings are not expected to cause any surface subsidence.

532 SEDIMENT CONTROL:

Six diversion ditches along with five sediment impoundments are proposed for the Coal Hollow Mine. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2. An evaluation of the possible addition of the underground mine water pumped to Sediment Pond 3 is included as Appendix 5-13. These structures have also been analyzed in relation to the requirement for borrow at the end of underground operations to backfill Pit 10. The Drawings and Appendices listed above note this analysis. Eighteen diversion ditches, a temporary 18” culvert directing undisturbed runoff beneath Pond T1, a temporary engineered mobile pump and pipeline system from Pond T1 to Pond 6, along with six sediment impoundments are proposed for the North Private Lease. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-65. Details associated with these structures can be viewed on Drawings 5-67 through 5-71A and Appendices 5-12 and 5-12A.

Mulch will be placed on the seedbed surface once soil amendments have been incorporated and seeding has been accomplished in areas that will be reclaimed to native plant communities. The mulch should control erosion by wind and water, decrease evaporation and seed predation, and increase survivability of the seeded species. Like the seeding methods, mulch will be applied with a variety of techniques and materials depending on the reclaimed area.

532.100 Disturbed Area:

The smallest practicable area, consistent with reasonable and safe mine operational practices will be disturbed at any one time during the mining operation and reclamation phases. This will be accomplished through progressive backfilling, grading, and prompt revegetation of disturbed areas. An estimated reclamation schedule is shown on Drawing 5-38 for the Coal Hollow Mine and on 5-76A and 5-76B for the North Private Lease.

532.200 Backfill Stabilization:

The backfilled material will be stabilized by grading to promote a reduction of the rate and volume of runoff in accordance with the applicable requirements. The excess spoil and fill above approximate original contour will be graded to a maximum angle 3h:1v slope and revegetated to minimize erosion. This area is designed with concave slopes and slope irregularities that will also assist in minimizing erosion. A geotechnical analysis of this configuration has been completed and the factor of safety is estimated at 1.6 to 1.7. This analysis can be viewed in Appendix 5-1. The remaining backfill will be placed in the mined out pit, and thus confined on all sides. Any backfill placed along pit boundaries or on top of operational highwalls to blend with original topography will be contoured at a final slope angle not to exceed 3h:1v (18.4°). Appendix 5-5 provides an analysis of reclaimed slopes which shows that a minimum safety factor of these slopes reclaimed with a planned maximum slope angle of 3h:1v (18.4°) will be 1.7 which exceeds the requirement of 1.3. Appendix 5-5 also states that this planned reclaim slope angle is much less than the general area angle of repose. In fact it is at least 14° less. Therefore, postmining slopes reclaimed at the planned angle of 3h:1v (18.4°) are inherently stable. Any backfill material that must be stockpiled for longer than six months will be stabilized using tackifier or another surface stabilization method. Additionally, in areas upgradient of completed or near completed reclamation, temporary berms will be utilized to ensure a reduction of rate and volume of runoff into and through working areas. Also, all pits will be bermed to minimize runoff into and through working areas.

Mulch will be placed on the seedbed surface once soil amendments have been incorporated and seeding has been accomplished in areas that will be reclaimed to native plant communities. The mulch should control erosion by wind and water, decrease evaporation and seed predation, and increase survivability of the seeded species. Like the seeding methods, mulch will be applied with a variety of techniques and materials depending on the reclaimed area.

533. IMPOUNDMENTS.

533.100.

No impoundments meeting the NRCS Class B or C criteria for dams in TR-60, or the size or other criteria of 30 CFR Sec. 77.216(a) are planned for the Coal Hollow Mine.

533.110

Impoundments not included in 533.100, will be designed and constructed with a minimum static safety factor of 1.3 for a normal pool with steady state seepage saturation conditions or meet the requirements of R645-301-733.210.

The proposed sediment impoundments are expected to impound seasonal water and storms. A geotechnical analysis of these designs has been performed and can be reviewed in Appendix 5-1 for the Coal Hollow Mine and Appendix 5-11 for the North Private Lease. Static safety factors for the proposed designs range from 2.2 to 5.3.

533.200. Foundations.

Foundations for temporary and permanent impoundments will be designed so that

- *Foundations and abutments for the impounding structure are stable during all phases of construction and operation. Such foundations for temporary and permanent impoundments will be designed based on adequate and accurate information on the foundation conditions*

  Refer to Appendices 5-1 and 5-11 for information related to foundations of the proposed impounding structures. No permanent impoundments are proposed.

- *All vegetative and organic materials will be removed and foundations excavated and prepared to resist failure. Cutoff trenches will be installed if necessary to ensure stability.*

All vegetation, topsoil and subsoil as identified in Chapter 2 will be removed from the impoundment areas prior to construction. Cutoff trenches will not be necessary for stability.

- *Slope protection will be provided to protect against surface erosion at the site and protect against sudden drawdown.*

  Slopes of impoundments will be seeded and sloped to protect against erosion at the site. The high clay content and compaction characteristics of the material present at the impoundments will also assist with minimizing erosion of the slopes.

- *Faces of embankments and surrounding areas will be vegetated except that faces where water is impounded may be riprapped or otherwise stabilized in accordance with accepted design practices.*

  Faces of embankments will be vegetated to minimize erosion. Standing water in the ponds is expected to be minimal and therefore these faces will also be seeded for erosion control.

- *The vertical portion of any remaining highwall will be located far enough below the low- water line along the full extent of highwall to provide adequate safety and access for the proposed water users.*

  All highwalls will be fully covered following active use and backfilling of pits.

533.300

A rapid drawdown analysis was completed assuming the spillways are plugged, the basin fills to top of the embankments and then the water is released or pumped down to the base of basins. The soil strengths utilized were based on total stress conditions as determined from the triaxial shear tests completed for this project. It should be noted that rapid drawdown is highly unlikely since spillway and outlet piping will be no more than 4-feet below the top of embankments. The resulting safety factors under these conditions range from 1.2 to 1.9. Based on this analysis, no additional protection measures are needed for the impoundments in relation to rapid drawdown. Details for this analysis on Coal Hollow impoundments are provided in Appendix 5-1, pages 6 through 7 in the main section of the report. Details for this analysis on the North Private Lease also refer to Appendix 5-1, pages 6 and 7, as the geotechnical report provided in Appendix 5-11 lists the soil characteristics present in the North Private Lease to be identical to those in the Coal Hollow Mine.

533.600.

The MRP does not contemplate construction of impoundments that meet the criteria of MSHA, 30 CFR 77.216(a).

533.700 - 714. Plans.

Each detailed design plan for structures not included in 533.610 shall:

- *Be prepared by, or under the direction of, and certified by a qualified, registered, professional engineer, except that all coal processing waste dams and embankments covered by R645-301-536 and R645-301- 746.200 shall be certified by a qualified, registered, professional engineer;*

  Designs for the proposed impoundments have been prepared by a qualified, registered, professional engineer, with assistance from a geotechnical expert. These certifications can be viewed on Drawings 5-28 through 5-31 for the Coal Hollow Mine and on Drawings 5-67 through 5-71A for the North Private Lease.

- *Include any design and construction requirements for the structure, including any required geotechnical information;*

  A geotechnical analysis of the impoundments has been prepared by an expert in this field. This analysis can be viewed in Appendix 5-1 for the Coal Hollow Mine and Appendix 5-11 for The North Private Lease. Embankments will be constructed in 2 foot lifts as recommended by the analysis.

- *Describe the operation and maintenance requirements for each structure; and*

  The proposed impoundments are designed to temporarily store water from storm events and snow melt. Long term standing water in the impoundments is anticipated to be seasonal and sediment will be removed as necessary to provide the required storage capacities. Emergency spillways have been included in the designs to provide a non-destructive discharge route should the capacities ever be exceeded, except in the case of Pond T1 which will utilize an engineered pump and pipeline to discharge excess water to Pond 6 Surveys of these impoundments will be regularly conducted to ensure that design capacities are available. An evaluation of the possible addition of underground mine water pumped to Sediment Pond 3 is included as Appendix 5-13.

- *Describe the timetable and plans to remove each structure, if appropriate.*

  All impoundments will be reclaimed at the end of operations except Pond T1, which will be mined through directly following construction of Pond 7 in Area 2 and will not be rebuilt following backfill and reclamation. Pond T1 will remain in place until approval of Areas 2 and 3 for mining. The estimated timeline for removal of these structures are shown on Drawing 5-38 for the Coal Hollow Mine and Drawing 5-76B for the North Private Lease. Expected removal is year seven of the mining and reclamation process for the Coal Hollow Mine and year five - seven for the North Private Lease. In areas where soils are not stabilized following the removal of these sediment impoundments, silt fence will be appropriately installed and maintained to provide sediment control until stable conditions are met.

Detailed designs of impoundments can be viewed on Drawings 5-28 through 5-31 for the Coal Hollow Mine and Drawings 5-67 through 5-71A for the North Private Lease. Locations can be viewed on Drawing 5-3 and 5-25 for the Coal Hollow Mine and Drawings 5-47, 5-65 and 5-65A for the North Private Lease.

534. **ROADS**

534.100-200 Roads will be located, designed, constructed, reconstructed, used, maintained, and reclaimed so as to:

- *Prevent or control damage to public or private property;*

  All roads will be reclaimed to approximate original contour as shown on Drawings 5-37, 5-37A and 5-38 for the Coal Hollow Mine and Drawings 5-74 through 5-76B for the North Private Lease. These roads are designed to control damage to public and private property.

- *Use nonacid - or nontoxic-forming substances in road surfacing; and*

  There will be no acid or toxic forming substances used in road surfacing.

- *Have, at a minimum, a static safety factor of 1.3 for all embankments.*

  All embankments are designed with static safety factors that exceed 1.3.

- *Have a schedule and plan to remove and reclaim each road that would not be retained under an approved postmining land use.*

  All roads not planned to remain postmining will be removed and reclaimed according to Drawings 5-37 and 5-37A for the Coal Hollow Mine and Drawings 5-74, and 5-75 for the North Private Lease. The estimated timetable for removing these roads is shown on Drawing 5-38 and 5-76B respectively.

- *Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices.*

  Cut ditches will be established on the shoulders of all primary roads to control drainage and erosion. Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles. Also, the upper slope of pit 10 is cut into alluvium at 4:1, this slope will be stabilized by planting with the interim seed mix found in Chapter 2 page 2-25.

- *To ensure environmental protection and safety appropriate for their planned duration and use, including consideration of the type and size of equipment used, the design and reconstruction of roads will incorporate appropriate limits for grade, width, surface materials, and any necessary design criteria established by the Division.*

The following specifications apply to the Primary Mine Haul roads:

1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing, except for the section of the Pit B-1 access extending from County Road 136 to the pit. This section of road will utilize approximately 6" of crushed rock or gravel for road surfacing. This

shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during a short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.

5) Cut and fill slopes of 1.5 h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The underground mine portal access and haul road in Pit 10 (shown in Drawing 5-22I) will also be a primary road. This road is accessed from the main haul road from the coal unloading area. The underground access road will be approximately 1500' in length and will be constructed to the same specifications for the haul roads above, except that the road may be narrowed to a 40 foot width.

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width. A typical cross section for the ancillary roads can be viewed on Drawing 5-24.

The location and details for Primary Mine Haul roads can be viewed on Drawings 5-3, 5-22, 5-23, 5-47, and 5-58 through 5-60.

For the Coal Hollow Mine, in addition to the two primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road is referred to as "Facilities Roadway" and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

In addition to the primary roads that will be present during active mining, four additional roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- Road to Water Well with details shown on Drawing 5-22D
- Road to east C. Burton Pugh property (K3993) with details shown on Drawing 5-22C
- County Road 136 (K3900) with details on Drawings 5-22E, 5-22F and 5-22G for the Coal Hollow Mine, and Drawings 5-61 and 5-63 for the North Private Lease. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawings 5-38 and 5-76B and is expected to be completed by the end of Year 5 for the Coal Hollow Mine and Year 7 for the North Private Lease.
- Alton Coal Mine Road (K3100) in the North Private Lease with details on Drawings 5-62 and 5-63. This short section of County Road will also be reconstructed within the permit area by Kane County. The reconstruction

will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-76B and will be completed in Year 7.

- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawings 5-37 along with the post mining topography.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

Other temporary ancillary roads (such as the Pond 3 access road shown on Drawing 5-3) outside the mining area may be necessary from time to time to access facilities or impoundments during the life of operations. These roads will not remain post-mining and also will not be individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

534.300-340. Primary Roads.

Primary roads will:

- *Be located, insofar as practical, on the most stable available surfaces;*

  These roads are designed on the most practicable, stable surfaces.

- *Be surfaced with rock, crushed gravel, asphalt, or other material approved by the Division as being sufficiently durable for the anticipated volume of traffic and the weight and speed of vehicles using the road;*

  Primary haul roads will be surfaced with approximately 18” of crushed rock or gravel to provide a durable surface for the anticipated volume of traffic and equipment, except for the section of the Pit B-1 access extending from County Road 136 to the pit. This section of road will utilize approximately 6” of crushed rock or gravel for road surfacing. This shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during a short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.

- *Be routinely maintained to include repairs to the road surface, blading, filling potholes and adding replacement gravel or asphalt. It will also include revegetation, brush removal, and minor reconstruction of road segments as necessary; and*

  All roads will be maintained on an as needed basis using motor graders, water trucks for dust suppression, and other equipment as necessary. Crushed stone and/or gravel will be used as a surface course for primary roads outside the active mining area, and may be used as needed for ramps and travelways within the pit. Should the roads be damaged by a catastrophic event, such as an earthquake or a flood, repairs will be made as soon as possible after the damage has occurred or the road will be closed and reclaimed. Roads will be reclaimed once they are no longer needed for their intended use.

- *Have culverts that are designed, installed, and maintained to sustain the vertical soil pressure, the passive resistance of the foundation, and the weight of vehicles using the road.*

  Road fill over culverts will be at minimum two times the diameter of the culvert. This is a conservative standard that has been effectively utilized at mining operations with similar equipment and mining practices.

535. **SPOIL**

535.100 -150 Disposal of Excess Spoil.

Excess spoil will be placed in designated disposal areas within the permit area in a controlled manner. The fill and appurtenant structures will be designed using current, prudent engineering practices and will meet any design criteria established by the Division.

- *The fill will be designed to attain a minimum long-term static safety factor of 1.5. The foundation and abutments of the fill must be stable under all conditions of construction.*

  A geotechnical analysis has been completed for both the long term excess spoil structure located at the Coal Hollow Mine and the temporary excess spoil structure located at the North Private Lease. These analyses estimate the long-term safety factor to be 1.6 to 1.7 based on the proposed designs. Following proper construction practices of building the structures in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structures will be stable under all conditions of construction. The following earthwork specifications will be followed:

  1) Areas to receive fill will be stripped of all vegetation, organic material, and debris. Any existing undocumented or non-structural fill/backfill materials and other unsuitable materials will be excavated in their entirety. All areas that are to receive fill will be observed by a professional engineer experienced in the design of earth and rock fills prior to placement of fill.

  2) Fill will be compacted to 85% of the maximum density as compared to ASTM D 698 (standard proctor) for the spoil.

3) Individual lift thickness will not exceed 4 feet, unless approved by both the Division and the professional engineer based on compaction test results during field verification.

4) Saturated soils will be placed in an area that will have minimal effect on the performance of slopes.

5) A qualified professional engineer with experience in the design of earth and rock fills will periodically observe the placement of fill and conduct in-place field density tests on the fill to check for adequate moisture and relative compaction. The compaction tests will be conducted as part of the periodic inspections required in R645-301-514.100, 514.311, and R645-301-514.120. These compaction tests will be conducted using nuclear density (ASTM D2292-9) or equivalent method. If less than the specified relative compaction is obtained, additional compactive effort will be applied and the fill moisture-conditioned as necessary until the specified relative compaction is attained.

6) Wherever, in the opinion of the ACD's representatives, an unstable condition is being created, the work will not proceed in that area until an evaluation has been made and the grading operations revised, if necessary.

7) During unfavorable weather conditions, construction of the fill will not proceed without confirmation from the professional engineer experienced in the design of earth and rock fills.

This construction will occur only in the designated excess spoil areas as shown on Drawings 5-3, 5-37, for the Coal Hollow Mine and Drawing 5-47 for the North Private Lease. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit have been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. In preparation for final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-36. The spoil and coal will be surface mined utilizing the same equipment and methods as the previous pits and will be extracted to an extent that protects eventual regrading and reclamation efforts in the Borrow Area from potential oxidation, heating, or spontaneous combustion. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36. Then, upon completion of underground mining, Pit 10 will be backfilled and all ground will be returned to the final landform shown in Drawings 5-37 and 5-37A. The geotechnical analysis for this structure can be viewed in Appendix 5-1 for the Coal Hollow Mine and in Appendix 5-11 for the North Private Lease.

- *Be located on the most moderately sloping and naturally stable areas available, as approved by the Division, and placed, where possible, upon or above a natural terrace, bench or berm, if such placement provides additional stability and prevents mass movement;*

  The excess spoil is planned to be placed in areas where natural grades range from 0 to 5%. These are some of the most moderately sloping locations in the Permit Area. Stability of these structures is estimated to be 1.6 to 1.7 based on the Appendix 5-1.

- *Be subject of sufficient foundation investigations. Any necessary laboratory testing of foundation material, will be performed in order to determine the design requirements for foundation stability. The analyses of foundation conditions will take into consideration the effect of underground mine workings, if any, upon the stability of the fill and appurtent structures; and*

  Geotechnical borings and trench samples were completed in the foundations of the proposed disposal areas. Laboratory analysis of these borings and trench samples have also been completed. Details of this analysis can be viewed in Appendix 5-1 and Appendix 5-11.

- *Incorporate keyway cuts (excavations to bedrock) or rock buttresses to ensure stability where the slope in the disposal area is in excess of 2.8h:1v (36 percent), or such lesser slope as may be designated by the Division based on local conditions. Where the toe of the spoil rests on a downslope, stability analyses will be performed in accordance with R645-301-535.150 to determine the size of rock toe buttresses and keyway cuts*

  Slopes for the proposed excess spoil will not exceed 3h:1v (33 percent), therefore no keyway cuts have been proposed in the design. Appendix 5-1 and Appendix 5-11 detail the stability analyses for the proposed structures.

- *Excess spoil may be disposed of in underground mine workings,..*

Excess spoil will not be disposed of in underground mine workings.

- *Placement of Excess Spoil. Excess spoil will be transported and placed in a controlled manner in horizontal lifts not exceeding four feet in thickness; concurrently compacted as necessary to ensure mass stability and to prevent mass movement during and after construction; graded so that surface and subsurface drainage is compatible with the natural surroundings: and covered with topsoil or substitute material in accordance with R645-301-232.100 through R645-301-232.600, R645-301-234, R645-301-242, and R645-301-243. The Division may approve a design which incorporates placement of excess spoil in horizontal lifts other than four feet in thickness when it is demonstrated by the operator and certified by a professional engineer that the design will ensure the stability of the fill and will meet all other applicable requirements.*

  Horizontal lifts will not exceed four feet in thickness unless otherwise approved by the Division. The lifts will be concurrently compacted to meet 85% of the standard Procter. The geotechnical analysis (Appendix 5-1 and Appendix 5-11), provides information showing that these construction standards will provide mass stability and will prevent mass movement during and after construction. The excess spoil will be graded to provide drainage similar to original flow patterns. Topsoil and subsoil as designated in Chapter 2 will be removed and separated from other materials prior to placement of spoil.

- *For the purposes of SURFACE COAL MINING AND RECLMATION ACTIVITIES the design of the spoil disposal structures will include the results of geotechnical investigations as follows:*

  1) *The Character of the bedrock and any adverse geologic conditions in the disposal area;*

     Refer to Appendix 5-1 and Appendix 5-11.

  2) *A survey identifying all springs, seepage, and ground water flow observed or anticipated during wet periods in the area of the disposal site;*

     Spring and seep survey information is provided on Drawing 7-1. There are no springs or seeps identified in the excess spoil area.

  3) *A survey of the potential effects of subsidence of the subsurface strata due to past and future mining operations;*

     There no historical underground mining operations in the proposed excess spoil area. There are also no future underground operations proposed.

4) *A technical description of the rock material to be utilized in the construction of those disposal structures containing rock chimney cores or underlain by a rock drainage blanket; and*

   There are no rock chimneys or drainage blankets proposed.

5) *A stability analysis including, but not limited to, strength parameters, pore pressures and long-term seepage conditions. These data will be accompanied by a description of all engineering design assumptions and calculations and the alternative considered in selecting the specific design specifications and methods.*

   The stability analysis and all supporting data are available in Appendix 5-1for Coal Hollow and Appendix 5-11 for the North Private Lease.

- *If for the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, under R645-301-535.112 and R645-301-535.113, rock-toe buttresses or key-way cuts are required, the will include the following:*

  Neither rock-toe buttresses nor key-way cuts are required under R645-301-535.112 or R645-301-535.113.

535.200. <u>Disposal of Excess Spoil: Valley Fills/Head-of-Hollow Fills</u>.

The MRP does not contemplate disposal of excess spoil as valley fill or head-of-hollow fills.

535.300. <u>Disposal of Excess Spoil: Durable Rock Fills</u>.

The MRP does not contemplate disposal of excess spoil as durable rock fill.

535.400. <u>Disposal of Excess Spoil: Preexisting Benches</u>.

The MRP does not contemplate disposal of excess spoil on preexisting benches.

535.500 <u>Disposal of Excess Spoil: At Drift Entries.</u>

The MRP does not contemplate disposal of spoils resulting from face-up operations at the drift entries. Drift entries will originate from the existing Pit, excess spoil for which are stored in the pit backfill or in the approved Excess Spoils Pile.

536 **COAL MINE WASTE:**

The MRP does not contemplate processing of coal that would produce coal mine waste.

537 **REGRADED SLOPES**:

537.100 Geotechnical Analysis:

The long-term excess spoil structure and fill above approximate original contour at the Coal Hollow Mine are the only alternative specifications proposed. Although the structure will be rehandled as pit backfill prior to final reclamation to achieve AOC, a geotechnical analysis has been completed for this proposal and can be viewed in Appendix 5-1. All other mined areas within the Coal Hollow Mine and North Private Lease, for surface or underground will be restored to approximate original contour.

537.200 Regrading of Underground Fills/Spoil:

Any spoils produced by underground operations at the Coal Hollow Mine will be placed in the first instance in unused crosscuts or underground voids. If necessary, underground spoils may also be placed in the Pit 10 void, not to exceed approximate original contour. As a last resort, underground spoils may also be placed in the long-term excess spoil structure under the design criteria detailed in Appendix 5-1. No underground spoils are expected from the North Private Lease permit area.

540 **RECLAMATION PLAN**:

541.100 - 400 General

Concurrent with mining operations and when coal mining is complete, all pits within each permit area will be backfilled and reclaimed in accordance with the R645 rules and this permit. All equipment, structures, and other facilities, unless approved by the Division as suitable for the postmining land use or environmental monitoring, will be removed and the affected land reclaimed. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. In preparation for final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-36. The spoil and coal will be surface mined utilizing the same equipment and methods as the previous pits and will be extracted to an extent that protects eventual regrading and reclamation efforts in the Borrow Area from potential oxidation, heating, or spontaneous combustion. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36. Then, upon completion of underground mining, Pit 10 will be backfilled and all ground will be returned to the final landform shown in Drawings 5-37 and 5-37A.

Underground mine portals will be closed in accordance with R645-301-513, R645-301-529, R645-301-551 and approved MSHA plans and backfilled.

Since the underground mine portals are located in the bottom of Pit 10 at the Coal Hollow Mine, they will be reclaimed and permanently closed by the backfilling of the pit to a depth of greater than 100' when no longer required. Following the completion of underground mining, backfill of Pit 10 will be completed utilizing borrow from the areas delineated in Drawings 5-19 and 5-37. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If an exploration borehole is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

542 **NARRATIVE, DRAWINGS AND PLANS**:

542-100 through 600 Plan and Timetable.

Reclamation at the Coal Hollow Mine and North Private Lease includes both ongoing reclamation and final reclamation activities. Ongoing reclamation will follow mining operations as closely as practicable during the mine production phase. Major steps in the ongoing reclamation process are:

- Backfilling and Grading. The planned backfilling and grading operations are described more fully under section 553 below.
- Topsoil and Subsoil Replacement. Following grading, suitable topsoil and subsoil will be replaced on the regraded area. Topsoil may be direct placed from areas ahead of the mine, or may be taken from available stockpiled material. The planned topsoil operation will have topsoil ahead of the operation dozed into windrows, and loaded into trucks by a front end loader. The trucks will haul the

topsoil to the regraded area, or to a temporary topsoil stockpile. Subsoil will be handled similar to topsoil. Once dumped on the regraded area, topsoil and subsoil layers will be dozed to a consistent thickness. Approximately 8 inches of topsoil is expected to be removed ahead of mining and replaced over the regraded area. Subsoil removed and replaced will average 40 inches thick and will be placed between the topsoil layer and run of mine spoil. The total profile thickness of topsoil and subsoil in mined areas will average 48 inches. Once in place, the area will be fine graded to remove small erosion features and depressions. It is important to note that bonding calculations have accounted for double handling of the topsoil and subsoil quantities for the borrow area at the Coal Hollow Mine.

- Revegetation. Following replacement of topsoil the area will be revegetated by seeding. Mulch will be placed on the seedbed surface once soil amendments have been incorporated and seeding has been accomplished in areas that will be reclaimed to native plant communities. The mulch should control erosion by wind and water, decrease evaporation and seed predation, and increase survivability of the seeded species. Like the seeding methods, mulch will be applied with a variety of techniques and materials depending on the reclaimed area.

Generally, mined areas will be backfilled and graded within approximately 60 days following coal removal, or 1,500 feet of the active coal removal face. One exception to this standard is that a portion of Pit 10 will be left open for access to the underground portals until completion of underground mining. Following the completion of underground mining, backfill of Pit 10 will be completed utilizing borrow from the areas delineated in Drawings 5-19 and 5-37. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC. Another possible exception would be the necessity of leaving a block of approximately 200’ X 600’ of North Private Lease Pit 9 open pending final approval of continued mining in Areas 2 and 3. Should approval of Areas 2 and 3 for further mining be delayed, the block would need to remain open until construction of Pond 7 was completed, so that mining of Pit 9 could progress through Pond T1. As shown on Drawing 5-76A, under any final circumstance that disallows continuation of mining from the extension of Area 1 into Areas 2 and 3, the final pit void remaining in Pits 9 will be backfilled from backfill borrow upgradient to the West while achieving AOC in both areas. Areas needed for in-pit roads, ramps, drainage controls or areas which must be left open temporarily for operational reasons will be backfilled and graded when they are no longer needed. The rate of backfilling will depend on the availability of mined out pit areas for backfilling, and the rate of production at the mine. Based on anticipated production rates, Drawing 5-38 for the Coal Hollow Mine and Drawing 5-76A and 5-76B for the North Private Lease provide an estimated sequence and timing for reclamation.

Topsoil will be replaced on the graded areas as soon as operationally practicable. This work will depend on weather and soil conditions in the removal and replacement areas, but is generally anticipated to occur within 90 days of completion of regrading.

Revegetation activities will be seasonal in nature. As currently planned, initial seeding will occur at the first planting opportunity following replacement of topsoil. Supplemental seeding may be done subsequently as needed.

At the Coal Hollow Mine, surface mining operations are at a steady state and nearing completion. As such, all material mined goes directly to a backfill or reclaim capacity and is covered by subsoil and topsoil then prepared for mulching and seeding as soon as possible. During this last stage of mining, material from the Highwall Trench is directly backfilled into the remnants of Pits 9, 10 (a portion), 20, 21 and the northern extent of the trench itself. While a majority of Pit 10 will remain open until completion of underground mining, all other pits will be backfilled and reclaimed to approximate original contour. Any shortage of material for final backfill of the Highwall Trench will be made up by rehandle of spoil from the long term excess spoil pile. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit have been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. The last pit (shown on Drawing 5-9 and Drawing 5-10 as Pit B-1) at the Coal Hollow Mine will be encountered incident to reclamation and borrow activities where it would not have been practical to mine otherwise. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36. As shown on in these drawings, this pit is nearly fully contained within the greater Borrow Area but will require approximately 91,000 CY of backfill material to establish the final 3:1 slope on top of the 1:1 operational slope and bench on the South pit wall. This 91,000 CY will remain in place in the final slope and will not be recovered in the final borrow. The remaining backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pits 9-C and 10. Upon completion of underground mining, Pits 9-C and 10 will be backfilled and all ground will be returned to the final landform shown in Drawings 5-37 and 5-37A. For the disturbed area that falls within the 62.0 acres required for eventual borrow and backfill of Pit 10, the ground surface will be smooth graded subsoiled and treated for topsoil cultivation (according to described plans in Chapter 2) following completion of backfill of Pit B-1. The ground will remain in this cultivated state, but will not be released, until borrow and backfill following completion of the underground mine.

For start-up of the North Private Lease, some delay is unavoidable in reclamation of the initial mining areas due to the time required to establish the initial working pit and backfill area, and to achieve a steady state excavation/backfill operation. As currently planned, Pits 1 and 2 will be backfilled to the planned post mining contour, graded, and the subsoil and topsoil replaced concurrently with mining of Pits 3, 4, and 5 midway through the first year of mining. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 (which contains Pits 7, 8 and 9) may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Temporary Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. Once these approvals are obtained, the Area 2 facilities will be constructed and Pond T1 and the other Area 1 extension temporary facilities will be removed or mined out by advancing pits. Reclamation activities will proceed at the regular planned rate thereafter. As mining progresses through the second and into the third year (culminating with Pit 21), a backfill void will develop between the mining face and the direct backfill behind it. This void is a product of the interaction between coal being mined (leaving approximately 15 ft. of extra depth to fill) and the placed backfill swelling from in-situ to loose at an average factor of 10.725%, which is insufficient to make up for the coal depth loss. The final void on completion of Pit 21 will be approximately 1,000,000 cubic yards. As mining commences on the eastern side of the permit area in the Highwall Trench, material will be hauled from the trench back across the property to backfill the remaining void. Therefore, the void will in effect be transferred to the eastern side of the permit where a natural topographic ridge rests above the Highwall trench. This ridge will provide adequate material to fill the Pit 21 void while natural landform, post-mining land use, and drainage will be maintained or improved. Proposed final reclamation contours and cross sections can be viewed on Drawings 5-37 and 5-37A for the Coal Hollow Mine and on Drawings 5-74 and 5-75 for the North Private Lease.

The sequence and timing of reclamation activities is dependent on the coal production rate. Should that rate differ significantly from the current plan, the reclamation schedule will also vary.

Final reclamation includes the following:

- Backfilling and Grading. Backfilling of all final pits will commence at the conclusion of coal production. All highwalls, spoil piles, and depressions will be removed, except that small depressions may be constructed if they are needed to retain moisture, minimize erosion, create and enhance wildlife habitat, or assist revegetation. No permanent final pit impoundments are currently planned. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Therefore, a small portion (apx. 250k C.Y.) of the long-term excess spoil structure may remain at the Coal Hollow Mine until final backfill of Pit 10. In preparation for final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-36.

Then, following the completion of underground mining, backfill of Pit 10 will be completed utilizing borrow from the areas delineated in Drawings 5-19 and 5-37. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC. All exposed coal seams, and acidic or toxic-forming strata will be covered with at least five feet of noncombustible material.

- Topsoil and Subsoil Replacement. 8 inches of topsoil underlain by 40 inches of subsoil will be placed on the backfilled pits and excess spoil. Other disturbed areas will have topsoil replaced (including facilities sites, roads etc.).
- Removal of Structures. Before abandoning the permit area or seeking bond release, all structures not needed for the approved post mining land use will be removed and reclaimed. The Lower Robinson Creek diversion is proposed to be temporary. Material from the coal stockpile base area and other areas where coal spillage may accumulate will be excavated and placed in a controlled manner in the final pit and covered with noncombustible material to prevent sustained combustion. The only structure for both permit areas planned to exist postmining is the water well in the Coal Hollow Mine permit area with details shown in Drawing 5-8C and location shown on 5-3, 5-35 and 5-37.
- Removal of Roads. Roads not retained for use under an approved postmining land use will be reclaimed immediately after they are no longer needed for mining and reclamation operations. Roads that are not listed as postmining roads in this section, will be closed to traffic, and all bridges and culverts removed. Prior to reclamation, surface material that is incompatible with the postmining land use and revegetation requirements will be removed from the roads and properly disposed of at the mine site. The main haul road roadbeds will be scarified or ripped to break up the surface. Topsoil will be replaced on the roadbed and the surface revegetated in accordance with the standards set forth in R645. The portal access/haul road is in Pit 10 and will be backfilled when no longer needed.

  Roads that will remain postmining are the following:
  - Road to Water Well with details shown on Drawing 5-22D
  - Road to east C. Burton Pugh property (K3993) with details shown on Drawing 5-22C
  - County Road 136 (K3900) with details on Drawing 5-22E, 5-22F and 5-22G for the Coal Hollow Mine permit area and Drawings 5-61 and 5-63 for the North Private Lease. This County road will be reconstructed within the permit areas by Kane County. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-38 for the Coal Hollow Mine and Drawing 5-76B for the North Private Lease and is expected to be completed by 2017 and year 5 of operations, respectively.
  - Alton Coal Mine Road (K3100) with details on Drawings 5-62 and 5-63. This County road will also be reconstructed within the permit area by Kane County, and will also be constructed concurrently with the final stage of reclamation as shown on Drawing 5-76B. It is expected to be completed by year 5 of operations.

- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawings 5-37 and 5-38 along with the post mining topography for each permit area.

- Removal of Water Control Structures. All sedimentation control structures, including ditches, berms and sedimentation ponds not retained as part of the approved post-mining land use will be removed, the areas regraded, topsoiled, and revegetated. All water control structures will be removed at final reclamation. See Appendices 5-12 and 5-12A and Drawing 5-79 for descriptions and plans. ACD has obtained a Nationwide Permit through the US Army Corps of Engineers (SPK 2011-01248) for the crossing of Culvert C-2. ACD will send the Division a copy of the mitigation completion report for this permit along with the Division's annual report in the year which the mitigation is completed. ACD will also notify the Division of completion and approval by the Corp of ACD's application for an Individual Section 404 permit under the same number. This notification will include a copy of the approval letter and reference to USACOE's public archive for viewing of the permit documents.

Final pit backfilling, removal of buildings, roads and other facilities, along with replacement of topsoil is expected to require approximately 15 months after the last coal is removed.

542.700. Final Abandonment of Mine Openings and Disposal Areas.

Final abandonment of alternative mined highwall panels (See Chapter 9 which addresses R645-302 regulations) will be at the time when completed panels are backfilled as described in Section 529.

Underground mine openings will be closed in accordance with R645-301-513, R645-301-529, R645-301-551 and approved MSHA requirements and backfilled.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If an exploration hole is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

542.720. Disposal of Excess Spoil.

A geotechnical analysis has been completed for the proposed long term and temporary excess spoil structures for each permit area. This analysis estimates the long-term safety factor to be 1.6 to 1.7 based on the proposed design. Following proper construction practices of building the structure in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structure will be stable under all conditions of construction. This construction will occur only in the designated excess spoil area as shown on Drawings 5-3 and 5-35 for the Coal Hollow Mine and

Drawing 5-47 and 5-51A for the North Private Lease. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. The geotechnical analysis for this structure can be viewed in Appendix 5-1 for the Coal Hollow Mine and Appendix 5-11 for the temporary structure at the North Private Lease. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Therefore, a small portion (apx. 250k C.Y.) of the long-term excess spoil structure may remain at the Coal Hollow Mine until final backfill of Pit 10. In preparation for final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-36. Then, following the completion of underground mining, backfill of Pit 10 will be completed utilizing borrow from the areas delineated in Drawings 5-19 and 5-37. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC.

Excess spoil that is combustible will be adequately covered with noncombustible material to prevent sustained combustion.

542.730. Disposal of Coal Mine Waste.

The MRP does not contemplate processing of coal that would produce coal mine waste.

542.740. Disposal of Noncoal Mine Wastes.

Noncoal mine waste including, but not limited to grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber and other combustible materials generated during mining activities will be placed and temporarily stored in a controlled manner in a designated portion of the permit area and hauled offsite to a state approved recycling or solid waste disposal site. Final disposal of noncoal mine waste will not take place within the permit area. With the exception of removal of perforated piping used in the construction of Alluvial Ground Water Drains that will be left in place as mining advances and water line piping. This perforated piping will be covered in place approximately 20’ to 30’ below the final reclaimed surface. All other waste materials (ie. metal culvert) associated with the Alluvial Ground Water Drains will be removed and disposed of in a State-approved solid waste disposal site. The buried water line from the well to the Coal Yard, all buried water pipe within the Coal Yard and the buried water line from the tank East of Pit 10 will be cut off 4’ below the final surface, capped and left in place.

542.800. Reclamation Cost.

The amount of the bond will depend upon the requirements of the ***approved*** permit and reclamation plan (R645-830.120).

A preliminary estimate of reclamation costs is included in Chapter 8 and Appendices 8-1 and 8-2. This estimate is based upon the proposed plan of open pit, highwall and underground mining, as well as eventual borrow to backfill Pit 10 at the conclusion of underground mining. A final bond estimate will be provided by the applicant to the Division upon completion of the approved permit and reclamation plan.

550. RECLAMATION DESIGN CRITERIA AND PLANS

551. SEALING AND CASING OF UNDERGROUND OPENINGS

When no longer required, underground mine openings will be closed in accordance with R645-301-513, R645-301-529, R645-301-551 and MSHA approved requirements and backfilled. When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of “Administrative Rules for Water Well Drillers”, State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer’s office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer’s office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If an exploration hole is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division. If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

552. **PERMANENT FEATURES**.

552.100

Small depressions may be constructed if they are needed to retain moisture, minimize erosion, create and enhance wildlife habitat, or assist revegetation.

552.200

All impoundments will be reclaimed, no permanent impoundments are proposed.

553 **BACKFILLING AND GRADING:**

Backfilling and Grading of the mined areas will proceed in conjunction with coal recovery operations.

The following is a description of the overburden removal and backfilling process:

For the Coal Hollow Mine, based on the overburden isopach map (Drawing 5-15), the overburden removal and backfilling process has been separated into three major stages. The first stage of this process is for the initial mining area, Pits 1-9. These pits have a relatively low strip ratio, approximately 4:3 (refer to Drawing 5-13). In order to efficiently remove overburden for this phase, spoil from the first three pits will be placed in an excess spoil area located immediately west of Pit 1. This excess spoil structure will hold approximately 2.7 million loose cubic yards (LCY) of material. Once the excess spoil pile is filled, overburden from the next 5 pits can then be used as pit backfill as the mining progresses through Pit 9. Pit 9 will not be backfilled at this stage; it has been left open for placement of the highwall miner (See Chapter 9 which addresses R645-302 regulations) to recover coal from panels 1-3.

From the initial mining area, operations will proceed from the southeast ¼ of Section 30, beginning with pit 28 and proceeding north to pit 20. Material from pit 28 was place in the excess spoil structure with overburden material from successive pits to the north being placed in the mined out pit to the south. These pits were not mined as initially laid out due to the coal being eroded in the eastern half of pit 28 and numerous sand channels replacing much of the coal in the eastern portions of pit 22-27. These pits as mined have a relatively low strip ratio of approximately 5.0:2. While overburden removal was occurring in pit 22, coal recovery was occurring from the pit 9 highwall panels. In this method of mining, an unmanned cutter module is driven underground and operated in front of the highwall. The highwall mining machine stands on the pit floor or on a bench, directly in front of the exposed seam and makes long parallel rectangular drives into the coal seam. A remote-operated cutter module is pushed into the seam by a string of push beams (unmanned coal-conveying elements) that transport the mined coal back to the entry of the drive onto a stockpile. Coal is then removed to the sizing/loading area. The miner is moved along the face making successive pushes into the coal face. Once coal is removed from the Pits/ Highwall Trench, overburden from excavation of the next Highwall Trench is used to backfilled the mined out area continuing with the progression of the trench. In hole 27 of Pit 9 Panel 3, the highwall miner head became lodged. Another head was leased in order to continue highwall mining from pits 22 and 23 while a recover plan was approved to mine Pit 10 and recover the lodged miner head.

In Stage three, Pit 21 was then mined along with the highwall panels in 21, then Pit10. The strip ratio for these two pits was 8.0 and 12.1 respectively. Overburden was placed in the pits to the south from pit 21 and in pit 9 from pit 10. Pit 10 will remain open for development of the underground portals and remain open until all underground coal is mined. There will be no additional overburden removal associated with the underground mining. Surface mining will continue with mining of Highwall Trench (HWT) 1 continuing south to HWT 3. The strip ratio for the highwall trench is 10.3:1. Overburden from HWT 1 will fill the remaining pit 9 with material from HWT 2 and 3 filling the previously mined portions of highwall trench and any remaining void in Pits 9, 20, 21, and 22.

Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Therefore, a small portion (apx. 250k C.Y.) of the long-term excess spoil structure may remain at the Coal Hollow Mine until final backfill of Pit 10. In preparation for final borrow, Pit B-1 (as shown on Drawing 5-10) will be excavated and simultaneously backfilled to remove all coal from the borrow volume to reach the intermediate landform depicted in Drawings 5-35 and 5-

36. Mining of Pit B-1 will begin by dozing a thin layer (apx. 5 ft) of overburden covering the eastern extent of Pit B-1 from east to west in a strip 50 to 100 ft wide to create a temporary overburden berm. The coal underneath this first strip will then be extracted leaving a void into which the berm and subsequent strip overburden can be placed. The coal strips will progress from east to west, with dozing and potentially truck haulage replacing the stripped overburden into the coal voids from west to east. Mining slopes will be maintained at a 1:1 face angle for mining benches under 50 ft. Above 50 ft., a 40 ft. catch bench will be installed between 40 ft. 1:1 benches. Additional fill material will be sourced from the adjacent pit slopes as necessary to establish the final 3:1 slope on the South pit wall and to meet the intermediate design surface depicted in Drawings 5-35 and 5-36. As shown on in these drawings, this pit is nearly fully contained within the greater Borrow Area but will require approximately 91,000 CY of backfill material to establish the final 3:1 slope on top of the 1:1 operational slope and bench on the South pit wall. This 91,000 CY will remain in place in the final slope and will not be recovered in the final borrow. The remaining backfill will then remain in place until closure of the Underground Mine and finally rehandled as backfill to Pits 9-C and 10. Final backfill will require approximately 1.5 Million C.Y. of borrow material, but will still achieve AOC.

The following table summarizes the overburden and backfill movement for the Coal Hollow Mine:

Coal Hollow Mine Overburden Summary	
2011	3,511,849 CY
2012	2,135,022 CY
2013	3,090,547 CY
2014	3,423,635 CY
2015	2,375,581 CY
2016	277,000 CY
Borrow	1, 516,200 CY
Total	16,329,834 CY

Rough backfilling and grading operations will follow coal removal by not more than 60 days or 1500 linear feet except that Pit 10 will remain open until removal of underground coal is complete. Another possible exception would be the necessity of leaving a block of approximately 200’ X 600’ of North Private Lease Pit 9 open pending final approval of continued mining in Areas 2 and 3. Should approval of Areas 2 and 3 for further mining be delayed, the block would need to remain open until construction of Pond 7 was completed, so that mining and backfilling of Pit 9 could progress through Pond T1. As shown on Drawing 5-76A, under any final circumstance that disallows continuation of mining from the extension of Area 1 into Areas 2 and 3, the final pit void remaining in Pits 9 will be backfilled from backfill borrow upgradient to the West while achieving AOC in both areas.

For the North Private Lease, the lease boundary encompasses three Permit Areas~~, of which Area 1 is currently proposed for inclusion in the MRP and Areas 2 and 3 remain under review~~. Due to bond requirements and the scarcity of open space with relation to the soil and spoil stockpiles in Permit Area 1, development of the mining pits must follow a rigid sequence. Bond increments typically include a release component and a posting component, as depicted in Chapter 8 and Appendix 8-2, the first increment of bonding in Permit Area 1 covers all of Area 1's Phase 2, Phase 3, and Facilities costs while only allowing Phase 1 (excavation) cost for Pit 1. Therefore, as shown in Drawing 5-48, the first stage of mining activity involves construction of the South Haul Road, Ponds 5 and 6, Ditches 5 through 11, and the temporary topsoil, subsoil and spoil stockpiles. To construct each of these facilities, ground cover, topsoil, and subsoil must be removed and stockpiled according to the plan and methods set out in Chapter 2 section 231 and section 523 of this chapter and also shown on Drawing 2-4. Once these facilities have been constructed, excavation of Pit 1 will commence. The second North Private Lease bond increment will then allow continued excavation of Pits 2-6 to the Permit Area 1 boundary. During mining and backfill of Pits 5 and 6, the third North Private Lease bond increment will allow construction of the Permit Area 1 extension facilities and structures shown on Drawing 5-48A. Depending on the timing of approval for Areas 2 and 3, mining in the extension of Area 1 may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. As long as Areas 2 and 3 are available, the third bond increment through the fourth, fifth and sixth will also allow for steady state mining and backfill from Pit 7 through Pit 21. Then, during mining and backfill of Pits 20 and 21 the seventh North Private Lease bond increment will allow construction of the Permit Area 3 facilities and structures shown on Drawing 5-50. The seventh bond increment also allows for mining and backfill of both of the Highwall trench pits in Permit Area 3.~~ Following Pit 9, further disturbance and excavation requires the approval of Permit Areas 2 and 3 which currently remain under review.~~

Based on the overburden isopach map (Drawing 5-56), the overburden removal has been separated into three major stages. The initial area of overburden removal is the mining area, Pits 1-10. These pits have a relatively low strip ratio, approximately 4.6:1 (refer to Drawing 5-54). In order to efficiently remove overburden for this phase, spoil from pit 1 and pit 2 will be placed in a temporary excess spoil area on the area of pits 5 and 6. This excess spoil structure will hold approximately 506,000 loose cubic yards (LCY) of material. Once the excess spoil pile is filled, overburden from the remaining pits can then be used as pit backfill as the mining progresses through Pit 10, also as pit 4 is completed, material from the temporary spoils pile can be placed in pit backfill.

From the initial mining area, operations will proceed North from Pit 11to Pit 21. These pits have a strip ratio increasing from 4.7:1 to 9.6:1. All spoils are placed in the proceeding void. Once coal is removed from Pit 21, overburden from the development of the highwall trench will be used to backfill the remaining Pit 21.

The final mining area will be developed on the East side of Kanab Creek. Overburden removal from Highwall Trench 1 will proceed north in the trench with overburden being placed into the previously mined out area of Pit 21 until it reaches AOC. After Pit 21 is filled, material mined from the highwall trench will be placed directly as backfill in the same highwall trench, progressing from South to North.

For start-up of the North Private Lease, some delay is unavoidable in reclamation of the initial mining areas due to the time required to establish the initial working pit and backfill area, and to achieve a steady state excavation/backfill operation. In accordance with R645-301-553, backfill of each pit will commence no more than 60 days after the removal of coal. As currently planned, Pits 1 and 2 will be backfilled to the planned post mining contour, graded, and the subsoil and topsoil replaced concurrently with mining of Pits 3, 4, and 5. Depending on the timing of approval for Areas 2 and 3, mining and backfill in the extension of Area 1 (which contains Pits 7, 8 and 9) may be limited as shown in Drawing 5-57 by Pond T1 and the geologic contact between Tropic Shale and Quaternary Alluvium in Pits 8 and 9. Temporary Pond T1 must remain in place until Pond 7 has been constructed and no alluvium will be mined until the hydrologic analysis of Areas 2 and 3 has been performed and approved. Once these approvals are obtained, the Area 2 facilities will be constructed and Pond T1 and the other Area 1 extension temporary facilities will be removed or mined out by advancing pits. Reclamation activities will proceed at the regular planned rate thereafter. As mining progresses from the second to the fourth year (culminating with Pit 21), a backfill void will develop between the mining face and the direct backfill behind it. This void is a product of the interaction between coal being mined (leaving approximately 15 ft. of extra depth to fill) and the placed backfill swelling from in-situ to loose at an average factor of 10.725%, which is insufficient to make up for the coal depth loss. The final void on completion of Pit 21 will be approximately 1,000,000 cubic yards. As mining commences on the eastern side of the permit area in the Highwall Trench, material will be hauled from the trench back across the property to backfill the remaining void. Therefore, the void will in effect be transferred to the eastern side of the permit where a natural topographic ridge rests above the Highwall trench.   This ridge will provide adequate material to fill the Pit 21 void while natural landform, post-mining land use, and drainage will be maintained or improved.

Of note, erosional scours and the stock ponds identified on Drawing 7-7 within the ~~(~~center and western drainages~~)~~ existing prior to mining will be eliminated per the landowner request. This requires coordination with the USACOE for the elimination of wet lands (final landform shown on Drawings 5-74 and 5-75) identified in the Preliminary Jurisdictional Determination SPK-2011-01248 November of 2012 and updated September 2015 (MRP, Volume 10, NPL Wetland Study Report Final). Disturbances within the identified wetlands will not occur until approval of the 404 permit. The 404 permit will allow for take of the wetlands within the center drainage with wetlands being replaced in offsite mitigation under USCOE jurisdiction.

The following table summarizes overburden movement for the North Private Lease.

North Private Lease Overburden Summary	
Year 1	2,094,000 CY
Year 2	2,972,900 CY
Year 3	3,535,700 CY
Year 4	3,449,100 CY
Year 5	2,790,200 CY
Year 6	2,780,700 CY
Year 7	977,200 CY
Total	18,599,800 CY

Major steps in the backfilling and grading process for both permit areas are:

- Backfilling of the Mined Out Pit. Material from active pits will be used to backfill mined out pits as mining progresses. Material will be placed in the in-pit backfill in lifts, until the approximate planned final elevation is reached. Working stability in the backfill will be achieved by placement of the material, and control of the overall spoil face slope at stable angles. The mined out area will be filled to its planned post-mining elevation, which approximates the pre-mining land contour. The backfill will be inherently stable because the exposed surface will have shallow slopes, and the backfill surface will not be significantly higher than the surrounding undisturbed ground.
- Backfilling of Ramps. Ramps and travelways within the active mining will be moved as necessary for safe operation and efficient hauling of overburden and coal. When a particular ramp or travelway is no longer needed, it will be backfilled with excavated overburden from the advancing pit.
- Grading. After backfilling is complete in each mined out area, the area will be graded using dozers and motor graders to achieve the planned post-mining contour, facilitate stable positive drainage patterns, and to blend in with the surrounding topography. Postmining slopes will not exceed either the angle of repose or such lesser slope as is necessary to achieve a minimum long-term static safety factor of 1.3 and prevent slides. A geotechnical analysis has been completed for the excess spoil structure and can be found in Appendix 5-1.

Timing of backfilling and grading operations will depend on the rate of mine advance and the availability of backfill space and material. It is planned that mined areas will commence backfilling and grading within 60 days following coal removal. As described in the previous text there will be a variance from this standard for Pit 10 of the Coal Hollow Mine as it remains open during underground mining operations. Another possible exception would be the necessity of leaving a block of approximately 200’ X 600’ of North Private Lease Pit 9 open pending final approval of continued mining in Areas 2 and 3. Should approval of Areas 2 and 3 for further mining be delayed, the block would need to remain open until construction of Pond 7 was completed, so that mining of Pit 9 could progress through Pond T1. As shown on Drawing 5-76A, under any final circumstance that disallows continuation of mining from the extension of Area 1 into Areas 2 and 3, the final pit void remaining in Pits 9 will be backfilled from backfill borrow upgradient to the West while achieving AOC in both areas. Also, as the North Private Lease progresses toward Pit 21 in the North of Permit Area 2 and accumulates an ever-growing void, the width of the void space increases but never exceeds 400 ft., therefore the area in the void may take slightly longer to commence backfill activities than the standard 60 days. This will be immediately resolved once mining commences in the Highwall Trench on the eastern side of the permit area. Areas needed for in-pit roads, ramps, drainage controls or areas which must be left open temporarily for operational reasons will be backfilled and graded as they become available.

553.110

All areas will be restored to approximate original contour for the Coal Hollow Mine as shown on Drawing 5-37. R645-301-553.800 (Thick Overburden) does not apply to this surface mine. The slopes will be regraded to a maximum angle of 3h:1v and most slopes are flatter as shown on Drawing 5-37 and 5-37A. A geotechnical analysis has been completed to verify that the spoil material will be stable long term. This analysis can be viewed in Appendix 5-1.

All areas will be restored to approximate original contour for the North Private Lease as shown on Drawings 5-74 and 5-75. R645-301-553.700 (Thin Overburden) does not apply to this surface mine. The slopes will be regraded to a maximum angle of 3h:1v and most slopes are flatter as shown on Drawing 5-74 and 5-75. A geotechnical analysis has been completed to verify that the spoil material will be stable long term. This analysis can be viewed in Appendix 5-11.

553.120

All highwalls will be eliminated in the final landform. Small depressions may be constructed as needed to retain moisture, minimize erosion, create and enhance wildlife habitat or assist vegetation. All spoil piles will be eliminated as shown on Drawing 5-37.

553.130

Postmining slopes for both permit areas will not exceed the angle of repose which is expected to be approximately 1.5h:1v (33° to 35°) as described in Appendix 5-5. This appendix is an analysis by Dr. Ben Seegmiller addressing the safety factor for the post mining reclaimed slope with the lowest safety factor outside the excess spoil area. This analysis concludes that a minimum safety factor of these slopes reclaimed with a planned maximum slope angle of 3h:1v (18.4°) will be 1.7 which exceeds the requirement of 1.3. Appendix 5-5 also states that this planned reclaim slope angle is much less than the general area angle of repose. In fact it is at least 14° less. Therefore, postmining slopes reclaimed at the planned angle of 3h:1v (18.4°) are considered stable.

The excess spoil slopes have been analyzed by Alan Taylor, P.E., an expert in geotechnical engineering. These slopes also significantly exceed the required 1.3 safety factor. Details for this analysis by Mr. Taylor can be viewed in Appendix 5-1.

553.140

Slopes will be regraded and vegetated to minimize erosion and water pollution on and off the site.

553.150

Backfilling and grading will be conducted to support the approved post mining land use.

553.200 Spoil and Waste.

Spoil located in each of the excess spoil areas will be compacted to 85% of the standard Procter to provide long term stability of these structures. Remaining backfill in mined out areas will be confined and regraded to approximate original contour and will therefore not require compaction for long term stability. Subsoil will be placed over spoils and waste prior to placement of topsoil. This subsoil layer will provide a covering with minimal infiltration rate to prevent leaching of toxic materials.

553.210

Excess spoil from surface mining activities will be disposed of according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.100, R645-301-745.300, and R645-301-745.400. Detail for meeting these standards can be reviewed in the corresponding sections.

553.220

The MRP does not contemplate placing spoil on areas outside the mined-out surface area for the purposes of restoring the approximate original contour.

553.300. Covering of Exposed Coal Seams, and Acid- and Toxic-Forming Materials.

Exposed coal seams, acid- and toxic-forming materials, and combustible materials exposed, used, or produced during mining will be adequately covered with nontoxic and noncombustible materials, or treated, to control the impact on surface and ground water in accordance with R645-301-731.100 through R645-301-731.522 and R645-301-

731.800, to prevent sustained combustion, and to minimize adverse effects on plant growth and on the approved postmining land use.

553.400. Cut and Fill Terraces

The MRP does not contemplate constructing cut and fill terraces.

553.500. Previously Mined Areas (PMA's) and Continuously Mined Areas (CMA's).

The MRP does not contemplate operations associated with PMA’s, CMA’s, or areas with remaining highwalls.

553.600. Highwall Management

The MRP does not contemplate operations associated with PMA’s, CMA’s, or areas with remaining highwalls.

553.700. Backfilling and Grading: Thin Overburden.

The Coal Hollow project is expected to have approximately 1.5 million cubic yards of spoil shortfall; but ACD proposes to make up for this void and still meet approximate original contour by handling approximately 1.5 million cubic yards of material from a borrow area as shown in Drawings 5-19, 5-37 and 5-37A to complete backfill of Pit 10 and the underground portals. In so doing, a surface configuration and drainage pattern that closely resemble original conditions will be achieved so that neither R645-301-553.700 nor 301-553.800 apply to the Coal Hollow Mine permit area.

For the North Private Lease, based on updated swell factors of mined material found in Appendix 5-11, mining is expected to result in a deficit of spoil of approximately 1.0 million cubic yards. ACD proposes to make up for this void and still meet approximate original contour by handling approximately 1.0 million cubic yards of material from a topographic high ridge in Area 3 to backfill the last portion of Area 2 (As shown in the post-mining topography of Drawing 5-74). In so doing, a surface configuration and drainage pattern that closely resemble original conditions will be achieved so that neither R645-301-553.700 nor 301-553.800 apply to the North Private Lease permit area.

553.800. Backfilling and Grading: Thick Overburden.

553.810

This rule does not apply to either the Coal Hollow Mine or the North Private Lease.

553.820 - 553.830

Backfilling and Grading of thick overburden will meet the following requirements:

- *R645-301-211: The applicant will present a description of the premining soil resources as specified under R645-301-221. Topsoil and subsoil to be saved under R645-301-232 will be separately removed and segregated from other material.*

  The soil resources for the proposed excess spoil disposal areas are described in Appendix 2-1. A plan has been developed for removal of topsoil and suitable subsoil based on the soil descriptions in this appendix. The handling plan can be viewed on Drawing 2-2. Topsoil and acceptable subsoil will be separately removed and segregated from other material prior to placement of any spoil.

- *R645-301-212: After removal, topsoil will be immediately redistributed in accordance with R645-301-242, stockpiled pending redistribution under R645-301-234, or if demonstrated that an alternative procedure will provide equal or more protection for the topsoil, the Division may, on a case-by case basis, approve an alternative;*

  The landform underneath the Excess spoil will have topsoil and subsoil redistributed in an approximately uniform, stable thickness with the approved post mining land use, contours and surface water drainage systems. Material handling practices will prevent excess compaction of these materials. Handling practices will also protect the materials from wind and water erosion before and after seeding and planting.

- *R645-301-412.300: Criteria for Alternative Postmining Land Uses.*

  Not Applicable

- *R645-301-512.210: Excess Spoil. The professional engineer experienced in the design of earth and rock fills will certify the design according to R645-301-535.100.*

  A professional engineer experienced in the design of earth and rock fills with assistance from a geotechnical expert has certified the design according to R645-301-535.100. These certifications can be viewed on Drawings 5-37, 5-37A, 5-47, 5-51A and 5-17.

- *R645-301-512.220: Durable Rock Fills*

  No durable rock fills are planned.

- *R645-301-514.100: Excess Spoil. The professional engineer or specialist will be experienced in the construction of earth and rock fills and will periodically inspect the fill during construction. Regular inspections will also be conducted during placement and compaction of fill materials.*

A professional engineer or specialist that is experienced in the construction of earth and rock fills will inspect the fill during construction and regular inspections will also be conducted during placement and compaction of fill materials.

- *R645-301-528.310: Excess spoil will be placed in designated disposal areas within the permit areas within the permit area, in a controllable manner to ensure mass stability and prevent mass movement during and after construction. Excess spoil will meet the design criteria of R645-301-535. For the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the permit application must include a description of the proposed disposal site and the design of the spoil disposal structures according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.100, R645-301-745.300, and R645-301-745.400.*

  Excess spoil will be placed in the areas designated on Drawings 5-3 and 5-37 for the Coal Hollow Mine. This fill will be placed in lifts not to exceed 4 feet. The material will be transported from the overburden removal area to the fill by end dump haul trucks and a dozer(s) will spread the spoil to this lift thickness. The fill will meet at minimum 85% compaction as related to the standard Procter. Final slopes will be regraded to a maximum slope of 3h:1v. The top of the fill will be sloped to approximately 2% to prevent pooling of water and to reestablish drainage similar to the original flow patterns. The excess spoil placed on the non-mined areas at the Coal Hollow Mine is approximately 32 acres and varies in height from 35 to 110 feet. The excess spoil pile will be completely rehandled as pit backfill prior to final reclamation. Following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit has been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. Design and the geotechnical study of this long-term fill can be viewed in Appendix 5-1.

- *R645-301-535.100 through R645-301-130: Disposal of Excess Spoil*

  A geotechnical analysis of the excess spoil structure designs has been completed by an expert in this field. The long term static safety factor for these structure designs is estimated at 1.6 to 1.7. Lifts will be placed in thicknesses not to exceed 4 feet. The lifts will meet 85% compaction by the standard Procter. The fills will be graded to allow for drainage similar to original patterns and to prevent excessive infiltration of water. For the Coal Hollow Mine, following the completion of surface mining in the highwall trench, backfill operations from the long-term excess spoil structure to the open pit have been ongoing to bring both the spoil structure and highwall trench areas to AOC. It is anticipated that backfill of the highwall trench will be completed by the 9th of June, 2016. The landform beneanth the fill will be covered with subsoil and topsoil as specified in Chapter 2 to provide conditions suitable for revegetation of the area. The geotechnical study can be viewed in Appendix 5-1for the Coal Hollow Mine.

- *R645-301-535.300 through R645-301-535.500: Disposal of Excess - Spoil Durable Rock Fills.*

  Not Applicable

- *R645-301-536.300: Disposal of Coal Mine Waste in Excess Spoil*

  No coal mine waste is planned in the excess spoil area.

- *R645-301-542.720: Excess spoil will be placed in designated disposal areas within the permit area, in a controlled manner to ensure that the final fill is suitable for reclamation and revegetation compatible with the natural surroundings and the approved postmining land use. Excess spoil that is combustible will be adequately covered with noncombustible material to prevent sustained combustion. The reclamation of excess spoil will comply with the design criteria under R645-301-553.240.*

  The landform beneath the Coal Hollow Mine long term excess spoil as shown in Drawing 5-37 and 5-37A will be suitable to the surrounding area and for the postmining land use of primarily grazing. No combustible excess spoil will be placed in the proposed structure. The reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v.

- *R645-301-553.240:   The final fill configuration of the fill (excess spoil) will be suitable for the approved postmining land use. Terraces may be constructed on the outslope of the fill if required for stability, control of erosion, to conserve soil moisture, or to facilitate the approved postmining land use. The grade of the outslope between terrace benches will not be steeper than 2h:1v (50 percent).*

  The landform beneath the Coal Hollow Mine excess spoil as shown in Drawings 5-37 and 5-37A will be suitable to the surrounding area and for the postmining land use of primarily grazing. The reclamation of the spoil does not include any terraces and the slopes will not exceed 3h:1v. This slope angle has been utilized at similar mining operations and found to be suitable for erosion control and revegetation of reclaim slopes. The long term static safety factor for these slopes is estimated to be 1.6 to 1.7.

- *R645-301-745.100: General Requirements.*

  745.110: Excess Spoil will be placed in designated disposal areas within the permit area, in a controlled manner to:

745.111: Minimize the adverse effects of leaching and surface water runoff from the fill on surface and underground water;

Reclamation of the landform beneath the Coal Hollow long term excess spoil will include a topsoil cover and subsoil layer. Infiltration through the reclamation is expected to be minimal based on the high clay content of these soils. In addition, laboratory data for the overburden shows that there is minimal potential for leaching of pollutants should infiltration rates become higher than expected.

The foundation of the excess spoil area also has high clay content with minimal potential for infiltration. This will provide an additional, natural barrier to protect ground water present beneath the proposed structure.

745.112: Ensure permanent impoundments are not located on the completed fill. Small depressions may be allowed by the Division if they are needed to retain moisture or minimize erosion, create and enhance wildlife habitat or assist revegetation, and if they are not incompatible with the stability of the fill; and

Permanent impoundments are not planned on the excess spoil area. Small depressions are also not planned in the excess spoil and are not viewed as a necessary enhancement to final reclamation based on average annual moisture data and the proposed slope configuration of the pile.

745.113: Adequately cover or treat the excess spoil that is acid- and toxic forming with nonacid nontoxic material to control the impact on the surface and ground water in accordance with R645-301-731.300 and to minimize adverse effects on plant growth and approved postmining land use.

Laboratory data representative of the overburden planned for disposal in the excess spoil area does not show acid- and toxic forming characteristics.

745.120: Drainage Control. If the disposal area contains springs, natural or manmade water courses, or wet weather seeps, the fill design will include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill and ensure stability.

A spring and seep survey available in Chapter 7 has identified no springs or wet weather seeps in the proposed excess spoil area. The final surface will be regraded to a contour that will route natural water from snowmelt and rainfall around the excess spoil as shown on the final contours Drawing 5-37. There are no manmade water courses present in the excess spoil area. No underdrains are planned for the excess spoil structure.

745.121: Diversions will comply with the requirements of R645-301-742.300

No diversions are planned in the excess spoil area.

745.122 : Underdrains

No underdrains are planned in the excess spoil area.

745.300: Durable Rock Fills

No Durable Rock fills are planned.

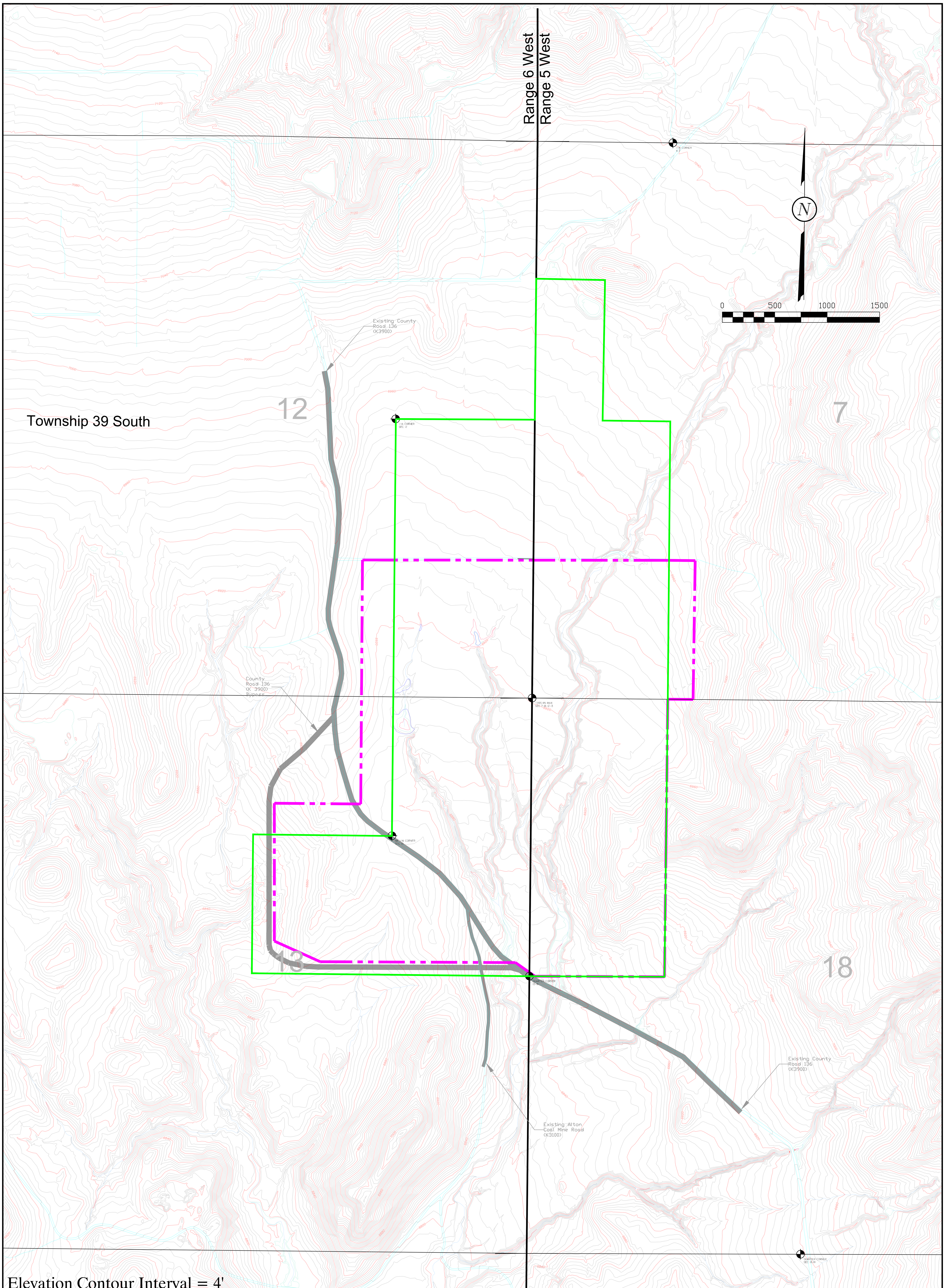
745.400: Preexisting Benches

The MRP does not contemplate disposal of excess spoil on preexisting benches.

Alton Coal Development, LLC will provide the Division, as part of the annual report for each calendar year, Drawing 5-38 for the Coal Hollow Mine and Drawing 5-76A and 5-76B for the North Private Lease. The Drawings will provide an as-built of the reclamation sequence, depicting the acres of open pit and /or trench, the acres backfilled, the acres fully reclaimed (topsoiled and seeded) and revisions to the reclamation timetable. This information will be submitted by March 28th of each calendar year with the appropriate C1/C2.

560. Performance Standards

Coal mining and reclamation operations will be conducted in accordance with the approved permit and requirements of R645-301-510 through R645-301-553.



LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING: 5-45	DATE: 7/14/14
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
03/11/15	KN
04/10/15	AC
10/15/15	AC
12/15/15	AC
1/8/16	AC
8/15/16	AC
5/4/17	AC

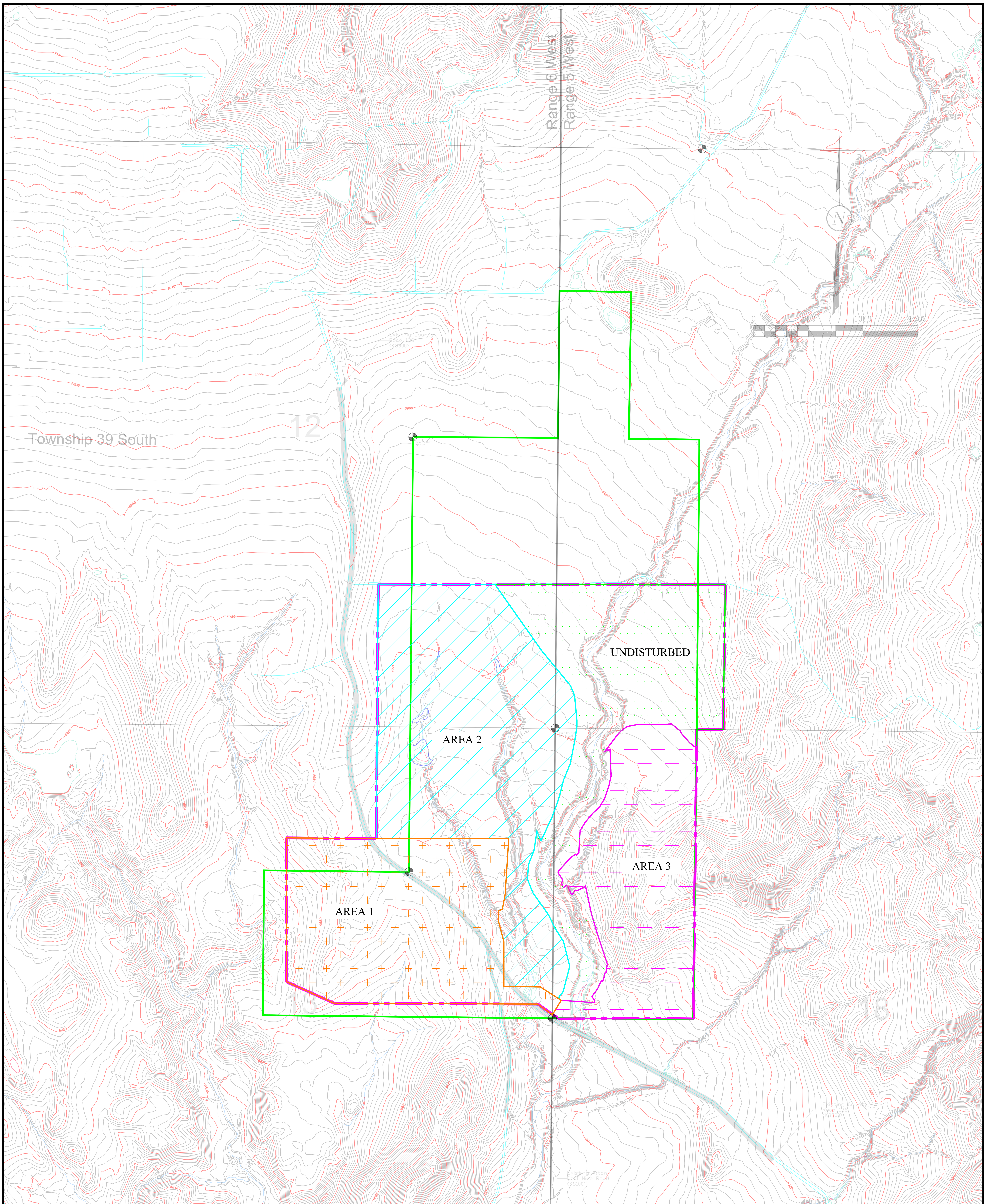
PRE-MINING TOPOGRAPHY

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-45

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Permit Area 1 Disturbance	=	69.8 Acres
Permit Area 2 Disturbance	=	97.8 Acres
Permit Area 3 Disturbance	=	57.2 Acres
Total Disturbance	=	224.8 Acres
Undisturbed Area	=	70.8 Acres
Total Lease Area	=	295.6 Acres

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING:	DATE:
5-46	7/14/14
	SCALE:
	1" = 400'
JOB NUMBER:	SHEET
0001	

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DISTURBANCE SEQUENCE

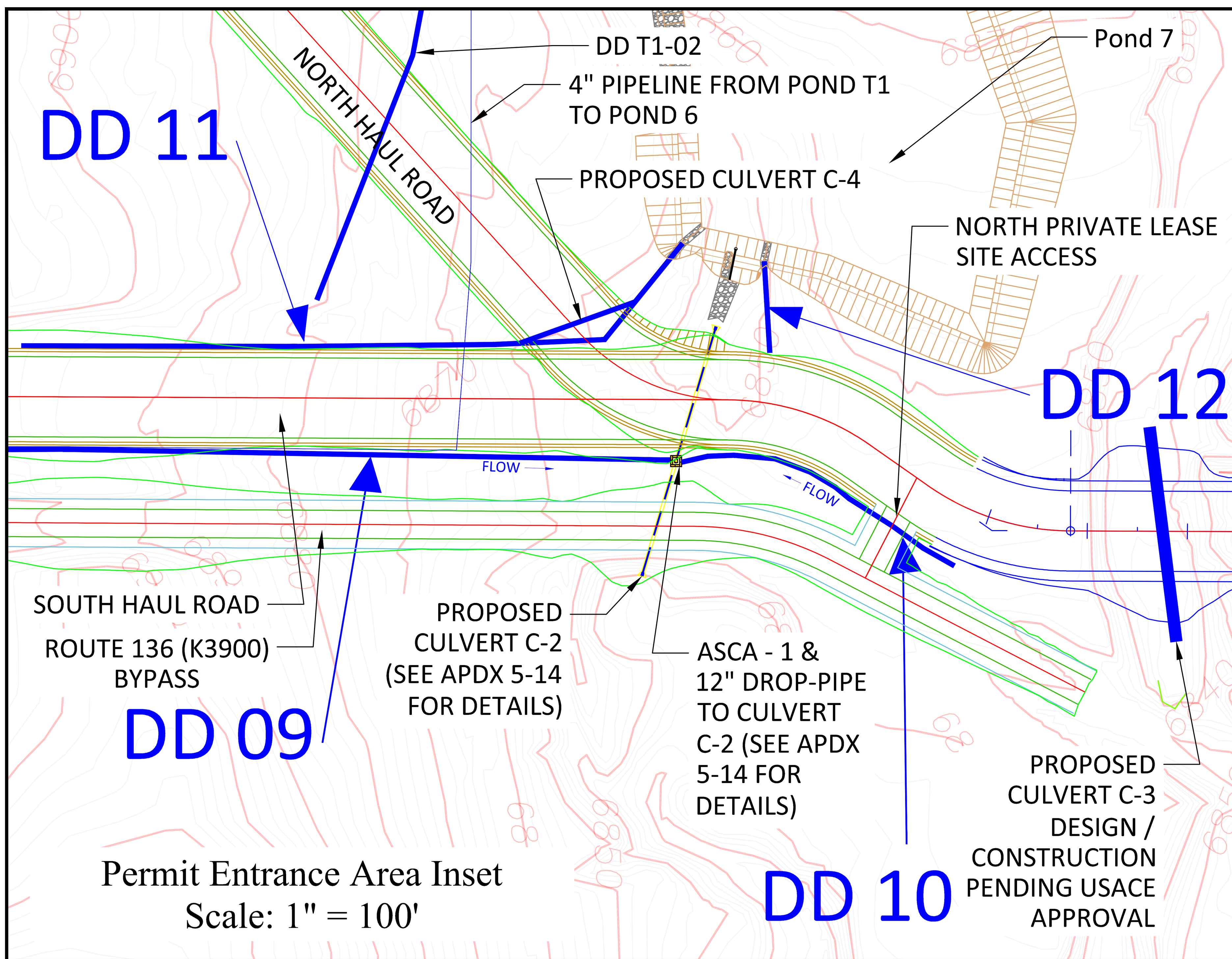
NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-46

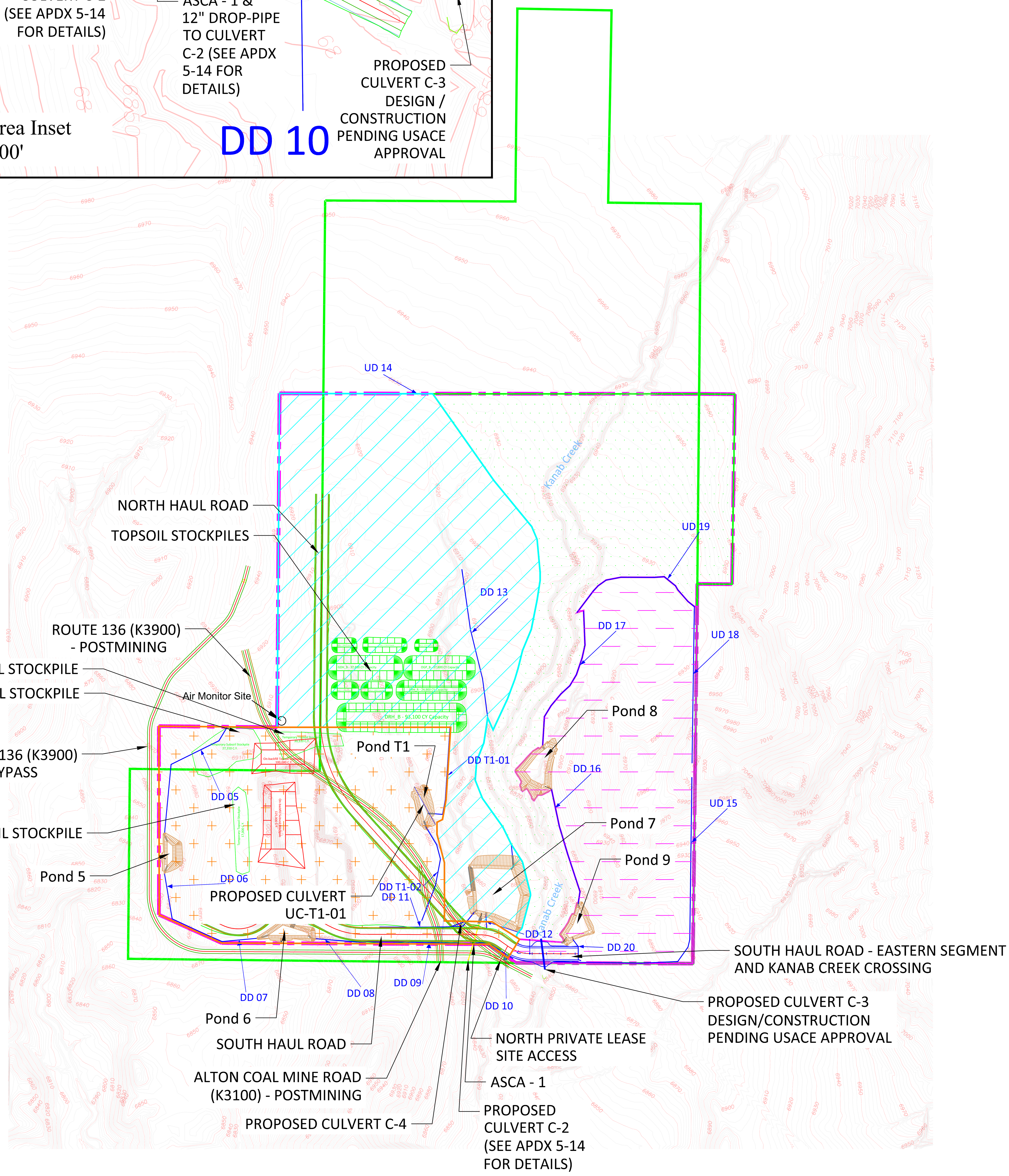
UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Permit Entrance Area Inset
Scale: 1" = 100'



Permit Area 1 Disturbance	=	69.8 Acres
Permit Area 2 Disturbance	=	97.8 Acres
Permit Area 3 Disturbance	=	57.2 Acres
Total Disturbance	=	224.8 Acres
Undisturbed Area	=	70.8 Acres
Total Lease Area	=	295.6 Acres

Contour Interval = 2'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-47	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	ARC
8/15/16	ARC
9/7/16	ARC
10/3/16	ARC
12/14/16	ARC
2/2/17	ARC
5/4/17	ARC

FACILITIES AND STRUCTURES LAYOUT

NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-47

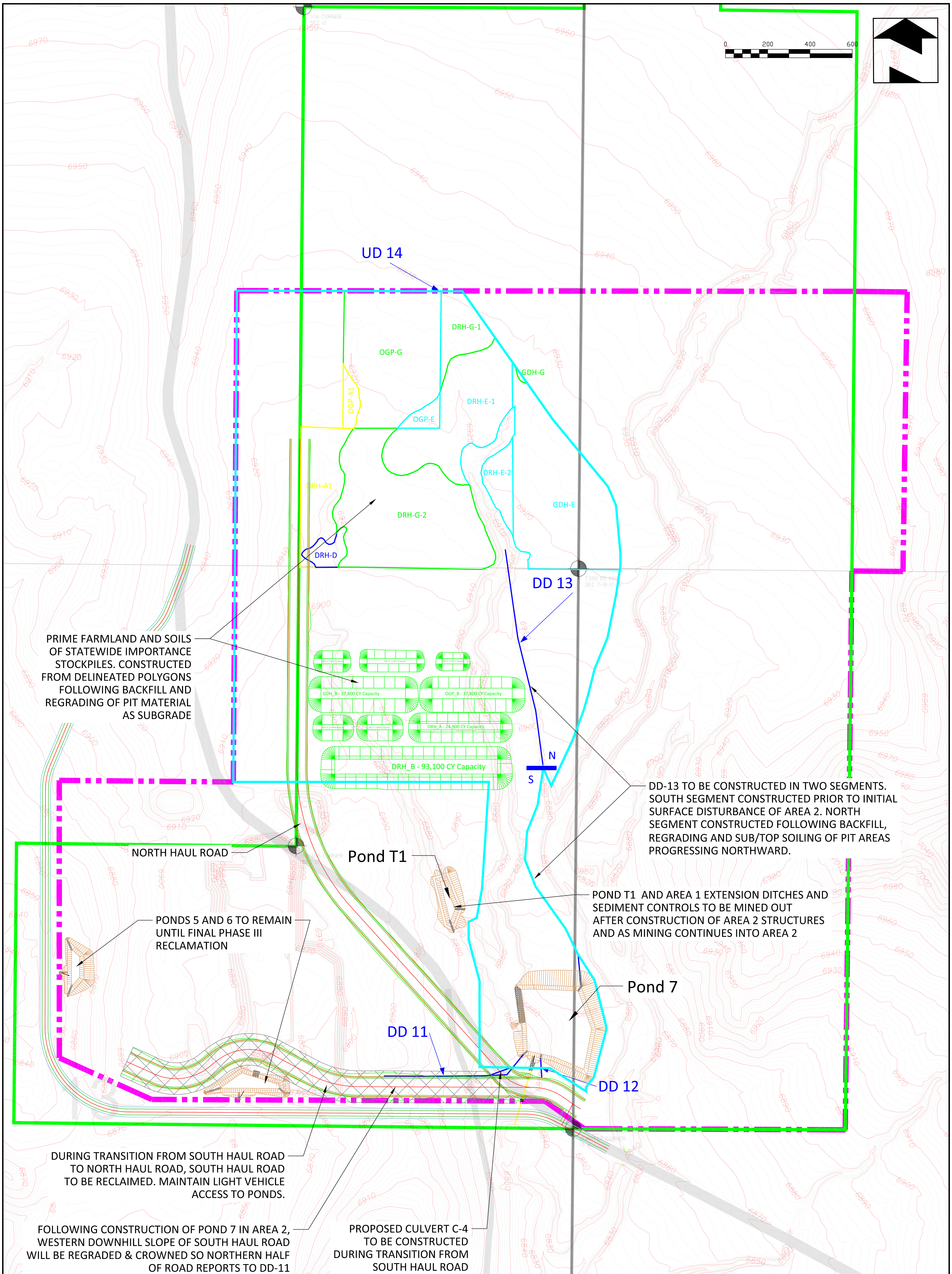
UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

TEMPORARY PIT 1/2 HAUL ROAD TO BE REMOVED FOLLOWING COMPLETION OF ROUTE 136 BYPASS & SOUTH HAUL ROAD
AIR MONITORING STATION TO BE INSTALLED PRIOR TO COMMENCEMENT OF MINING ACTIVITIES
TEMPORARY ACCESS GATES (4) TO BE REMOVED FOLLOWING COMPLETION OF ROUTE 136 BYPASS
Temporary Topsoil Stockpile 39,310 C.Y.
Temporary Subsoil Stockpile 27,310 C.Y.
TEMPORARY PERIMETER FENCE TO BE REMOVED FOLLOWING COMPLETION OF ROUTE 136 BYPASS
NE 1/16 CORNER
TEMPORARY PIT 1/2 HAUL ROAD TO BE REMOVED FOLLOWING COMPLETION OF ROUTE 136 BYPASS & SOUTH HAUL ROAD
DD 05
ROUTE 136 (K3900)
Temporary Spoil Stockpile 505,866 C.Y. (Pits 1 & 2)
Temporary Topsoil Stockpile 17,000 C.Y.
Pond 5
SEDIMENT CONTROL MEASURES (BERM & SILT FENCE) TO BE INSTALLED AS TOPSOIL IS SALVAGED ALONG EASTERN BOUNDARY OF AREA 1.
AREA 1 EXTENSION INTO PITS 7, 8 AND 9 ADDRESSED ON DRAWING 5-48A
PRIOR TO CONSTRUCTION OF POND 7 IN AREA 2, ALL SURFACE RUNOFF FROM WESTERN DOWNHILL SLOPE OF SOUTH HAUL ROAD WILL REPORT TO ASCA-1
DD 06
ASCA - 1 & 12" DROP-PIPE TO CULVERT C-2 (SEE APDX 5-14 FOR DETAILS)
SOUTH HAUL ROAD
PROPOSED CULVERT C-1
Pond 6
NORTH PRIVATE LEASE SITE ACCESS
Kanab Creek
QUARTER CORNER
ROUTE 136 (K3900) BYPASS
DD 07
DD 08
DD 09
PROPOSED CULVERT C-2 (SEE APDX 5-14 FOR DETAILS)
DD 10
TEMPORARY PERIMETER FENCE TO BE REMOVED FOLLOWING COMPLETION OF ROUTE 136 BYPASS
0 100 200 300
Contour Interval = 4'
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192
FACILITIES AND STRUCTURE CONSTRUCTION SEQUENCE - AREA 1
NORTH COAL HOLLOW PROJECT ALTON, UTAH
DRAWING: 5-48
REVISIONS
DATE: BY:
4/12/16 AC
5/18/16 AC
8/15/16 AC
9/7/16 AC
10/3/16 AC
2/2/17 AC
5/4/17 AC
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 5-48
DATE: 10/12/15
SCALE: 1" = 100'
JOB NUMBER: 0001
SHEET
LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER


ROUTE 136 (K3900)
TEMPORARY SEDIMENT CONTROL MEASURES (BERM & SILT FENCE) TO BE INSTALLED ALONG CREST OF UNDISTURBED DRAINAGE AS TOPSOIL IS SALVAGED IN AREAS ADJACENT TO UNDISTURBED DRAINAGE PRIOR TO APPROVAL AND DISTURBANCE OF AREA 2.
AREA 1 EXTENSION SEDIMENT CONTROL MEASURES ARE PROPOSED AS TEMPORARY STRUCTURES TO BE CONSUMED FOLLOWING APPROVAL OF AREAS 2 & 3 FOR MINING.
AREA 1 EXTENSION STRUCTURES TO REMAIN IN PLACE UNTIL CONSTRUCTION OF AREA 2 STRUCTURES.
DD T1-01
NE 1/16 CORNER
PROPOSED CULVERT UC-T1-01 CONSTRUCTED TO CARRY ALL UNDISTURBED DRAINAGE UNDER POND T1.
TEMPORARY SEDIMENT CONTROL MEASURES (EXCELSIOR LOG) TO BE INSTALLED ALONG CREST AND FACE OF POND SLOPES ABOVE UNDISTURBED CULVERT INLET AND OUTLET.
Pond T1
SEDIMENT CONTROL MEASURES (BERM & SILT FENCE) TO BE INSTALLED AS TOPSOIL IS SALVAGED ALONG EASTERN BOUNDARY OF EXTENDED AREA 1.
Pond 5
INSTALL PUMP AND 4" POLY PIPELINE TO POND 6 PRIOR TO MINING IN PIT 7
DD T1-02 TO BE CONSUMED AS PIT 9 ADVANCES, THEN REBUILT AS BACKFILL PROGRESSES UNTIL CONSTRUCTION OF AREA 2 STRUCTURES
SEDIMENT CONTROL MEASURES (BERM & SILT FENCE) FROM AREA 1 TO REMAIN UNTIL MINED OUT, THEN PARTIALLY REPLACED AFTER BACKFILL AS SHOWN
PRIOR TO CONSTRUCTION OF POND 7 IN AREA 2, ALL SURFACE RUNOFF FROM WESTERN DOWNHILL SLOPE OF SOUTH HAUL ROAD WILL REPORT TO ASCA-1
DD T1-02
SOUTH HAUL ROAD
Kanab Creek
Pond 6
13
0 100 200 300
AS PIT BACKFILL CONTINUES FROM WEST TO EAST, SOUTH HAUL ROAD TO BE RECLAIMED. MAINTAIN ACCESS TO PONDS.
QUARTER CORNER
ROUTE 136 (K3900) BYPASS
Contour Interval = 4'
Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192
FACILITIES AND STRUCTURE CONSTRUCTION SEQUENCE - AREA 1 EXT.
NORTH COAL HOLLOW PROJECT
ALTON, UTAH
DRAWING: 5-48A
REVISIONS
DATE: BY:
10/3/16 AC
11/22/16 AC
2/2/17 AC
5/4/17 AC
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 5-48A
DATE: 9/7/15
SCALE: 1" = 100'
JOB NUMBER: 0001
SHEET
LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER



Contour Interval = 4'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING:	DATE:
5-49	10/12/15
	SCALE:
	1" = 200'
JOB NUMBER:	SHEET
0001	

REVISIONS

DATE:	BY:
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

FACILITIES AND STRUCTURES CONSTRUCTION SEQUENCE - AREA 2

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-49

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
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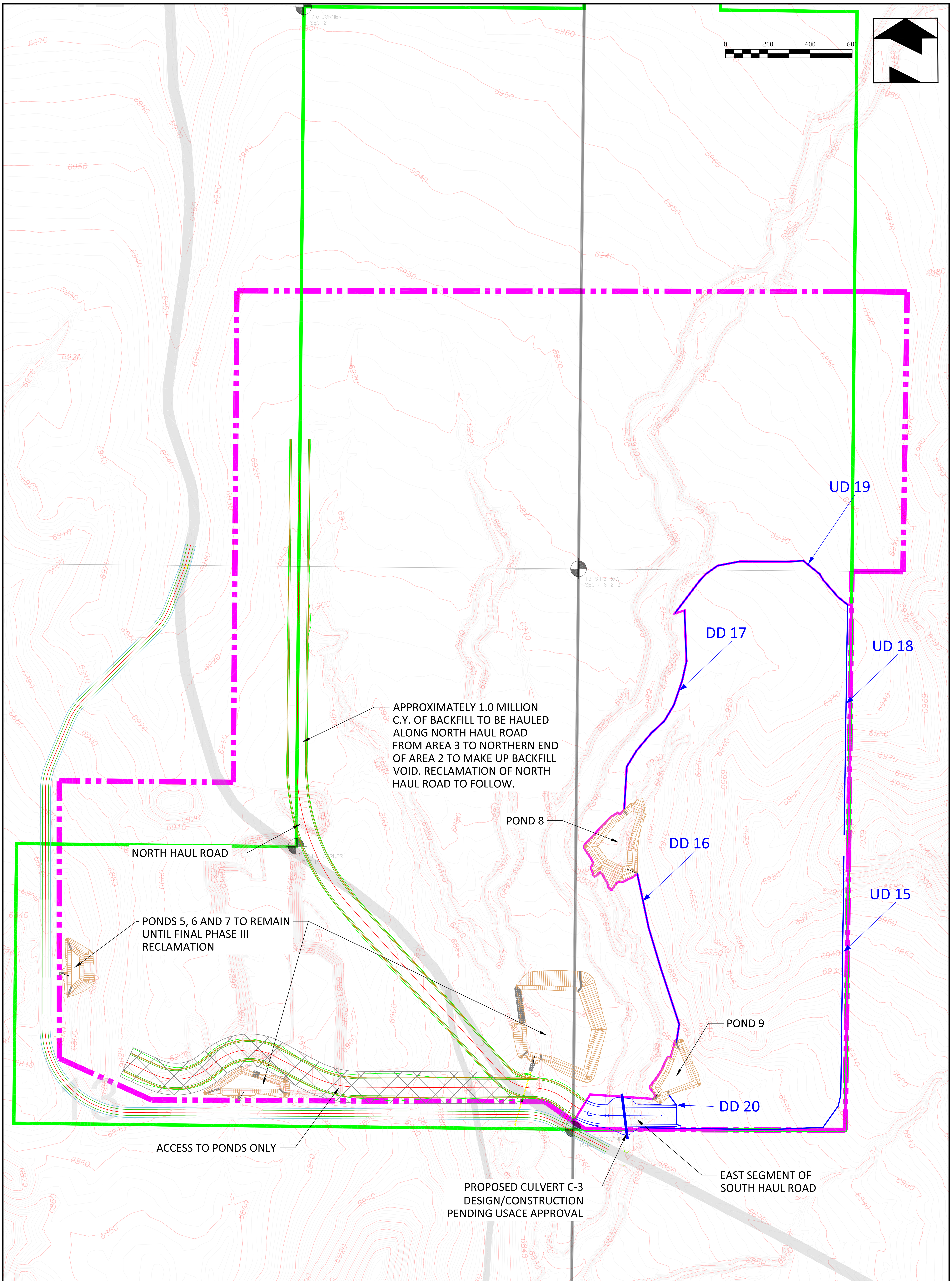

Contour Interval = 4'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 5-50
DATE: 10/12/15
SCALE: 1" = 200'
JOB NUMBER: 0001
SHEET

REVISIONS

DATE:	BY:
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

FACILITIES AND STRUCTURES CONSTRUCTION SEQUENCE - AREA 3

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-50

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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Coal Hollow Project

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Phone (435)867-5331
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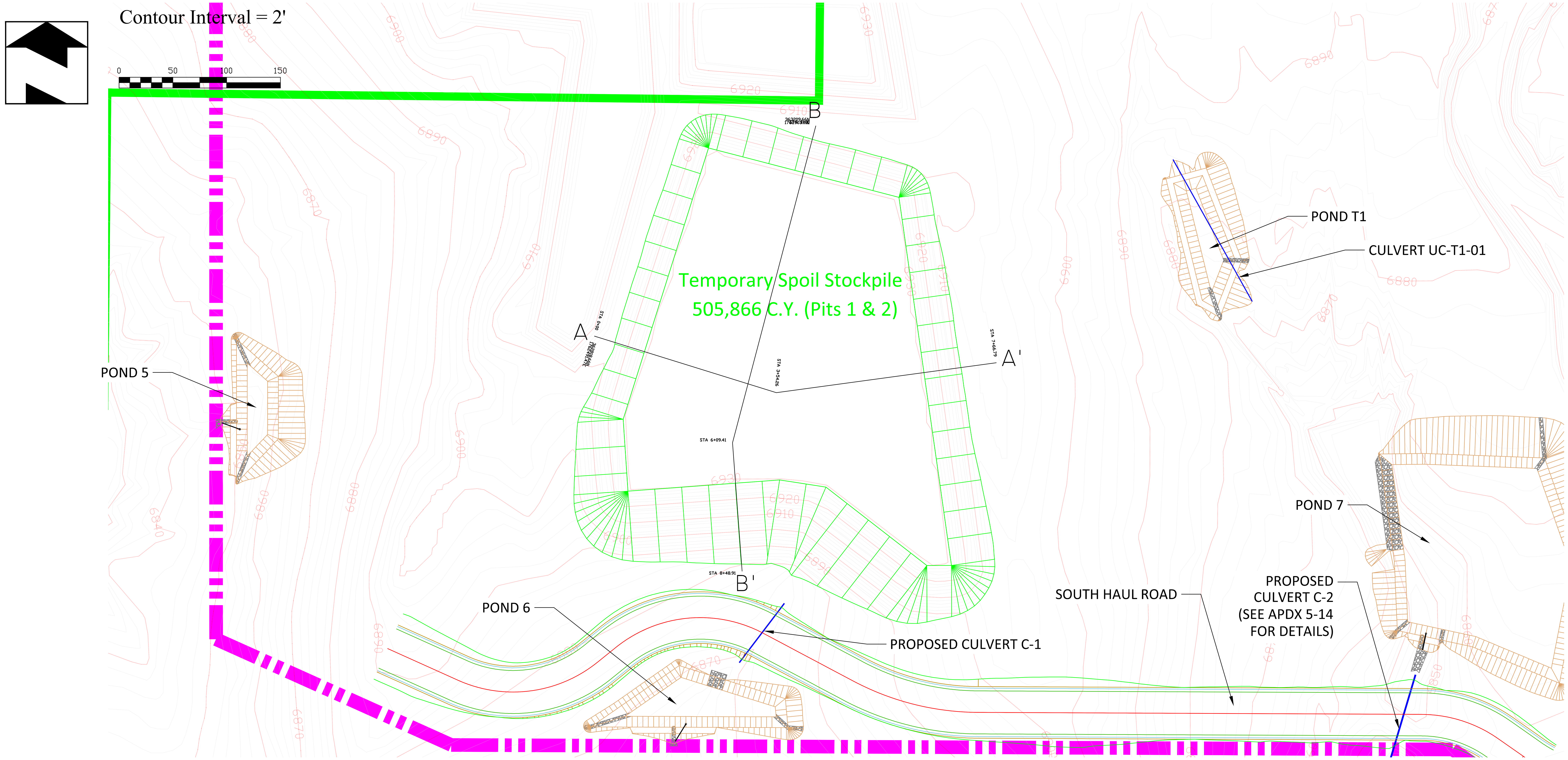
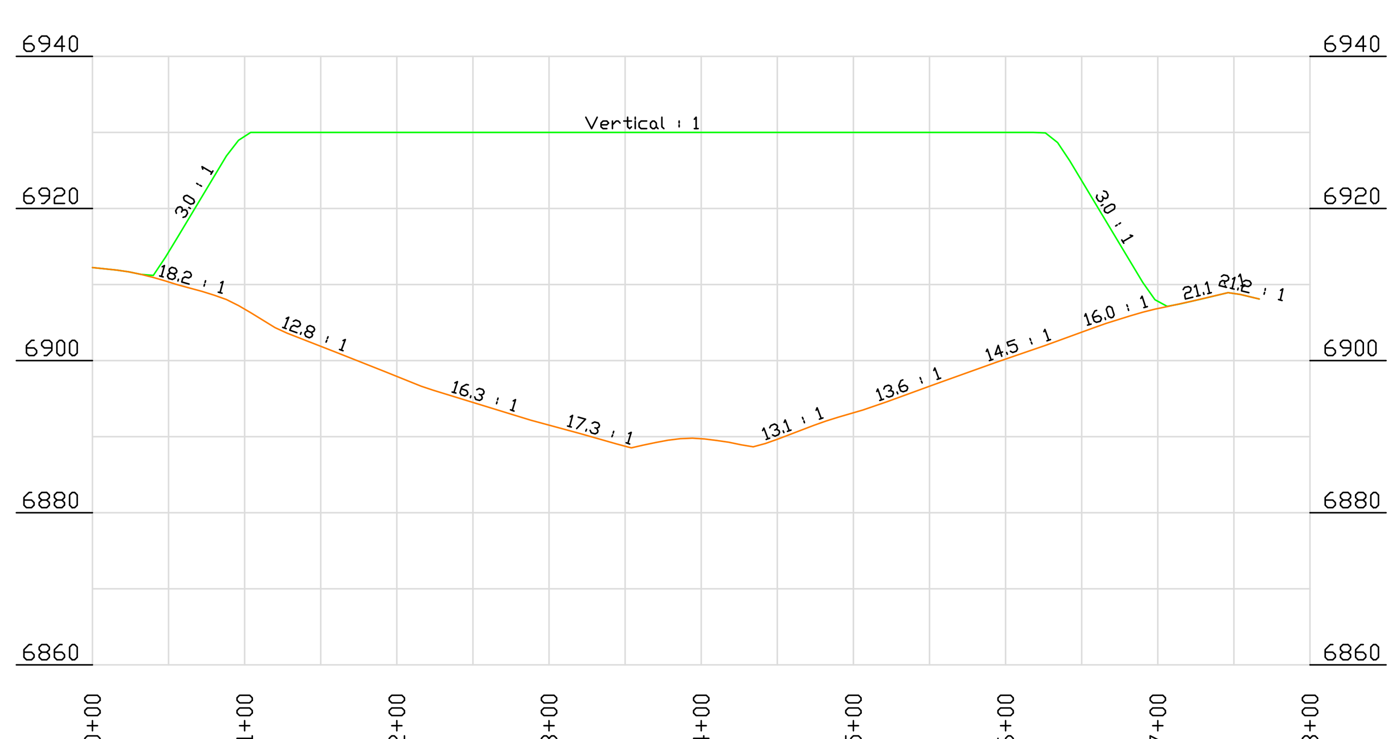
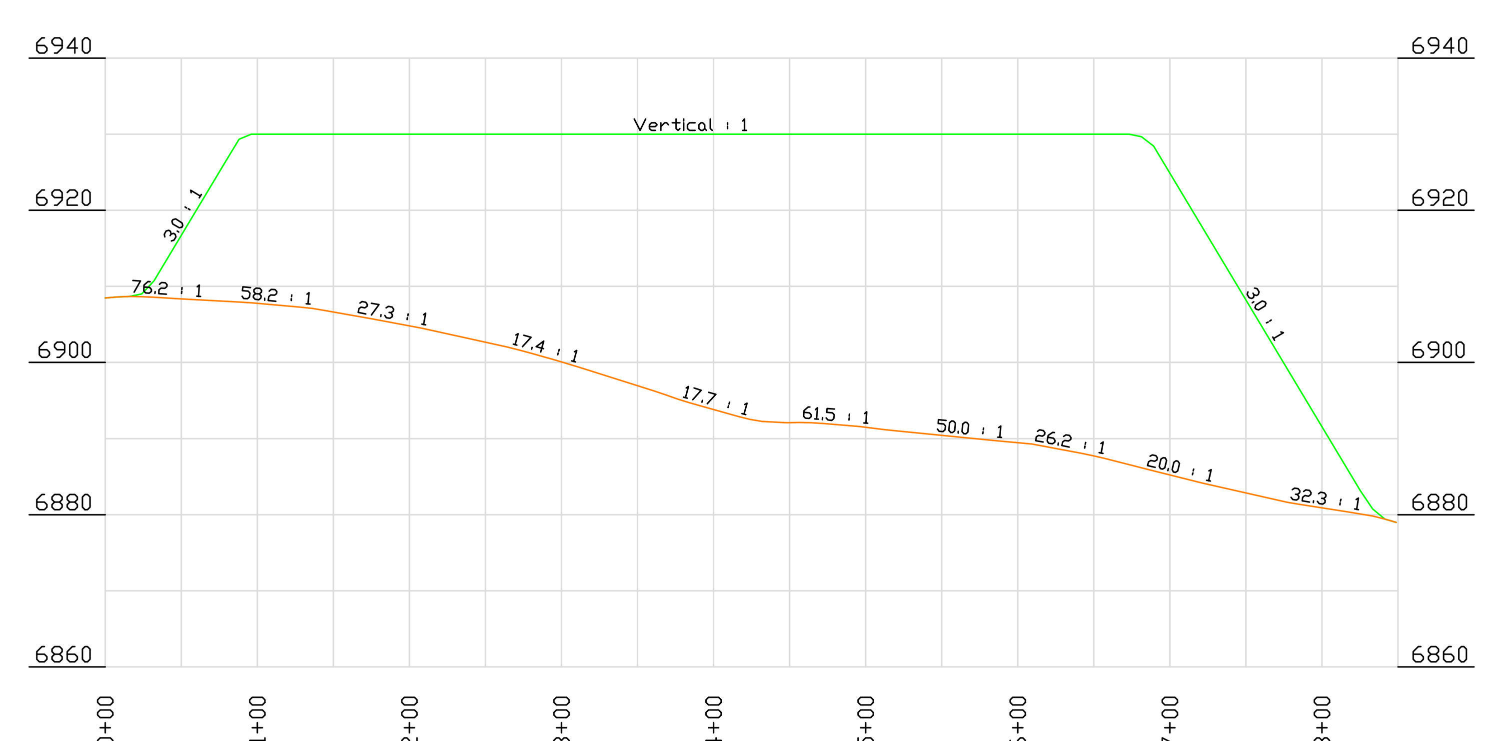
Contour Interval = 2'



TEMP. SPOIL PILE A-A'



TEMP. SPOIL PILE B-B'



1"=20'
X-Section Scale
1"=100'

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Coal Hollow Project
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TEMPORARY SPOIL STOCKPILE DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-51A

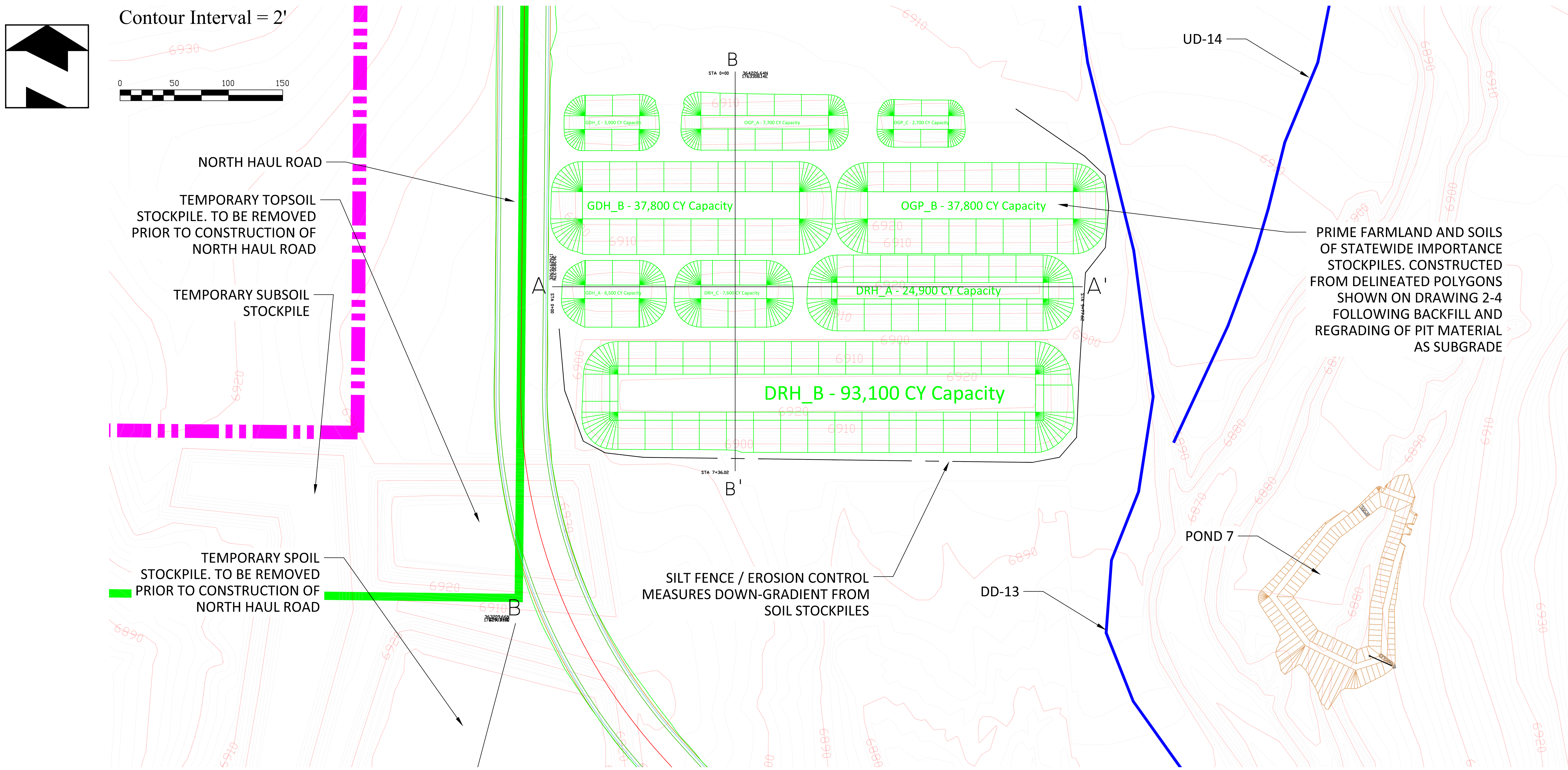
REVISIONS

DATE:	BY:
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

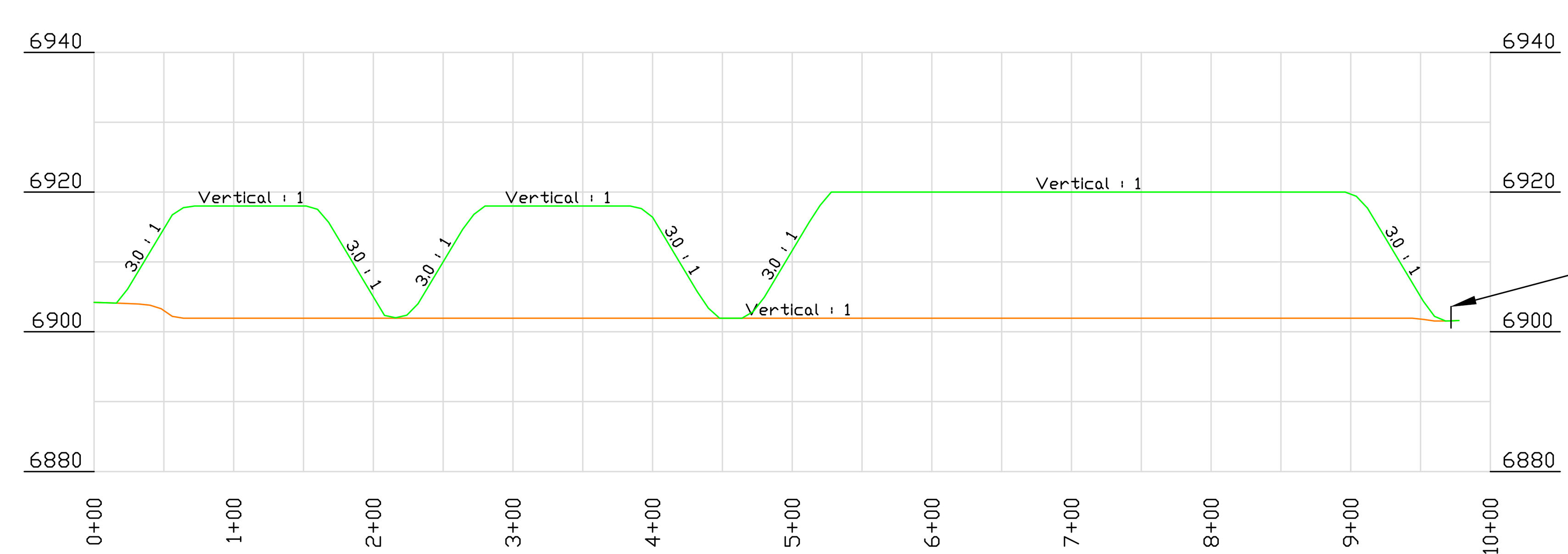
DRAWN BY: A. CHRISTENSEN	CHECKED BY: DG
DRAWING: 5-51A	DATE: 4/10/15
	SCALE: 1" = 50'
JOB NUMBER: 1400	SHEET

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

Contour Interval = 2'

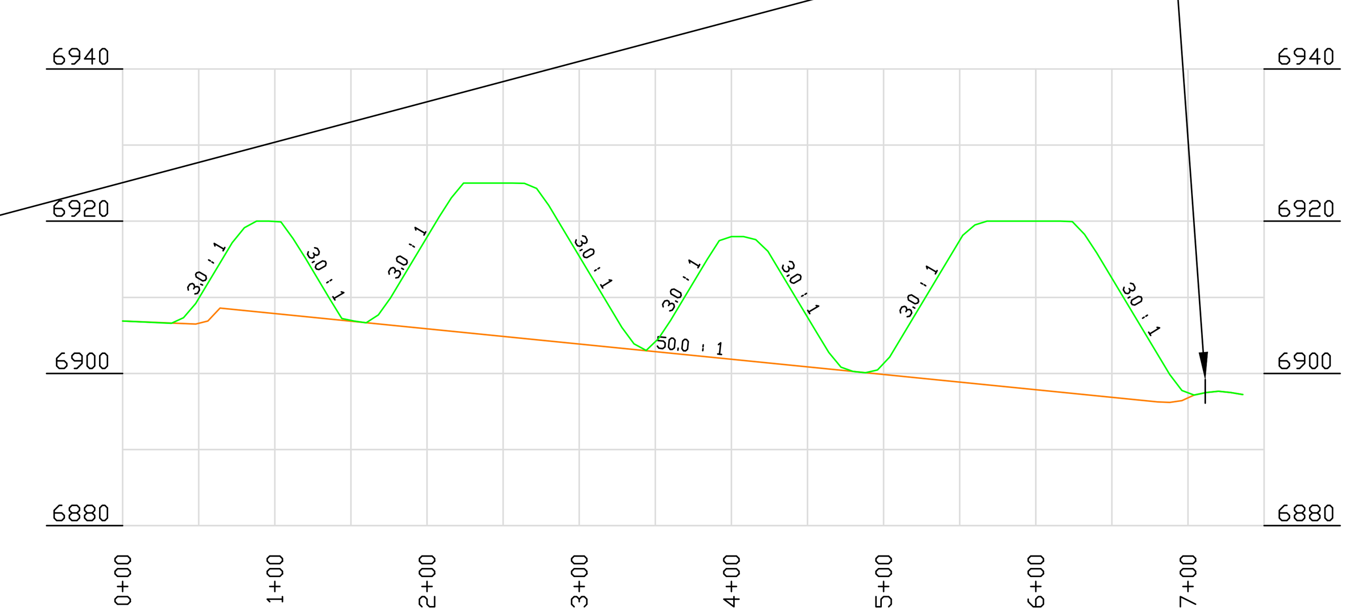


TOPSOIL PILES A-A'



TOPSOIL PILES B-B'

SILT FENCE / EROSION CONTROL MEASURES DOWN-GRADIENT FROM SOIL STOCKPILES



1"=20'
X-Section Scale
1"=100'

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Fax (435)867-1192

TOPSOIL STOCKPILES DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

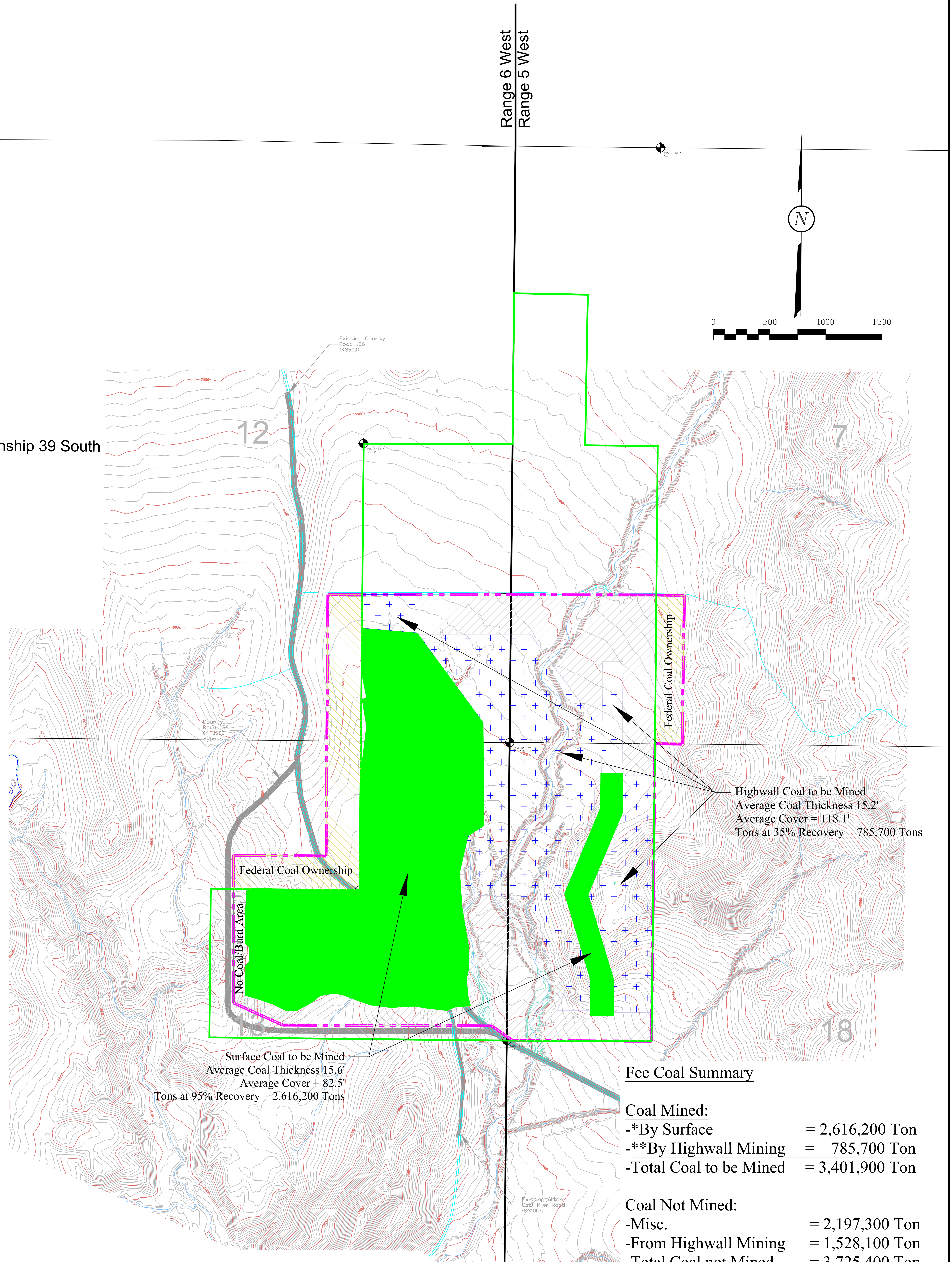
DRAWING: 5-51B

REVISIONS

DATE:	BY:
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DRAWING: 5-51B
DATE: 4/10/15
SCALE: 1" = 50'
JOB NUMBER: 1400
SHEET

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER



Fee Coal Summary

Coal Mined:

-*By Surface	= 2,616,200 Ton
-**By Highwall Mining	= 785,700 Ton
-Total Coal to be Mined	= 3,401,900 Ton

Coal Not Mined:

-Misc.	= 2,197,300 Ton
-From Highwall Mining	= 1,528,100 Ton
-Total Coal not Mined	= 3,725,400 Ton

Total Fee Coal = 7,127,300 Ton

*All tons are at 95% recovery
** All Tons are at 35% recovery

Federal Coal - Not Mined
Coal Mined Surface
Coal Mined Surface/Highwall Miner
Coal not Mined (Under Sloped Highwall, Misc)
No Coal, Burn Area

Contour Interval = 4'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING: 5-52	DATE: 8/8/14
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

COAL EXTRACTION OVERVIEW

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-52

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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Coal Hollow Project
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Cedar City, Utah 84721
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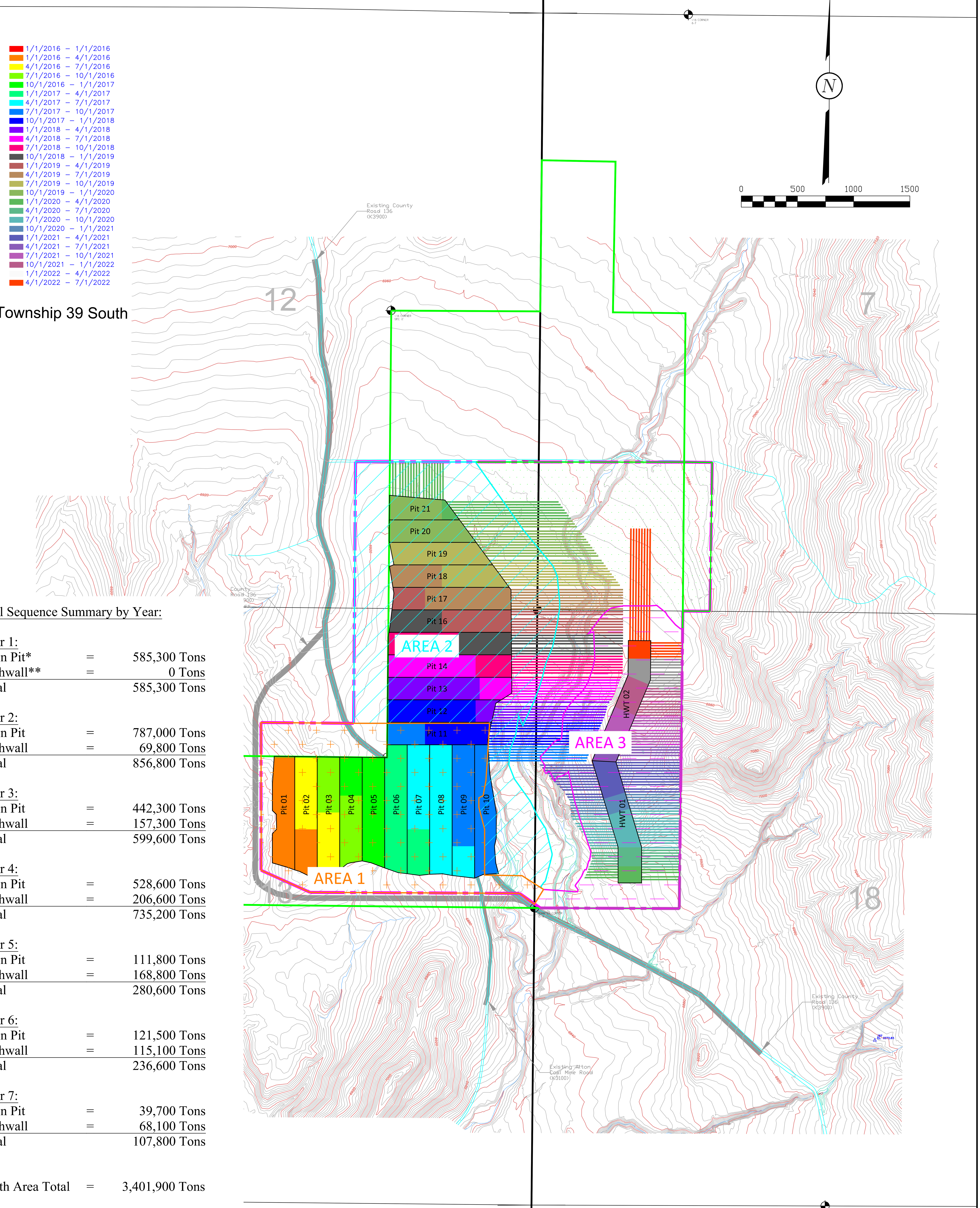
Fax (435)867-1192

Note:
- Pit boundaries represent extent of extracted coal, See Dwg. 5-57 for surface pit boundaries.
- Sequence colors represent Quarters of years as noted below.



Coal Sequence Summary by Year:

Year 1:		
Open Pit*	=	585,300 Tons
Highwall**	=	0 Tons
Total		585,300 Tons
Year 2:		
Open Pit	=	787,000 Tons
Highwall	=	69,800 Tons
Total		856,800 Tons
Year 3:		
Open Pit	=	442,300 Tons
Highwall	=	157,300 Tons
Total		599,600 Tons
Year 4:		
Open Pit	=	528,600 Tons
Highwall	=	206,600 Tons
Total		735,200 Tons
Year 5:		
Open Pit	=	111,800 Tons
Highwall	=	168,800 Tons
Total		280,600 Tons
Year 6:		
Open Pit	=	121,500 Tons
Highwall	=	115,100 Tons
Total		236,600 Tons
Year 7:		
Open Pit	=	39,700 Tons
Highwall	=	68,100 Tons
Total		107,800 Tons
North Area Total	=	3,401,900 Tons

*All tons are at 95% recovery
** All Tons are at 35% recovery

Contour Interval = 4'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-53	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

COAL REMOVAL SEQUENCE

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-53

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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Coal Hollow Project

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Cedar City, Utah 84721
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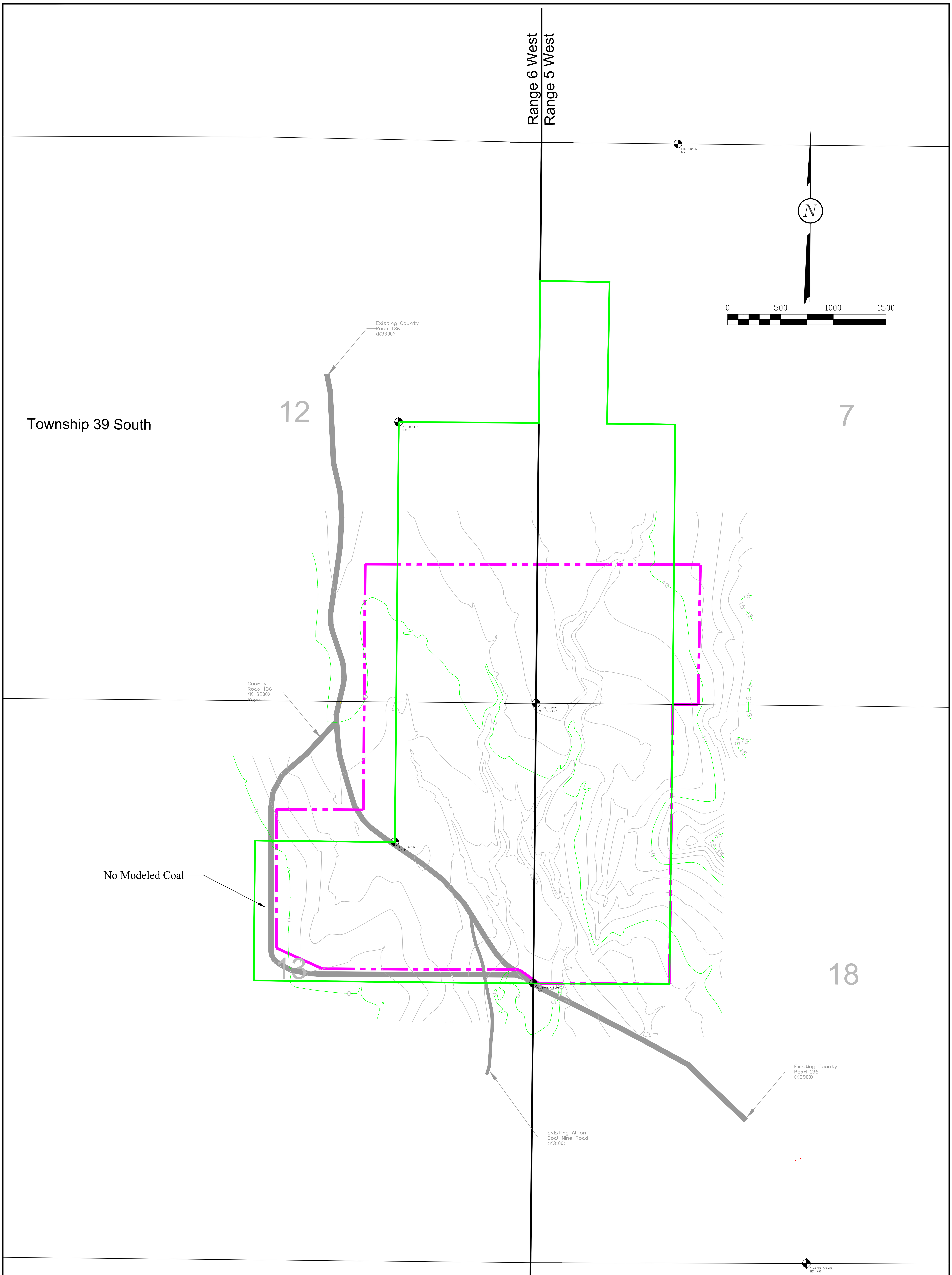

Strip Ratio in C.Y. Overburden / Ton Coal

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING:	DATE:
5-54	7/14/14
	SCALE:
	1" = 400'
JOB NUMBER:	SHEET
0001	

REVISIONS

DATE:	BY:
03/12/15	KN
04/10/15	AC
10/12/15	AC
12/15/15	AC
1/8/16	AC
8/15/16	AC
5/4/17	AC

STRIP RATIO ISOPACH

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-54

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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Coal Hollow Project

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Cedar City, Utah 84721
Phone (435)867-5331
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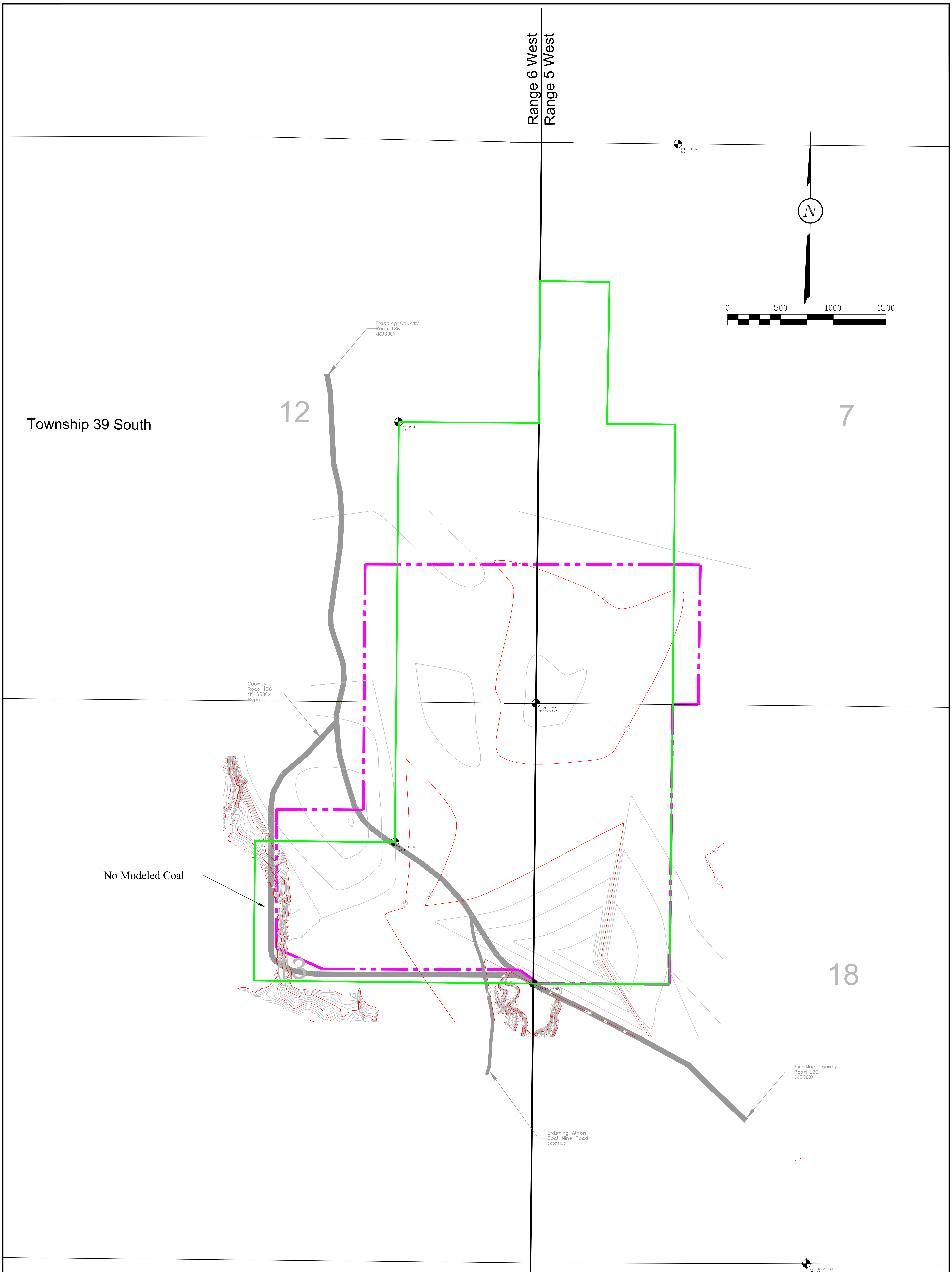

Thickness Contour Interval = 1'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING: 5-55	DATE: 7/14/14
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
03/11/15	KN
04/10/15	AC
10/12/15	AC
12/15/15	AC
1/8/16	AC
8/15/16	AC
5/4/17	AC

COAL THICKNESS
ISOPACH

NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-55

UTAH REGISTERED PROFESSIONAL ENGINEER
#154168
DAN W. GUY

Alton Coal Development
Coal Hollow Project

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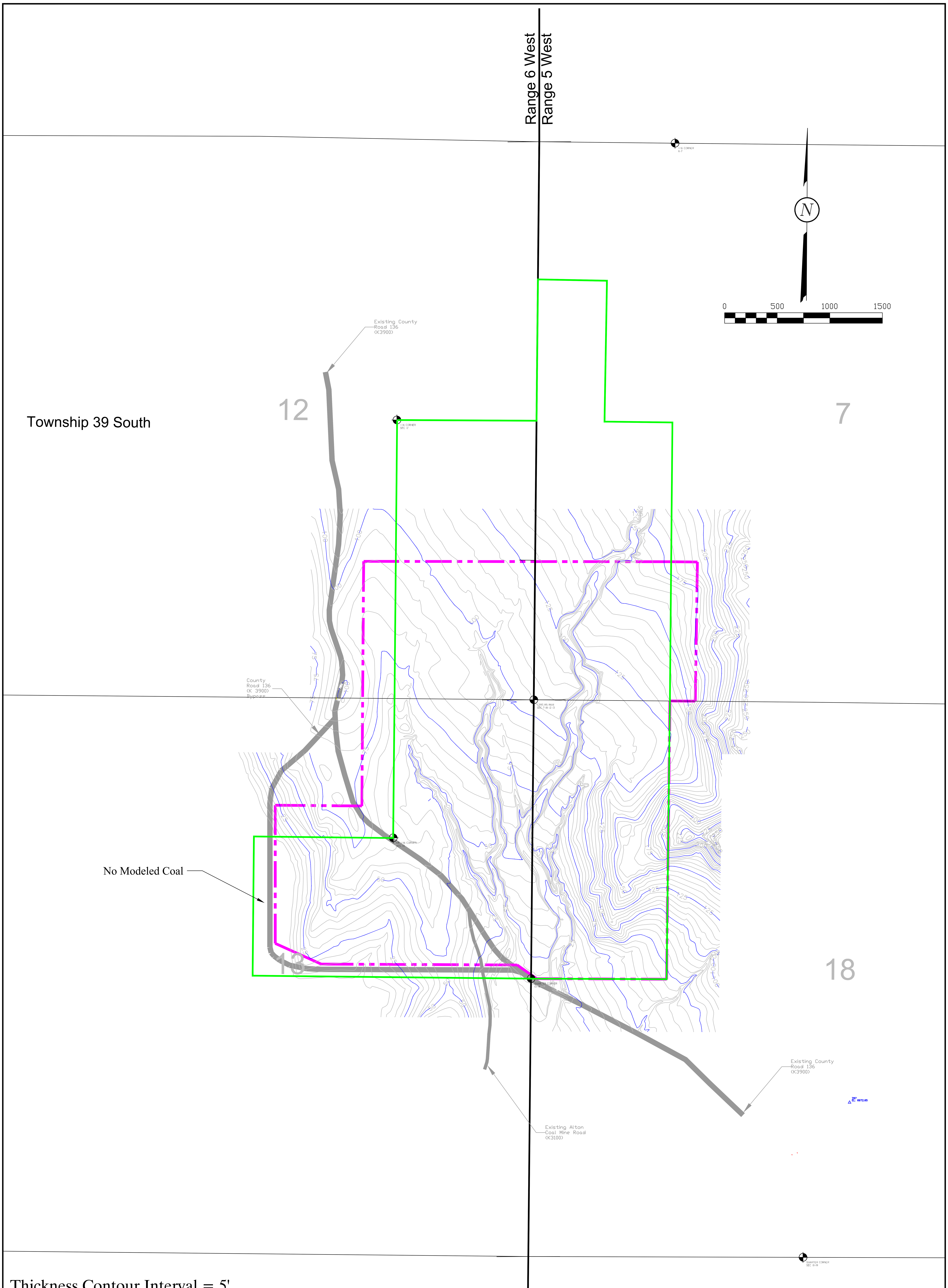
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Thickness Contour Interval = 5'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
K. NICHOLES	DWG
DRAWING: 5-56	DATE: 8/8/14
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS	
DATE:	BY:
03/11/15	KN
04/10/15	AC
10/12/15	AC
12/15/15	AC
1/8/16	AC
8/15/16	AC
5/4/17	AC

OVERBURDEN THICKNESS ISOPACH

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-56

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

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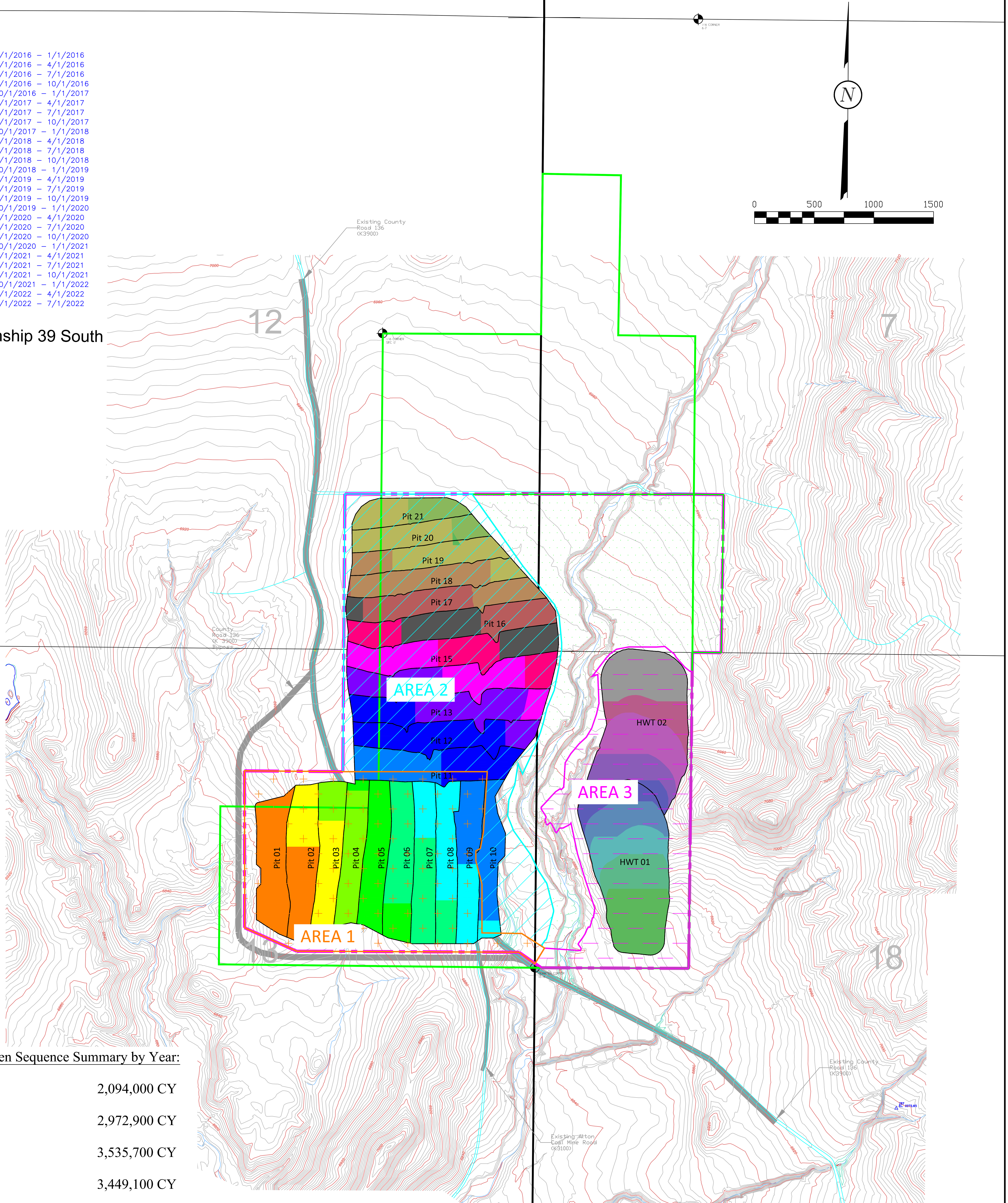
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

Note:
- Pit boundaries indicate projected pit limits and mining surface disturbance extents.
- Sequence colors represent Quarters of years as noted below.



Overburden Sequence Summary by Year:

Year 1:	2,094,000 CY
Year 2:	2,972,900 CY
Year 3:	3,535,700 CY
Year 4:	3,449,100 CY
Year 5:	2,790,200 CY
Year 6:	2,780,700 CY
Year 7:	977,200 CY
North Area Total	18,599,800 CY

Contour Interval = 4'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-57	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

OVERBURDEN REMOVAL SEQUENCE

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-57

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development Coal Hollow Project

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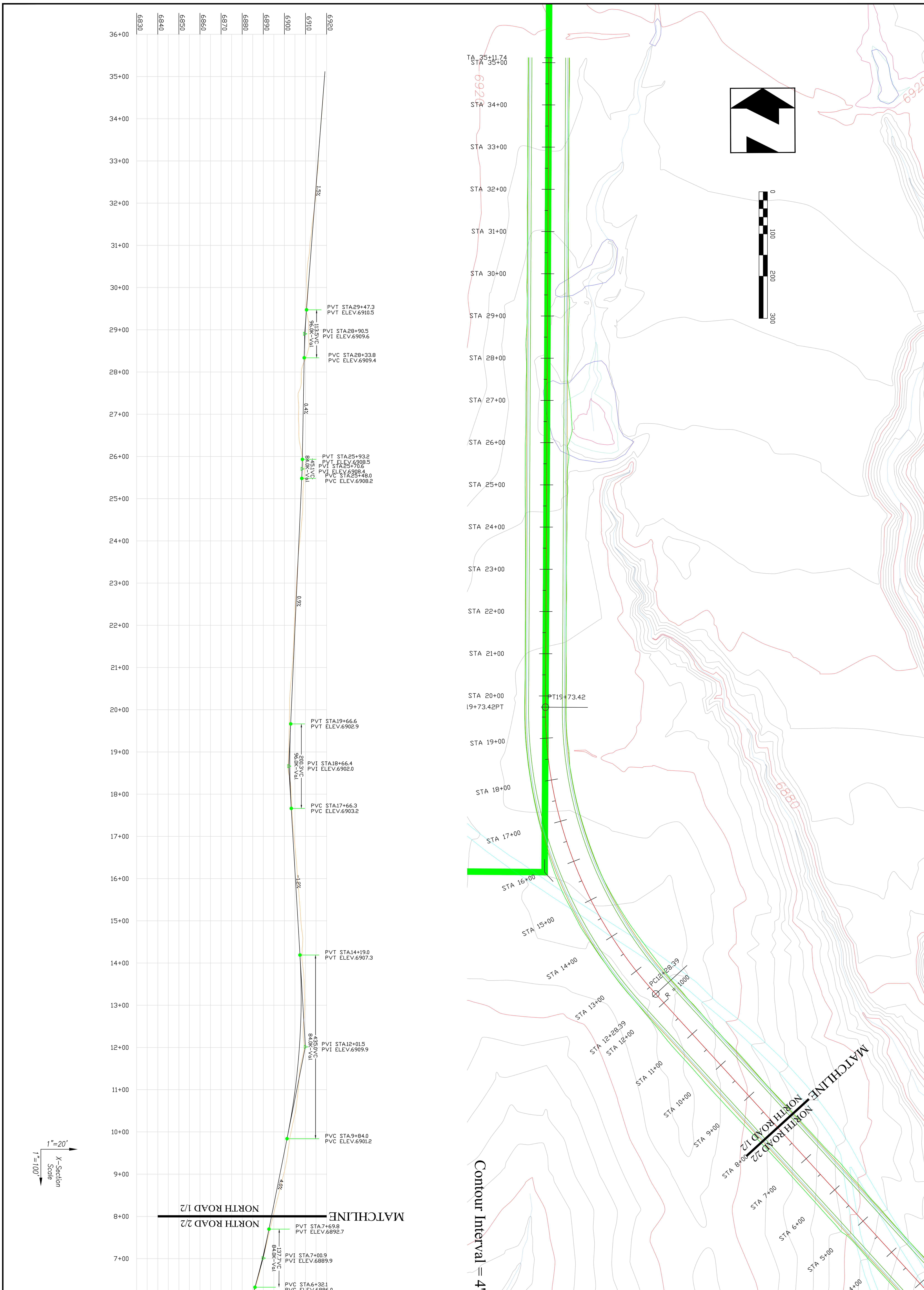
Phone (435)867-5331
Fax (435)867-1192



LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DG
DRAWING: 5-58	DATE: 4/10/15
	SCALE: 1" = 100'
JOB NUMBER: 1400	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

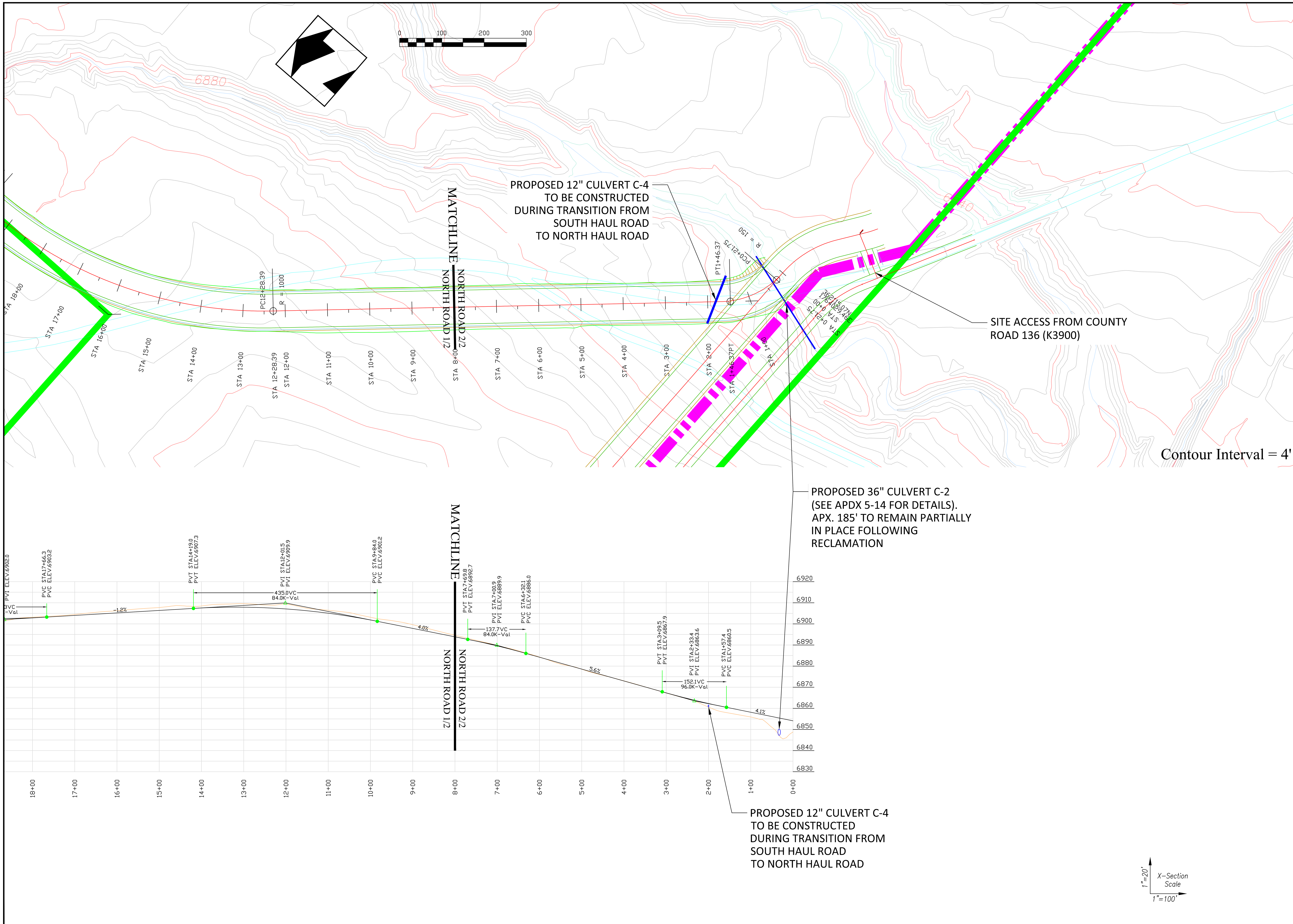
PRIMARY ROADS NORTHERN HAUL ROAD 1/2 PLAN & PROFILE

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-58

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435)867-5331
Fax (435)867-1192



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Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435)867-5331
Fax (435)867-1192

PRIMARY ROADS NORTHERN HAUL ROAD 2/2 PLAN & PROFILE

COAL HOLLOW PROJECT
ALTON, UTAH

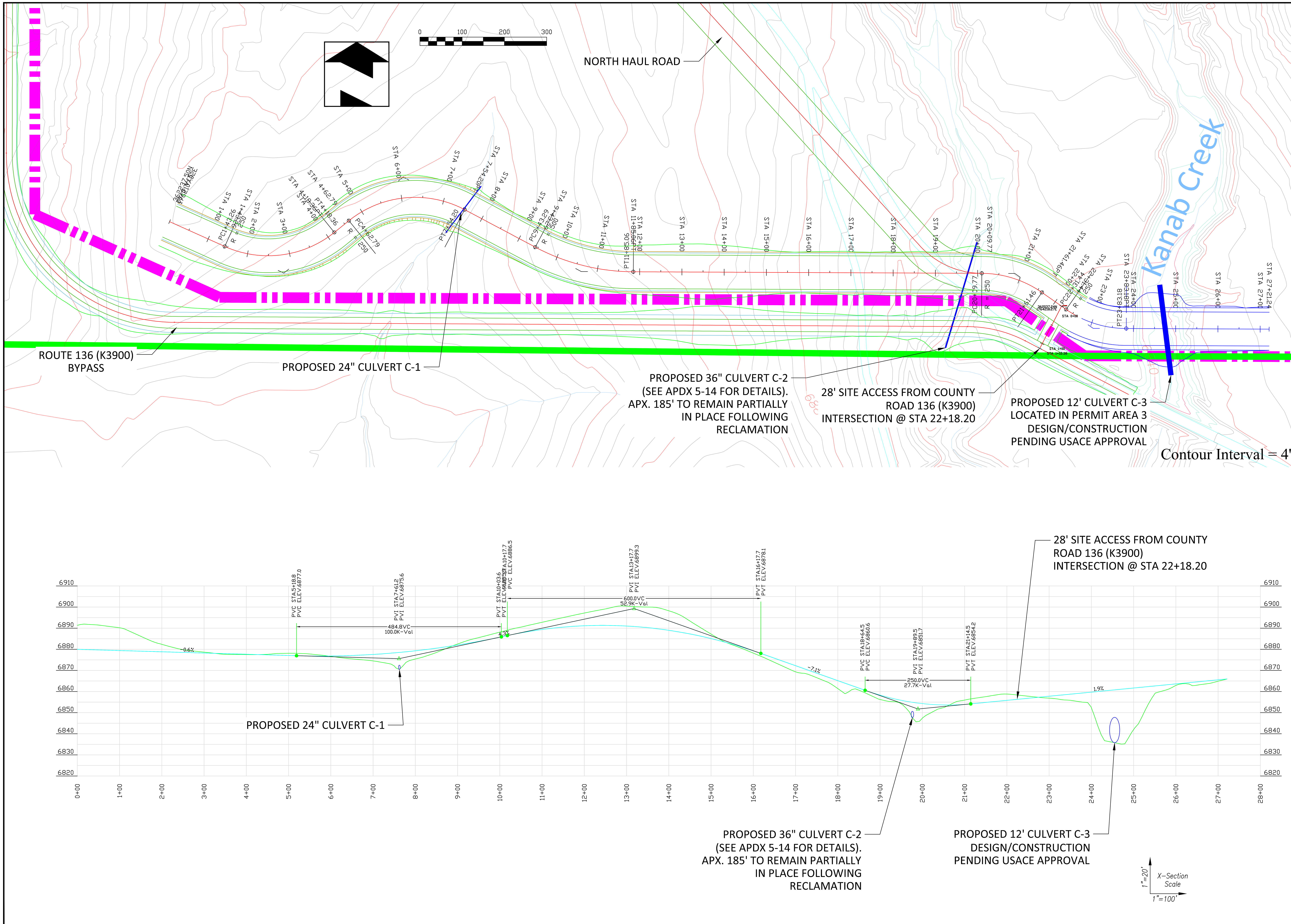
DRAWING: 5-59

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DRAWN BY: A. CHRISTENSEN	CHECKED BY: DG
DRAWING: 5-59	DATE: 4/10/15
	SCALE: 1" = 100'
JOB NUMBER: 1400	SHEET

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER



Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
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Phone (435)867-5331
Fax (435)867-1192

PRIMARY ROADS SOUTHERN HAUL ROAD PLAN & PROFILE

COAL HOLLOW PROJECT
ALTON, UTAH

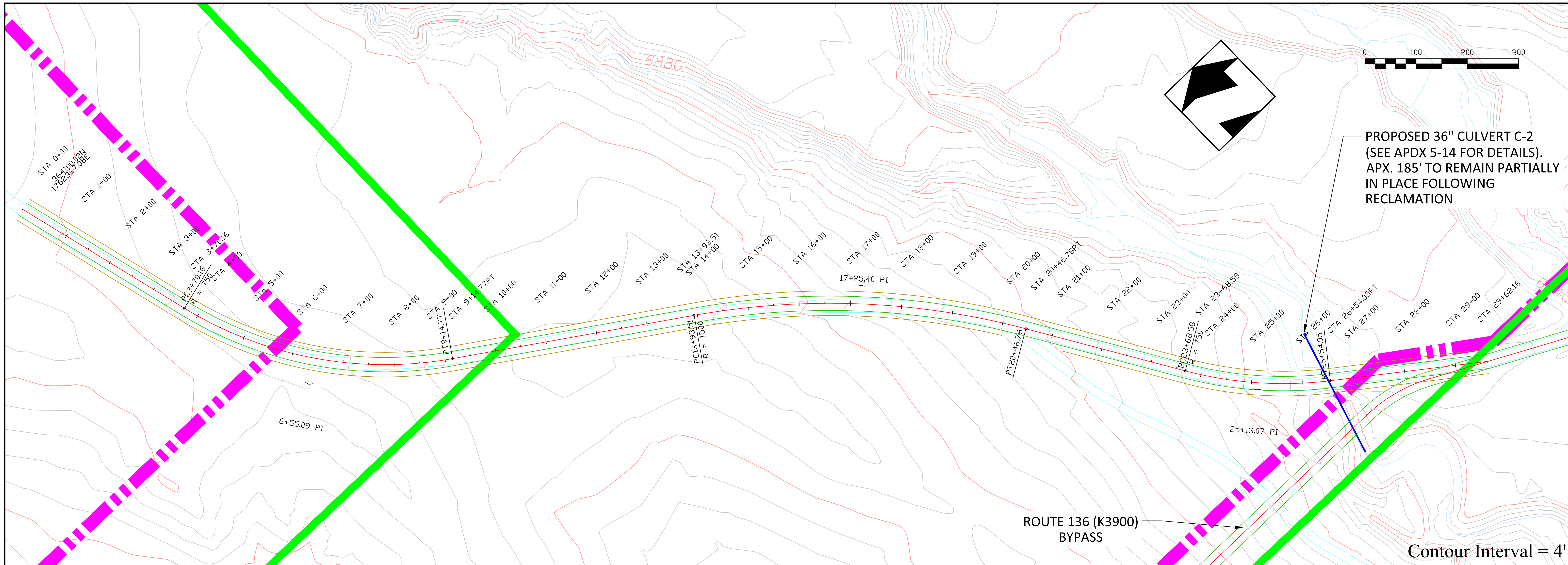
DRAWING: 5-60

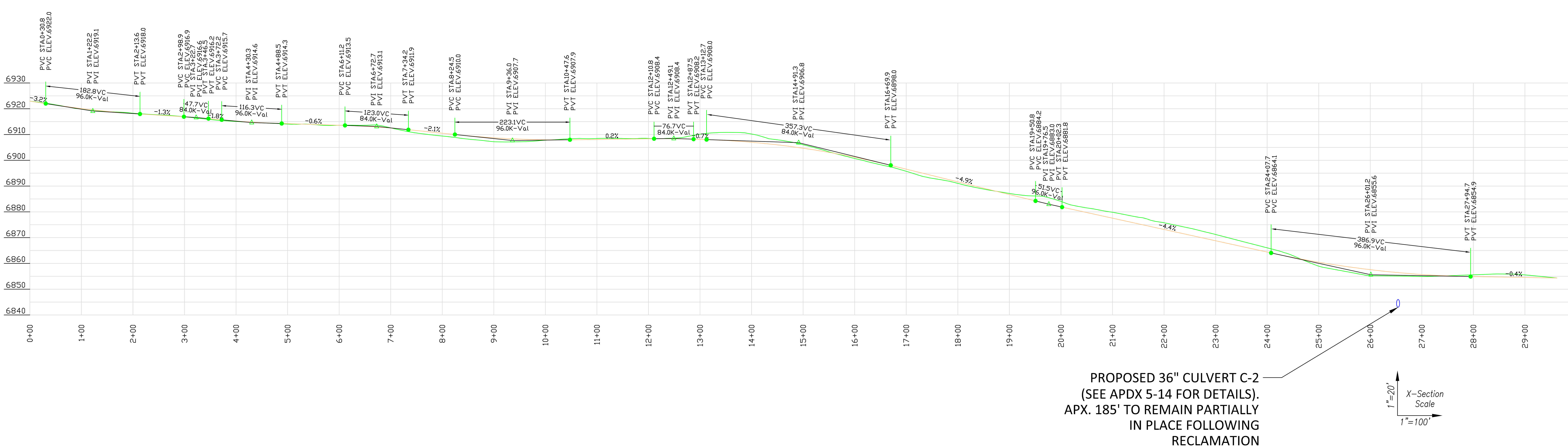
REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DRAWING: 5-60
DATE: 4/10/15
SCALE: 1" = 100'
JOB NUMBER: 1400
SHEET

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER





Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435)867-5331
Fax (435)867-1192

POSTMINING ROADWAYS ROUTE 136 (K3900) PLAN & PROFILE

COAL HOLLOW PROJECT
ALTON, UTAH

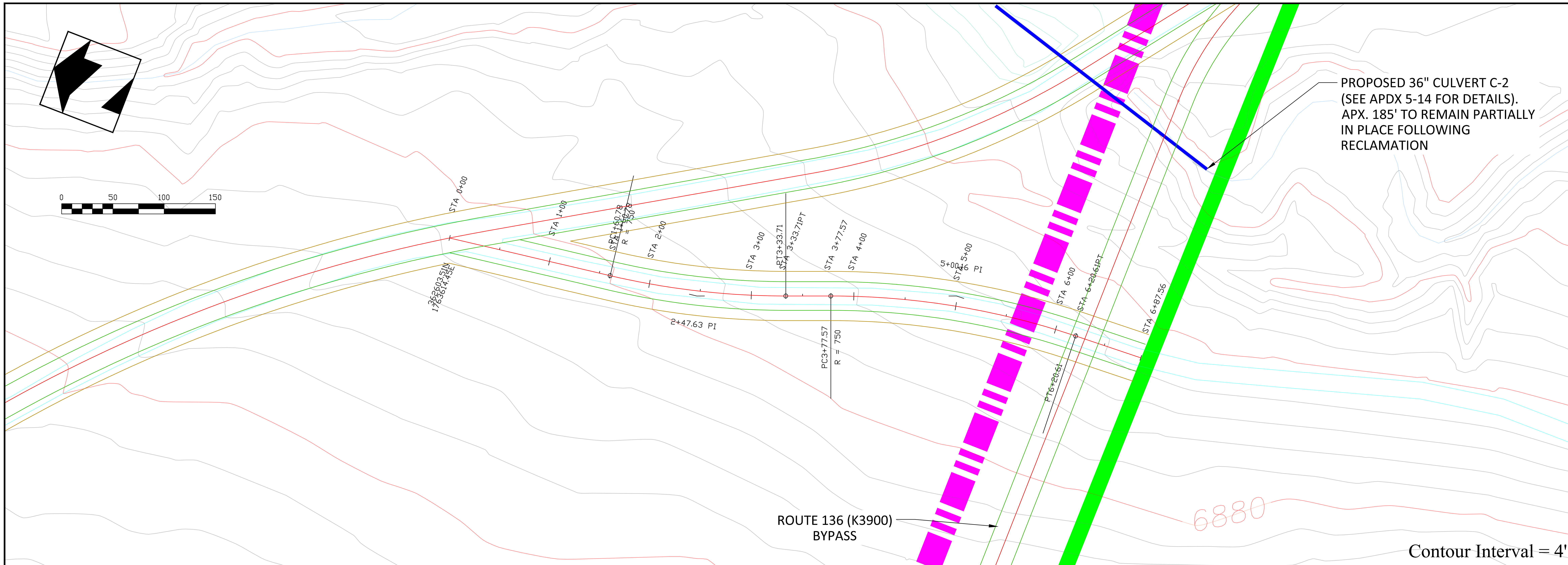
DRAWING: 5-61

REVISIONS

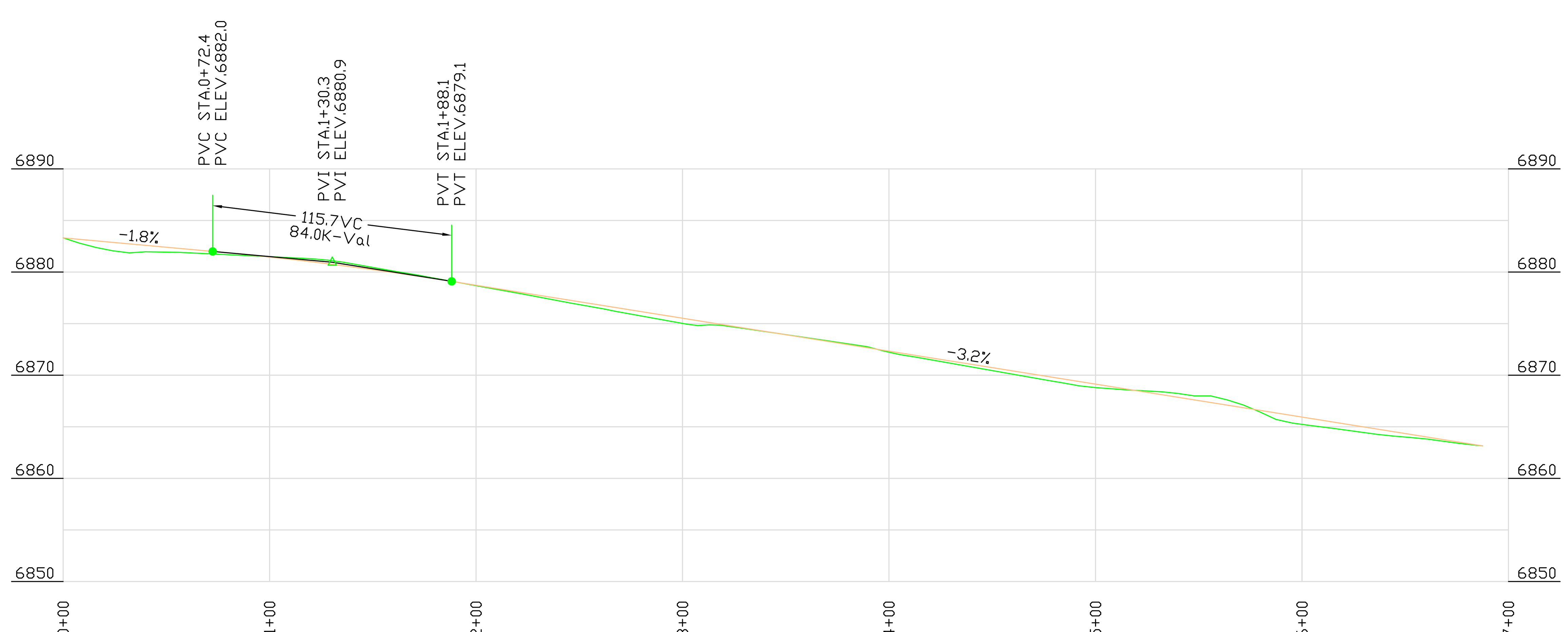
DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DRAWN BY: A. CHRISTENSEN	CHECKED BY: DG
DRAWING: 5-61	DATE: 4/10/15
	SCALE: 1" = 100'
JOB NUMBER: 1400	SHEET

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER



Contour Interval = 4'



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Fax (435)867-1192

POSTMINING ROADWAYS
ALTON COAL MINE ROAD (K3100)
PLAN & PROFILE

COAL HOLLOW PROJECT
ALTON, UTAH

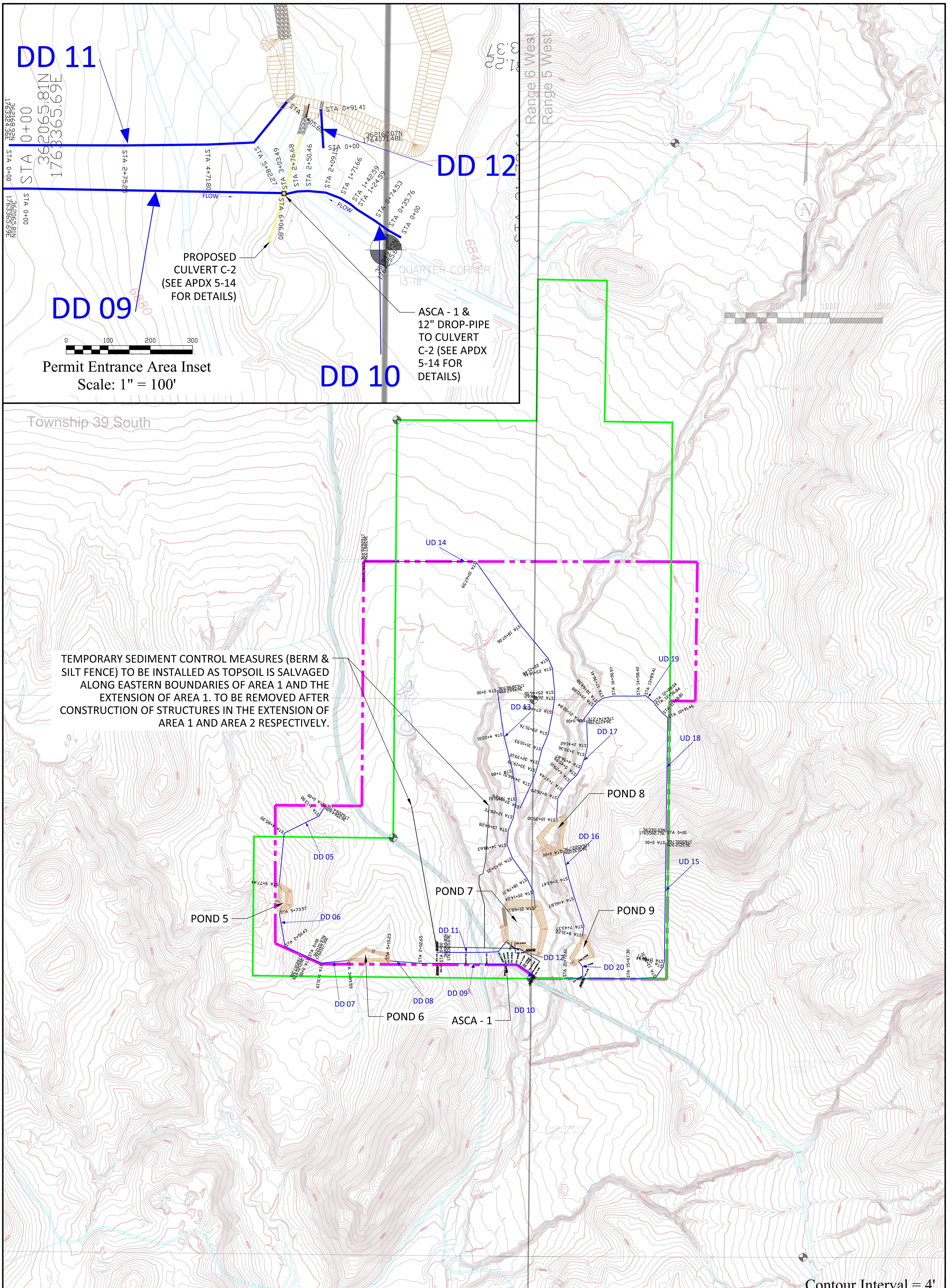
DRAWING: 5-62

REVISIONS

DATE:	BY:
12/1/15	AC
12/15/15	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DRAWN BY: A. CHRISTENSEN	CHECKED BY: DG
DRAWING: 5-62	DATE: 4/10/15
JOB NUMBER: 1400	SCALE: 1" = 50'
	SHEET

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER



LEGEND:

- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-65	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

DIVERSION DITCH AND SEDIMENT IMPOUNDMENT PLAN VIEW

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-65

UTAH REGISTERED PROFESSIONAL ENGINEER #154160 DAN W. GUY

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Coal Hollow Project
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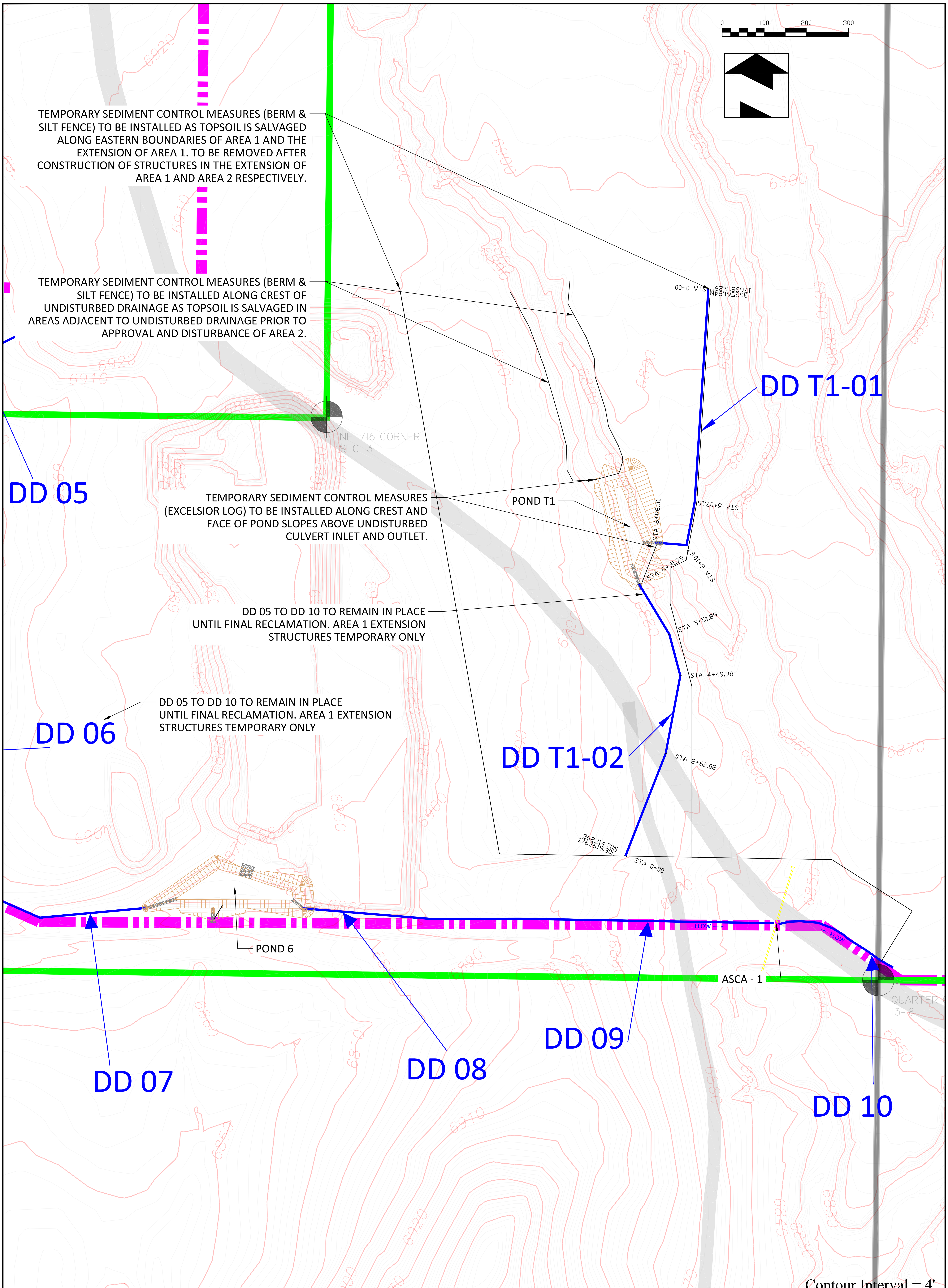

LEGEND:	
	PERMIT BOUNDARY
	PRIVATE COAL OWNERSHIP
	SECTION LINE
	FOUND SECTION CORNER
	FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5–65A	DATE: 9/7/16
	SCALE: 1" = 100'
JOB NUMBER: 0001	SHEET

REVISIONS	
DATE:	BY:
10/3/16	AC
11/21/16	AC
2/2/17	AC
5/4/17	AC

AREA 1 - EXTENSION DIVERSION DITCH AND SEDIMENT IMPOUNDMENT PLAN VIEW

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-65A

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

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Cedar City, Utah 84721
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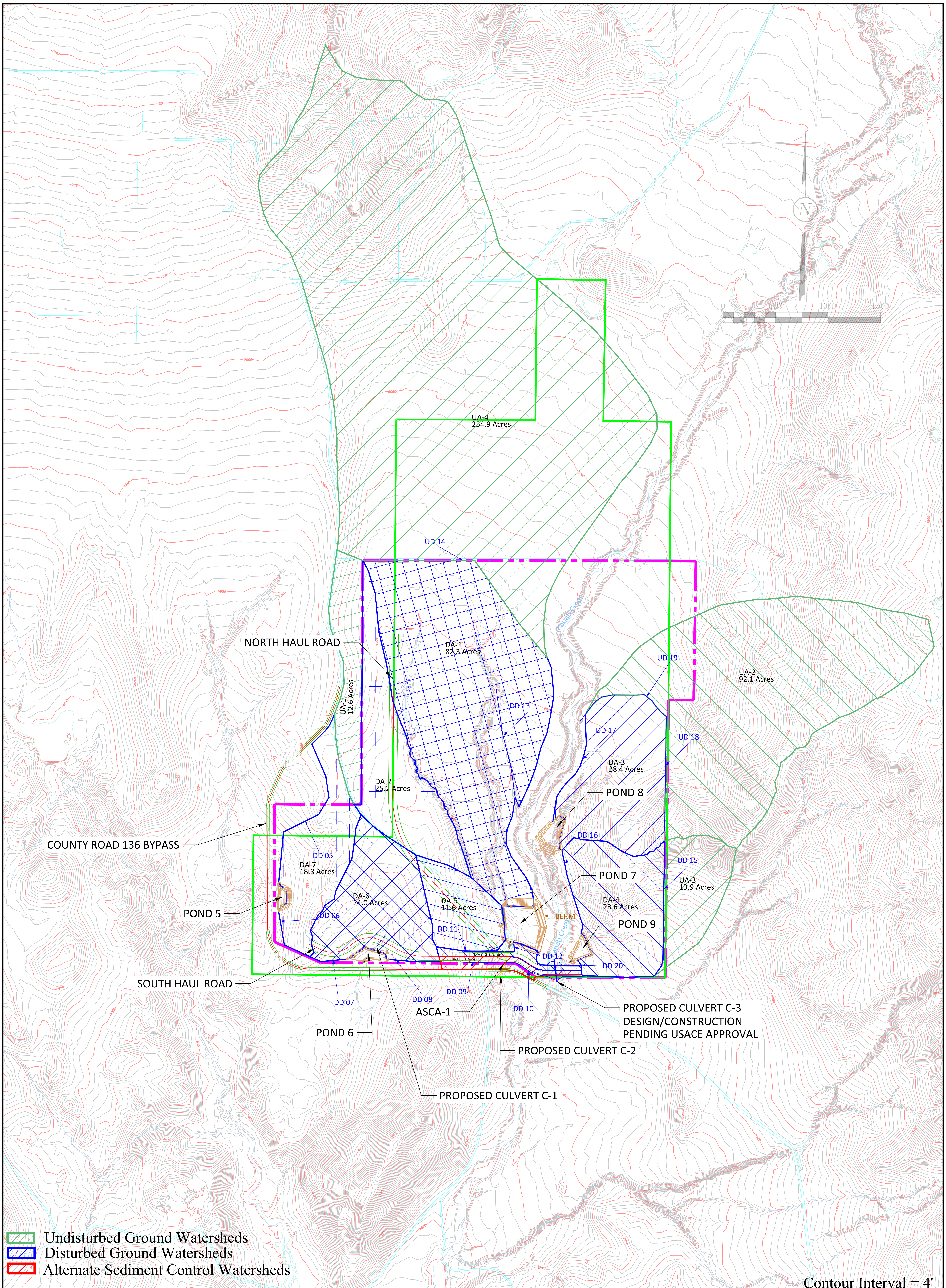

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-66	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

SEDIMENT CONTROL AREA WATERSHEDS

NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-66

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

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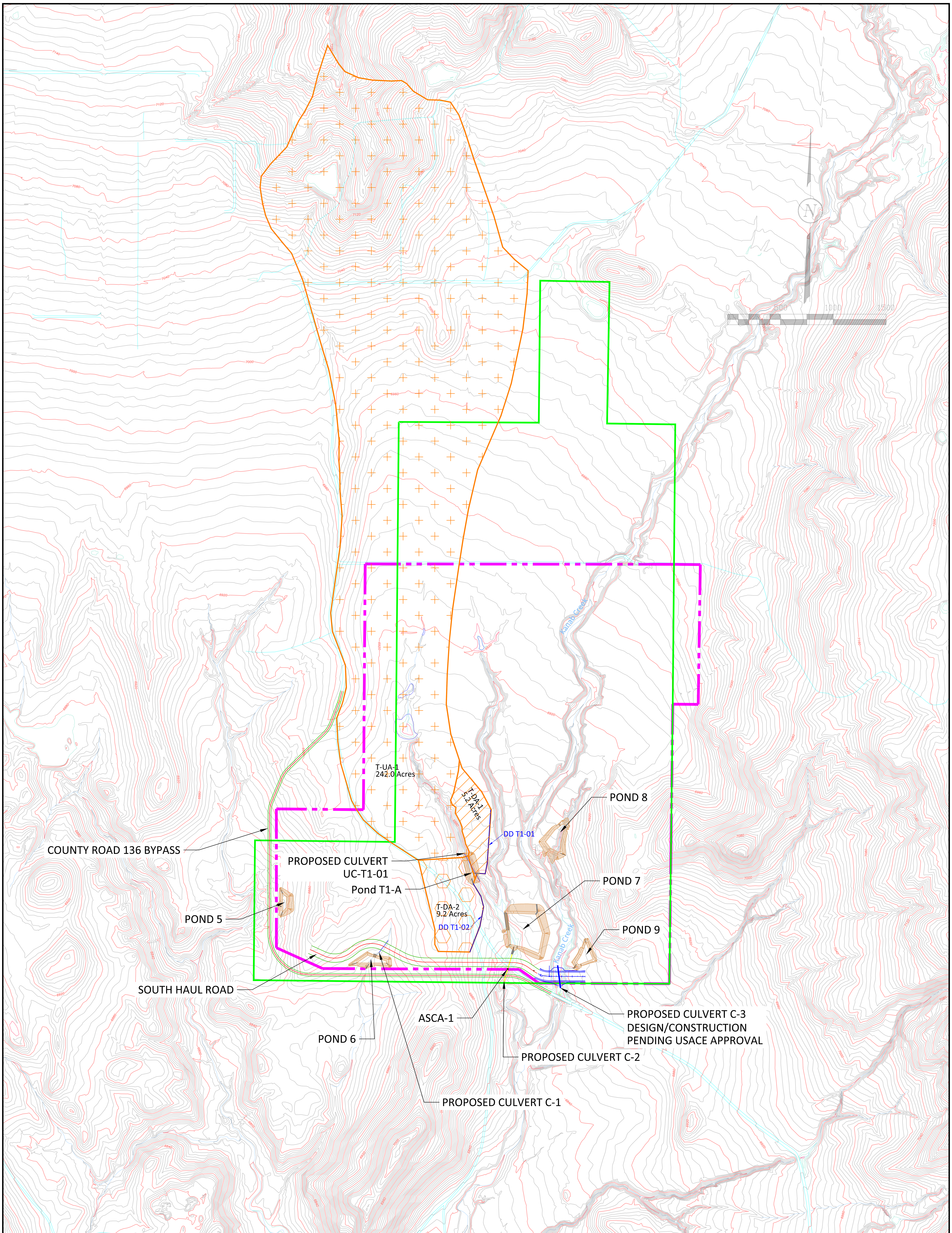

Undisturbed Ground Watersheds
Disturbed Ground Watersheds
Alternate Sediment Control Watersheds
Area 1 Extension Temporary Watersheds

Contour Interval = 4'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING:	DATE:
5-66A	9/7/16
	SCALE:
	1" = 400'
JOB NUMBER:	SHEET
0001	

REVISIONS	
DATE:	BY:
10/3/16	AC
11/21/16	AC
2/2/17	AC
5/4/17	AC

AREA 1 EXTENSION SEDIMENT CONTROL AREA WATERSHEDS

NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-66A

UTAH REGISTERED PROFESSIONAL ENGINEER
#154168
DAN W. GUY

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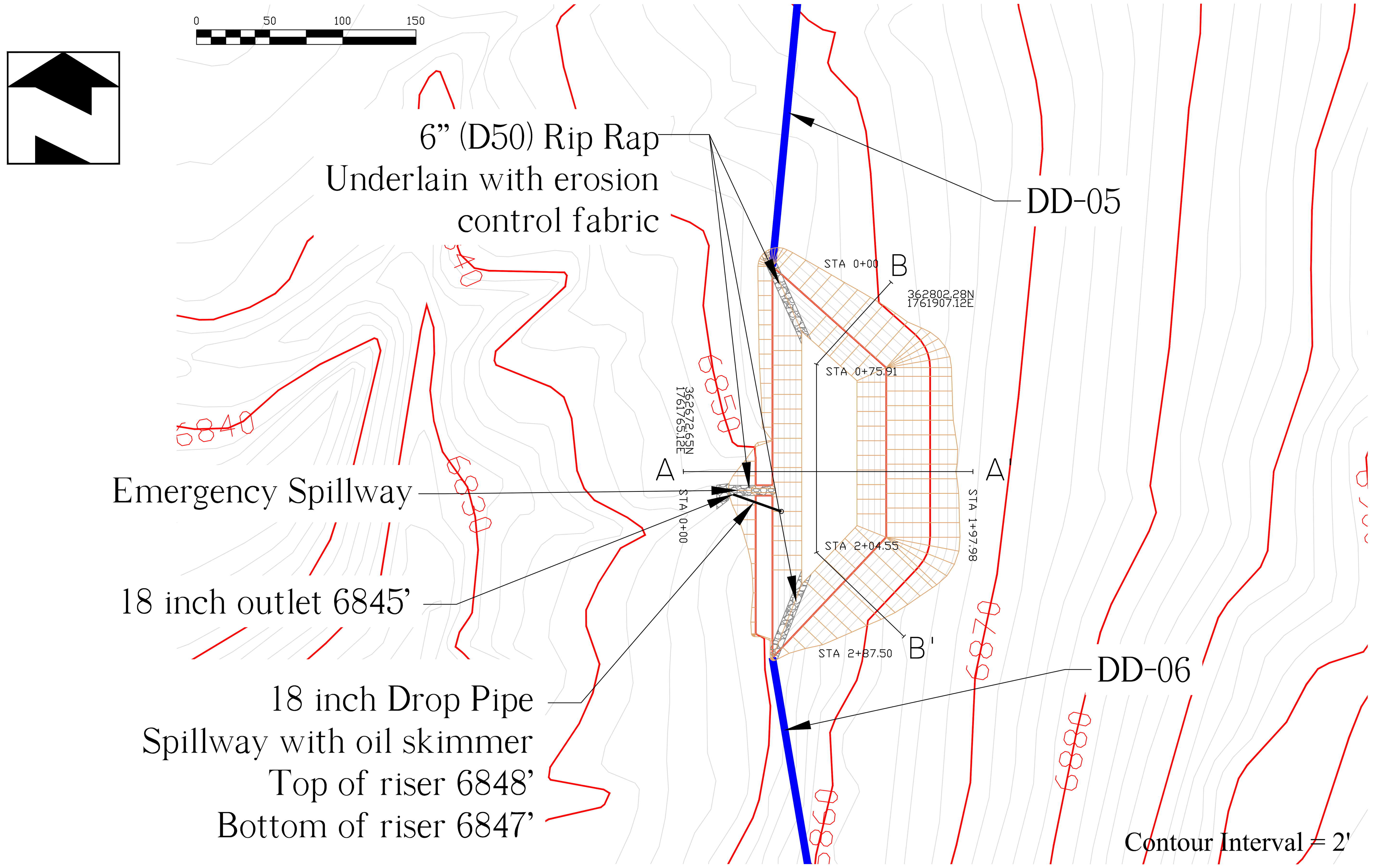
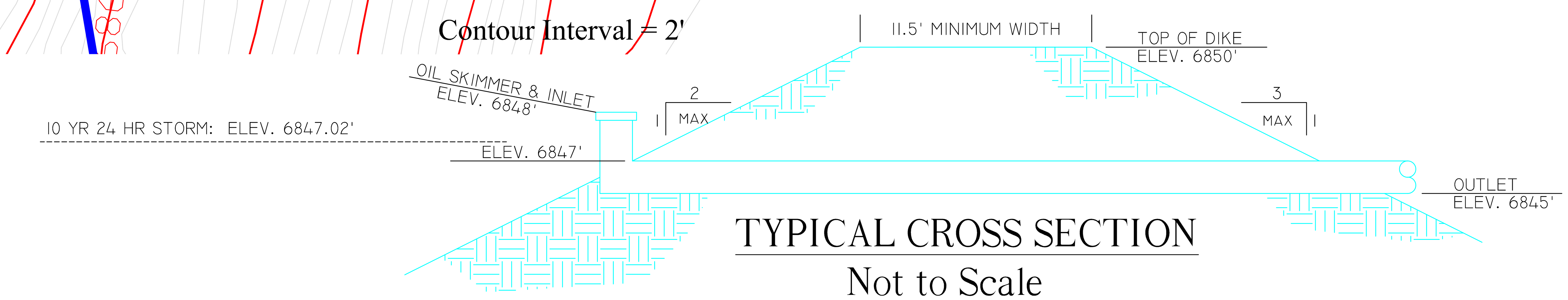


Pond Storage Volumes

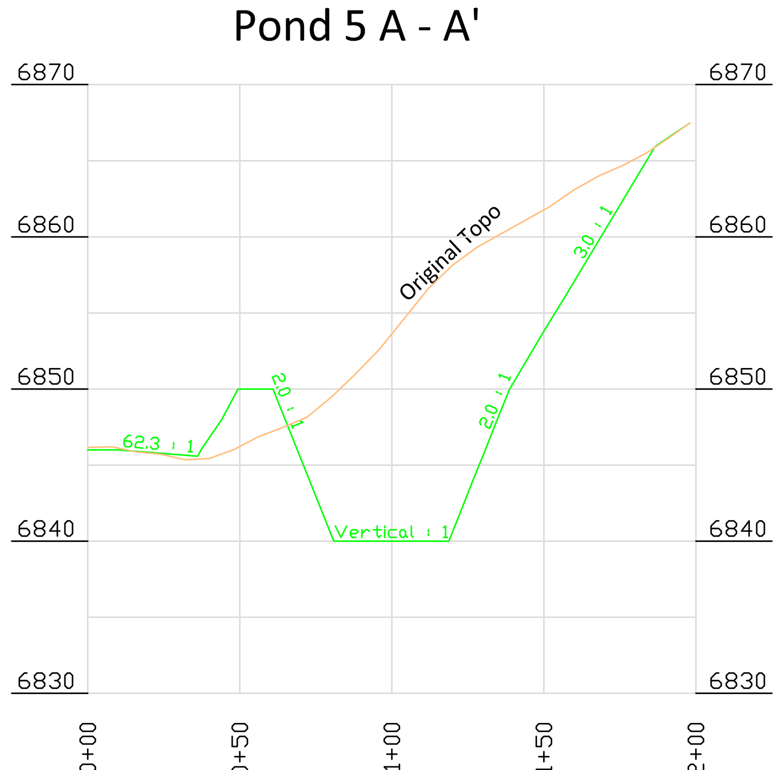
Sediment Control Structure No. 5

Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6840.00	0.089	-	-	-	Bottom Pond
6841.00	0.118	0.104	0.104	0.104	
6842.00	0.143	0.131	0.131	0.234	60% Sediment Cleanout
6843.00	0.176	0.160	0.160	0.394	Max Sediment Level
6844.00	0.205	0.191	0.191	0.584	
6845.00	0.216	0.211	0.211	0.795	
6846.00	0.243	0.230	0.230	1.024	
6847.00	0.256	0.250	0.250	1.274	
6848.00	0.299	0.278	0.278	1.551	Principle Spillway
6849.00	0.329	0.314	0.314	1.865	Emergency Spillway
6850.00	0.341	0.335	0.335	2.200	Top of Dike



TYPICAL CROSS SECTION
Not to Scale

Pond 5 A - A'



Pond 5 B - B'

Pond #5

Required Storage for 10 year, 24 hr event = 1.28 acre/ft

X-Section Scale
1"=10'
1"=50'

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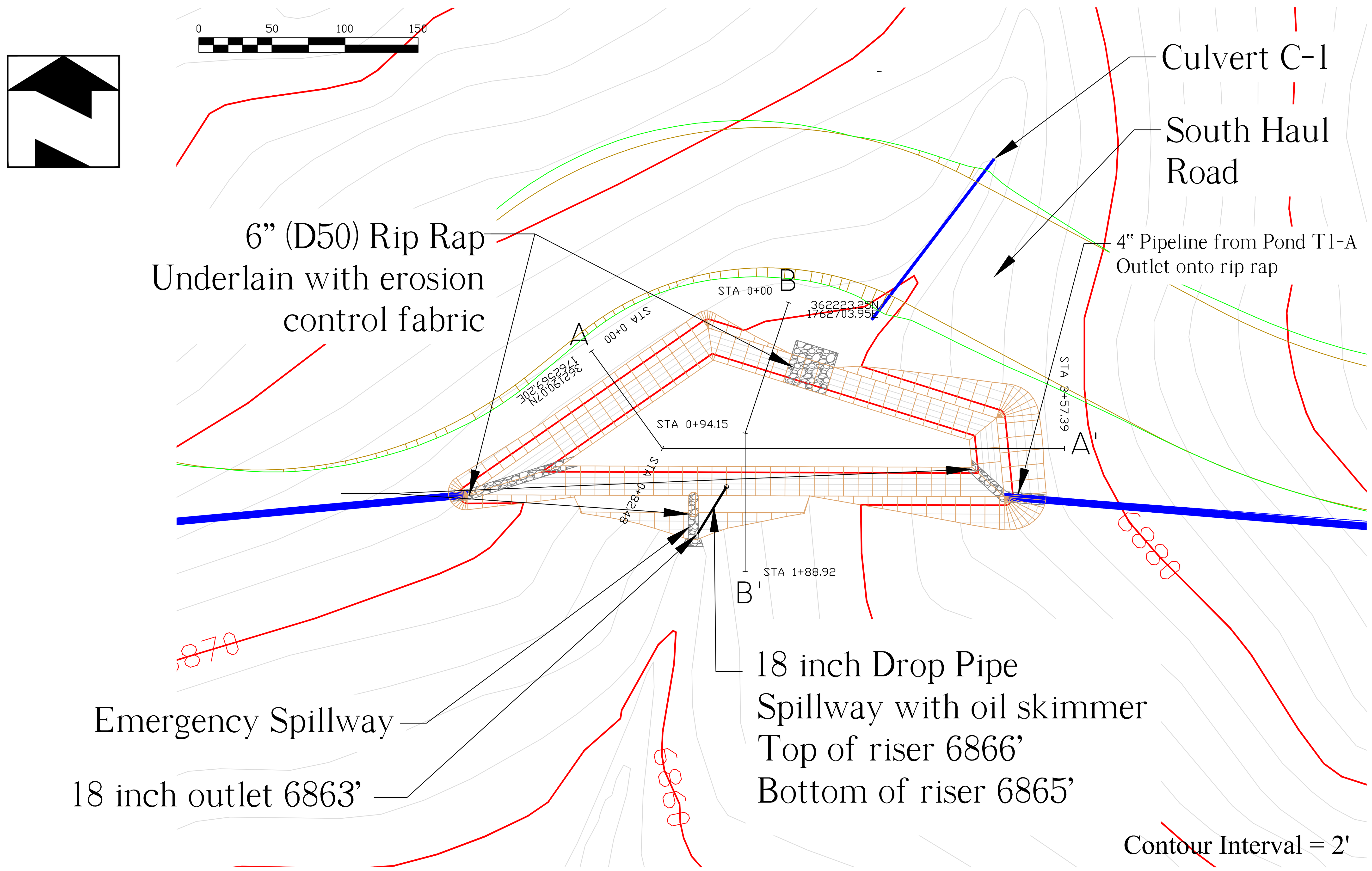
SEDIMENT IMPOUNDMENT 5 DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-67

REVISIONS	
DATE:	BY:
12/1/2015	AC
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC

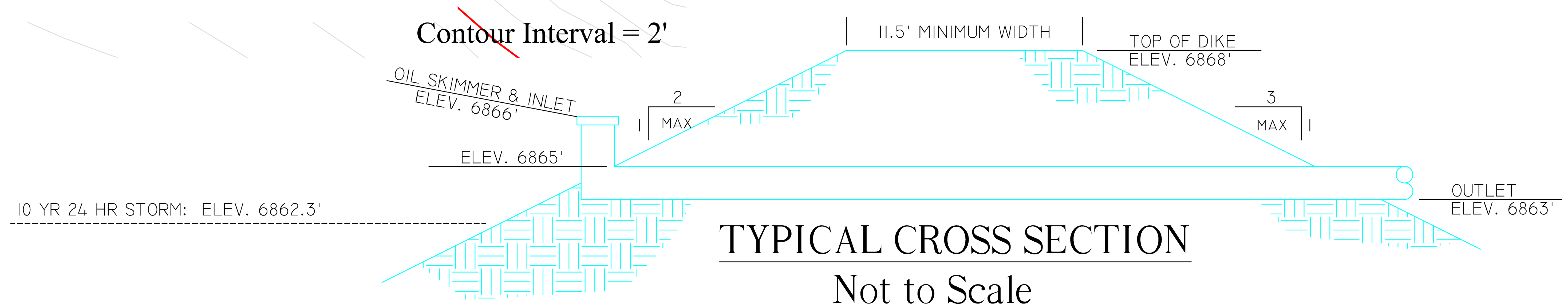
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DRAWING: 5-67
DATE: 10/12/15
SCALE: 1" = 50'
JOB NUMBER: 1400
SHEET



Pond Storage Volumes

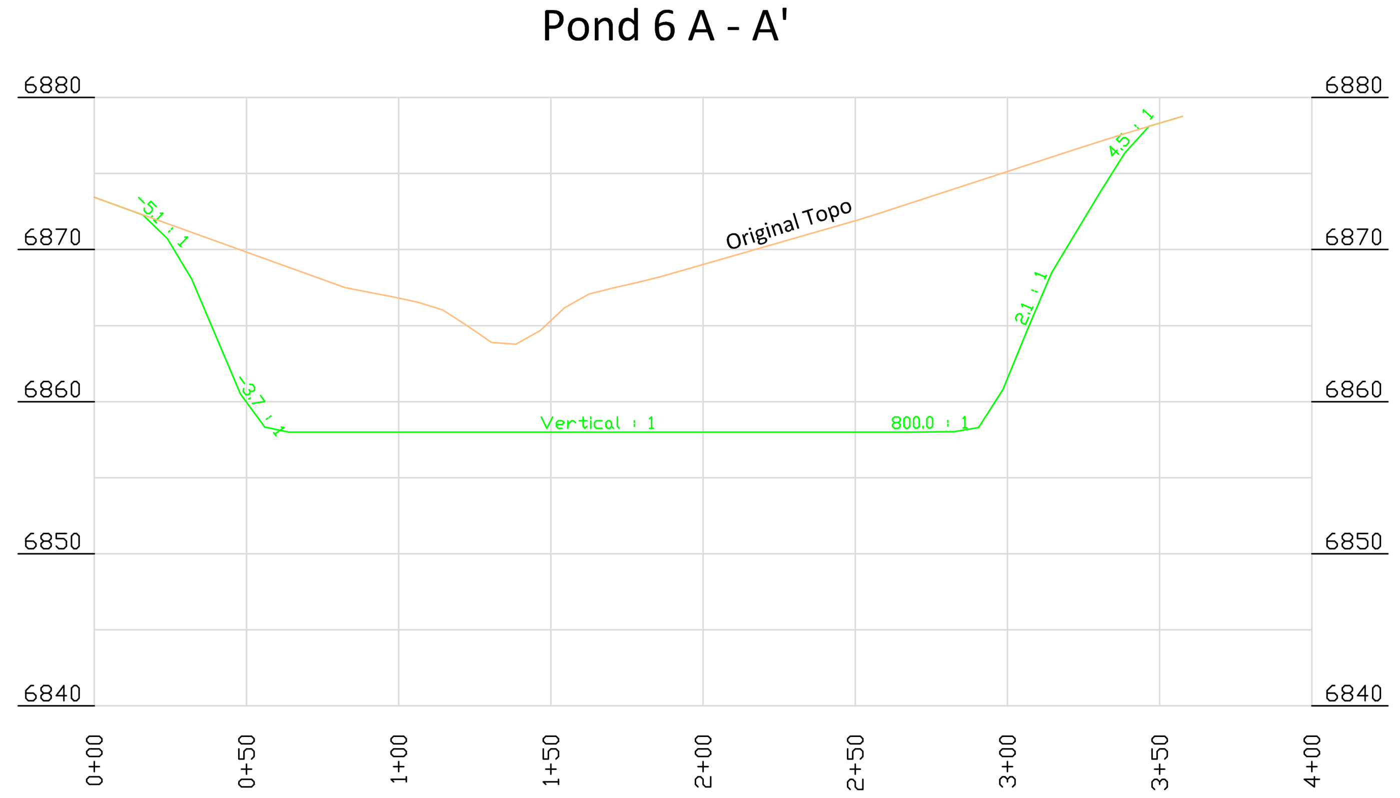
Sediment Control Structure No. 6

Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6858.00	0.233	-	-	-	Bottom Pond
6859.00	0.284	0.259	0.259	0.259	
6860.00	0.324	0.304	0.304	0.563	60% Sediment Cleanout
6861.00	0.370	0.347	0.347	0.910	Max Sediment Level
6862.00	0.394	0.382	0.382	1.292	
6863.00	0.429	0.412	0.412	1.703	
6864.00	0.468	0.449	0.449	2.152	
6865.00	0.489	0.479	0.479	2.630	
6866.00	0.549	0.519	0.519	3.149	Principle Spillway
6867.00	0.579	0.564	0.564	3.713	Emergency Spillway
6868.00	0.601	0.590	0.590	4.303	Top of Dike

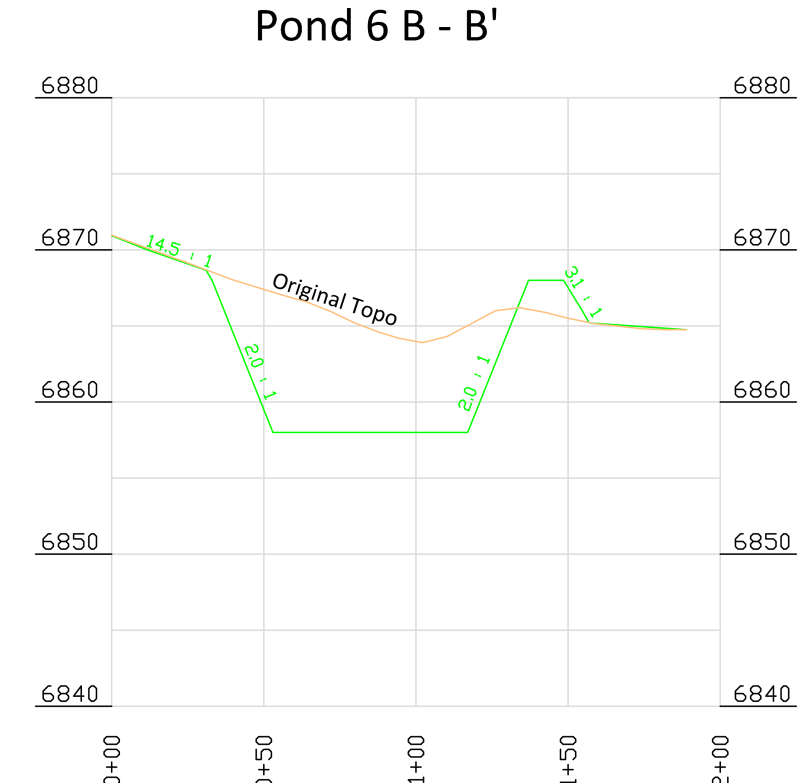


TYPICAL CROSS SECTION
Not to Scale

Pond 6 A - A'

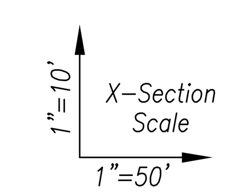


Pond 6 B - B'



Pond #6

Required Storage for 10 year, 24 hr event = 1.43 acre/ft



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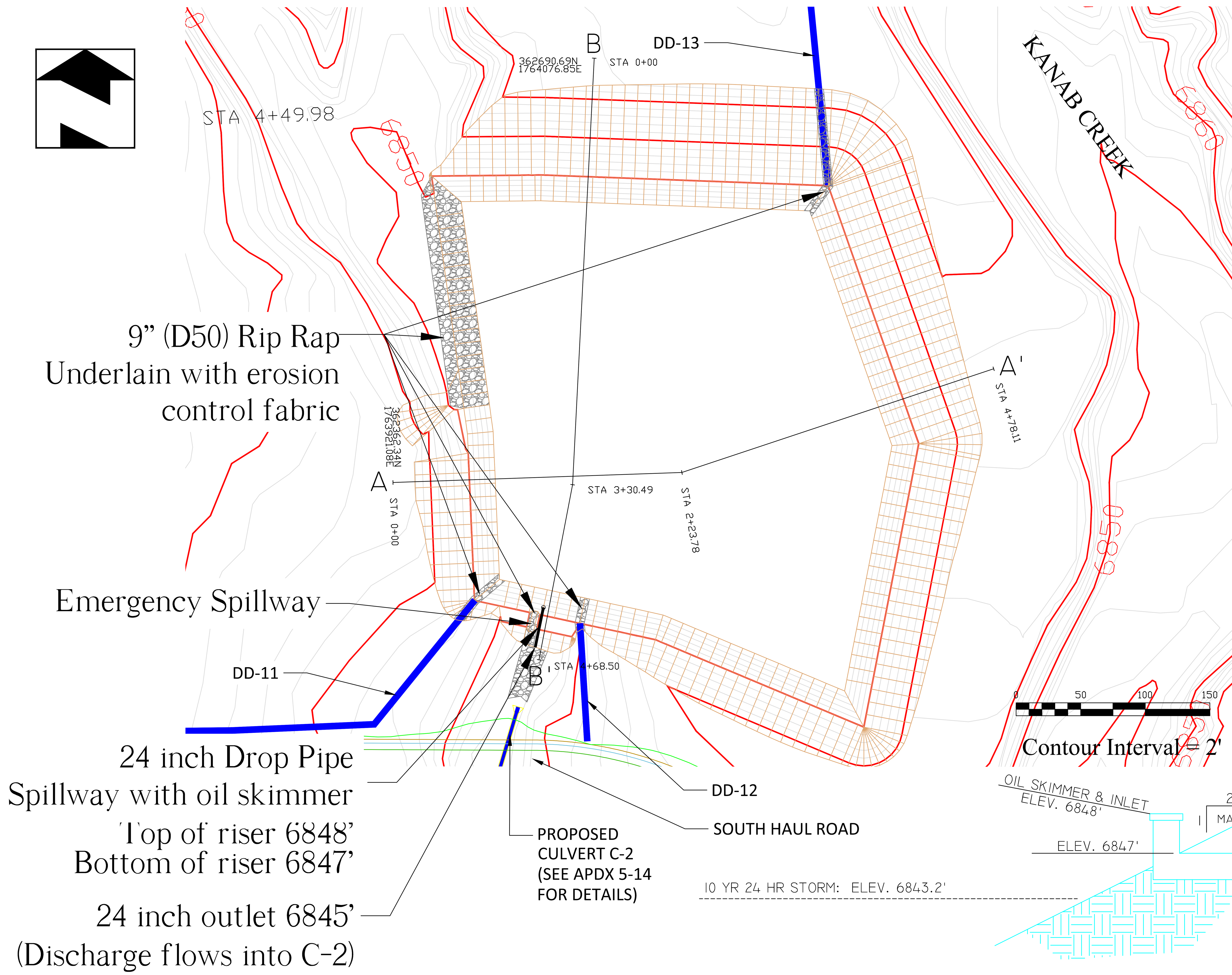
SEDIMENT IMPOUNDMENT 6 DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-68

REVISIONS DATE:	BY:
12/1/2015	AC
12/15/2015	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC

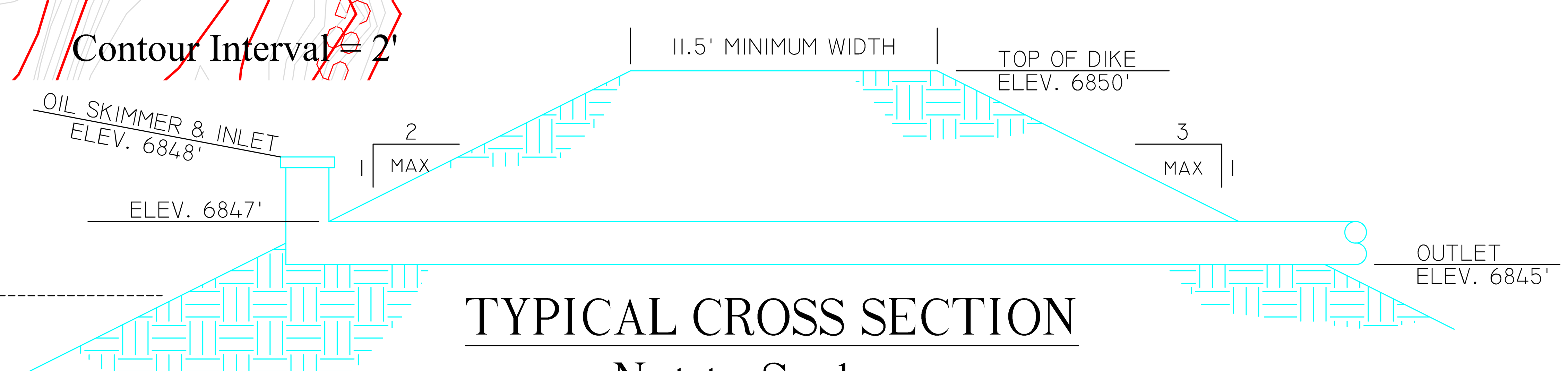
CHECKED BY: DG	DRAWN BY: A. CHRISTENSEN
DATE: 10/12/15	DRAWING: 5-68
SCALE: 1" = 50'	
SHEET	JOB NUMBER: 1400



Pond Storage Volumes

Sediment Control Structure No. 7

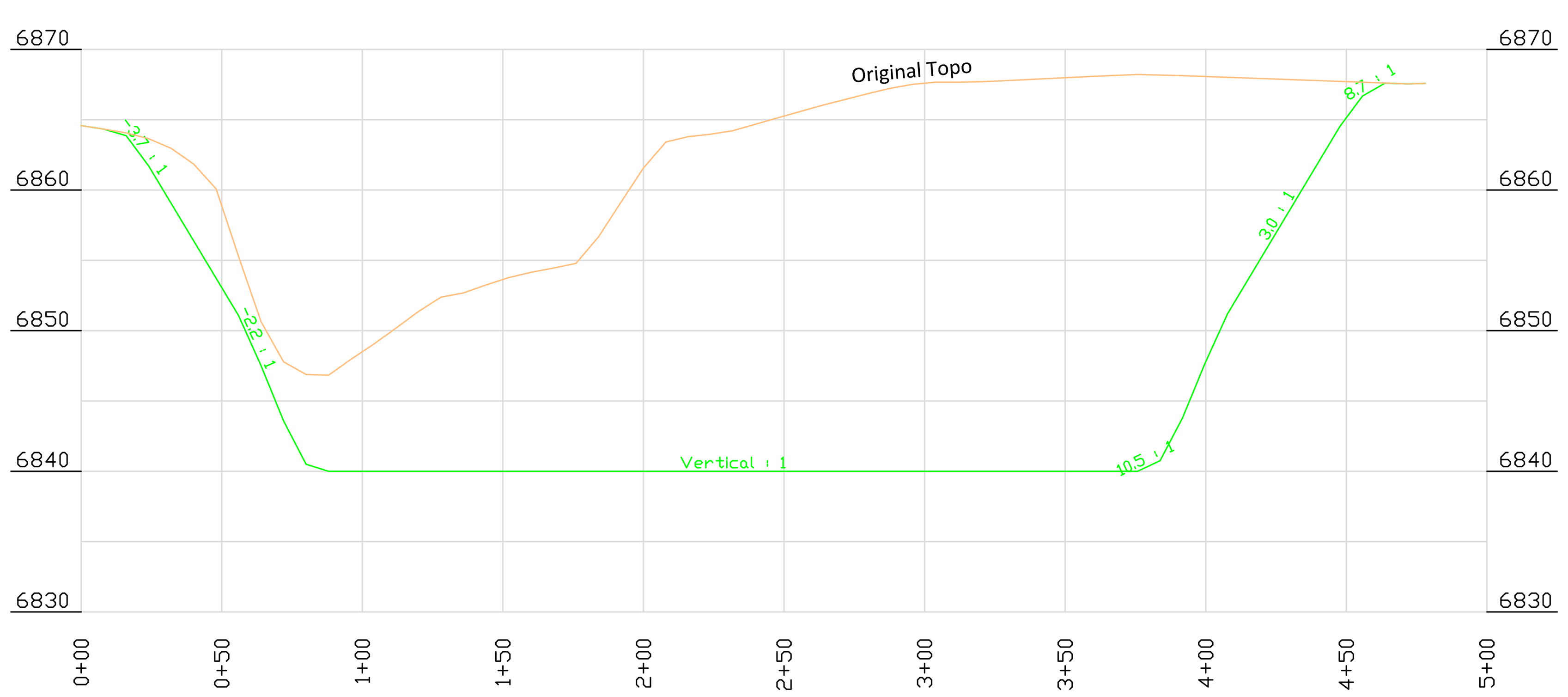
Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6840.00	2.071	-	-	-	Bottom Pond
6841.00	2.210	2.141	2.141	2.141	
6842.00	2.284	2.247	2.247	4.388	60% Sediment Cleanout
6843.00	2.356	2.320	2.320	6.708	Max Sediment Level
6844.00	2.414	2.385	2.385	9.093	
6845.00	2.477	2.446	2.446	11.538	
6846.00	2.542	2.510	2.510	14.048	
6847.00	2.598	2.570	2.570	16.618	
6848.00	2.676	2.637	2.637	19.255	Principle Spillway
6849.00	2.746	2.711	2.711	21.966	Emergency Spillway
6850.00	2.776	2.761	2.761	24.727	Top of Dike



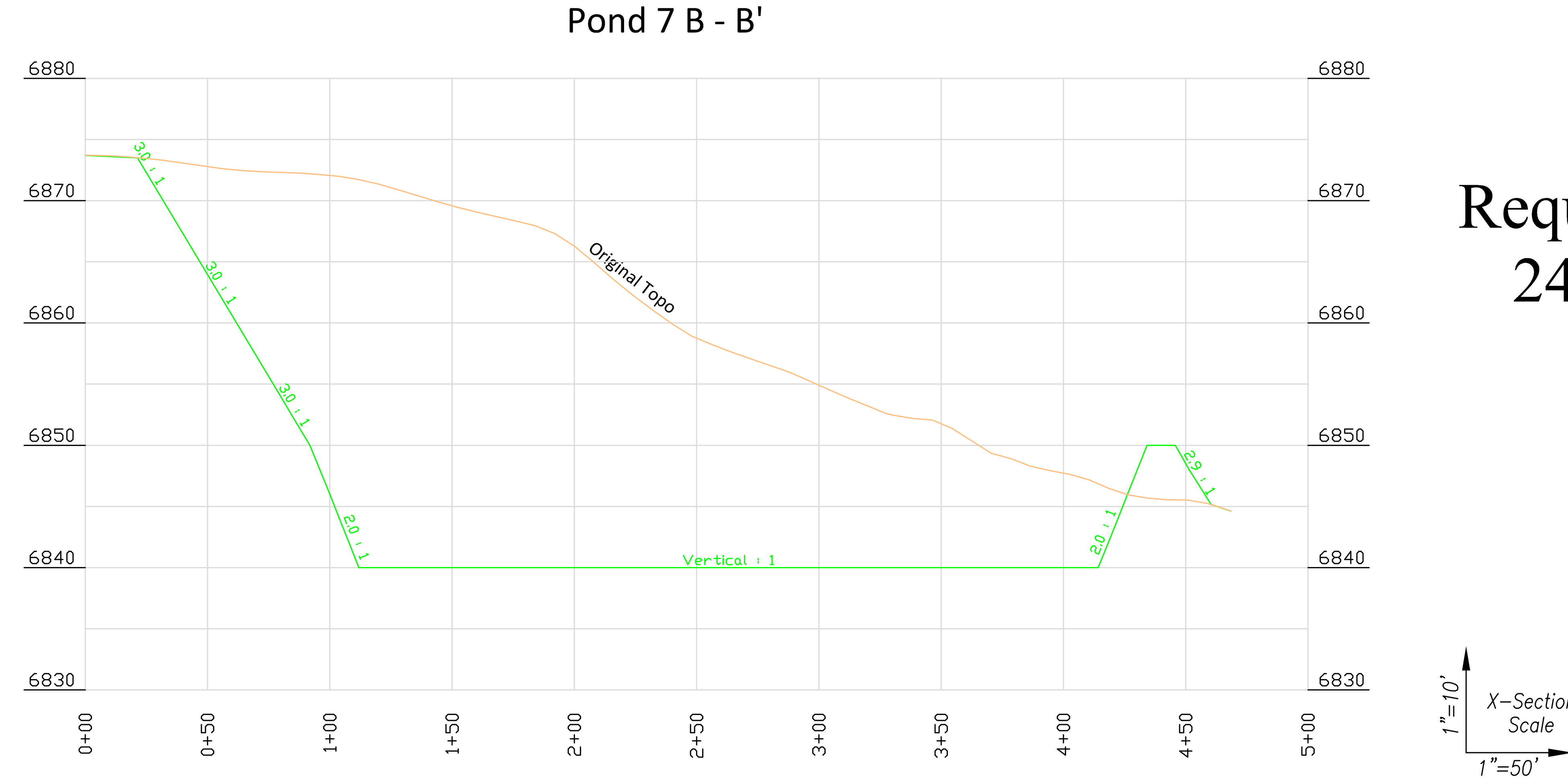
TYPICAL CROSS SECTION

Not to Scale

Pond 7 A - A'



Pond 7 B - B'



Pond #7

Required Storage for 10 year, 24 hr event = 7.11 acre/ft

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Phone (435)867-5331
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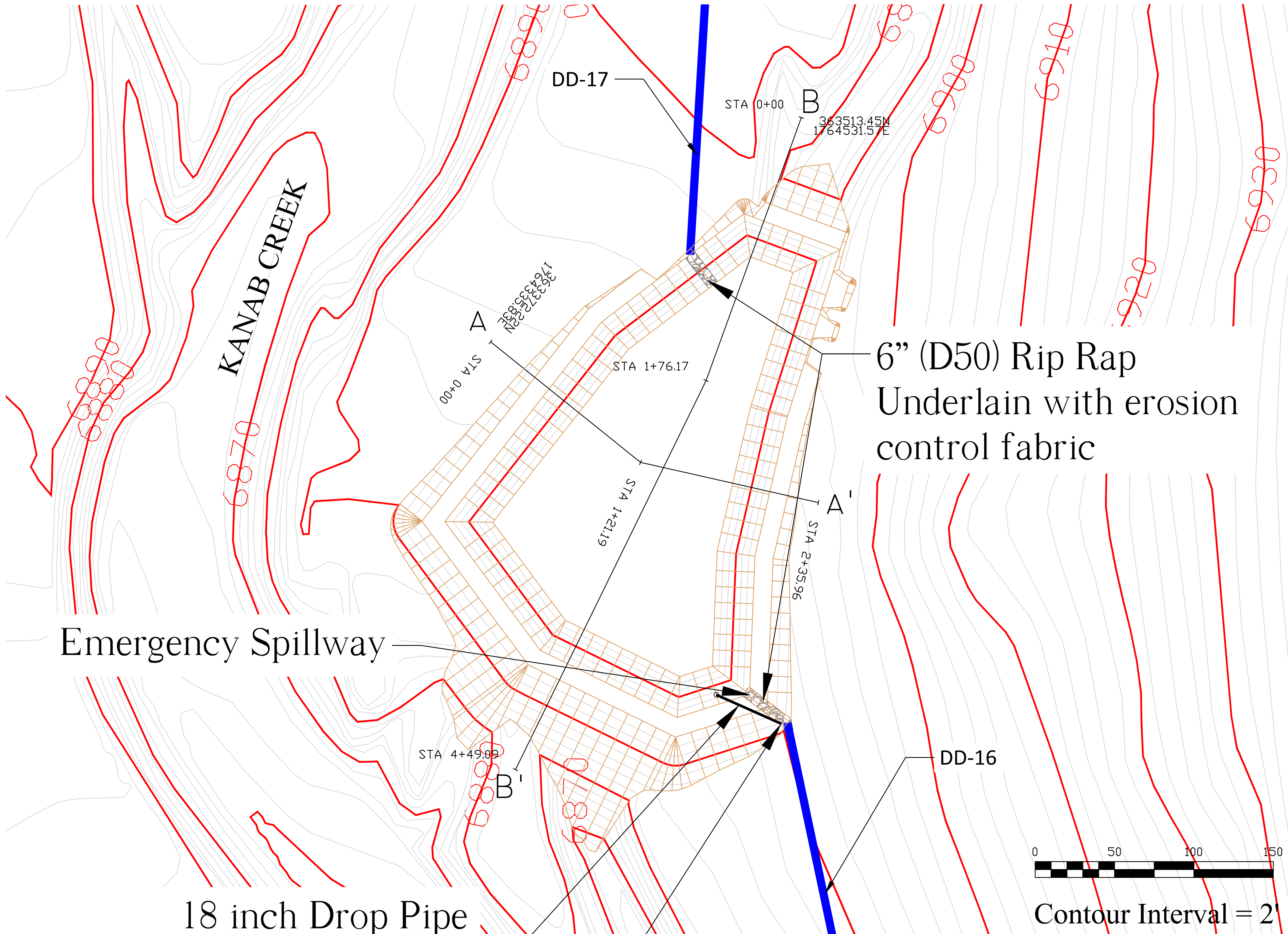
SEDIMENT IMPOUNDMENT 7 DETAILS

COAL HOLLOW PROJECT ALTON, UTAH

DRAWING: 5-69

REVISIONS DATE:	BY:
12/1/15	ARC
12/15/15	ARC
1/8/16	ARC
8/15/16	ARC
9/7/16	ARC
10/3/16	ARC
2/2/17	ARC

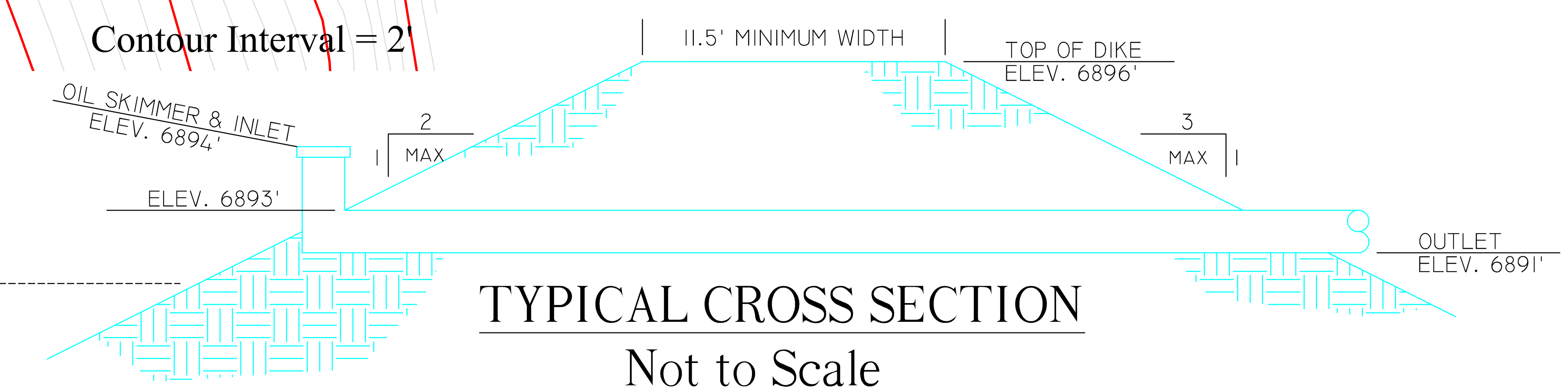
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DRAWING: 5-69
DATE: 4/10/15
SCALE: 1" = 50'
JOB NUMBER: 1400
SHEET



Pond Storage Volumes

Sediment Control Structure No. 8

Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6884.00	0.519	-	-	-	Bottom Pond
6885.00	0.600	0.560	0.560	0.560	
6886.00	0.644	0.622	0.622	1.182	
6887.00	0.678	0.661	0.661	1.843	
6888.00	0.716	0.697	0.697	2.540	60% Sediment Cleanout
6889.00	0.750	0.733	0.733	3.273	Max Sediment Level
6890.00	0.787	0.769	0.769	4.041	
6891.00	0.823	0.805	0.805	4.846	
6892.00	0.861	0.842	0.842	5.688	
6893.00	0.901	0.881	0.881	6.569	
6894.00	0.949	0.925	0.925	7.494	Principle Spillway
6895.00	1.001	0.975	0.975	8.469	Emergency Spillway
6896.00	1.010	1.006	1.006	9.475	Top of Dike

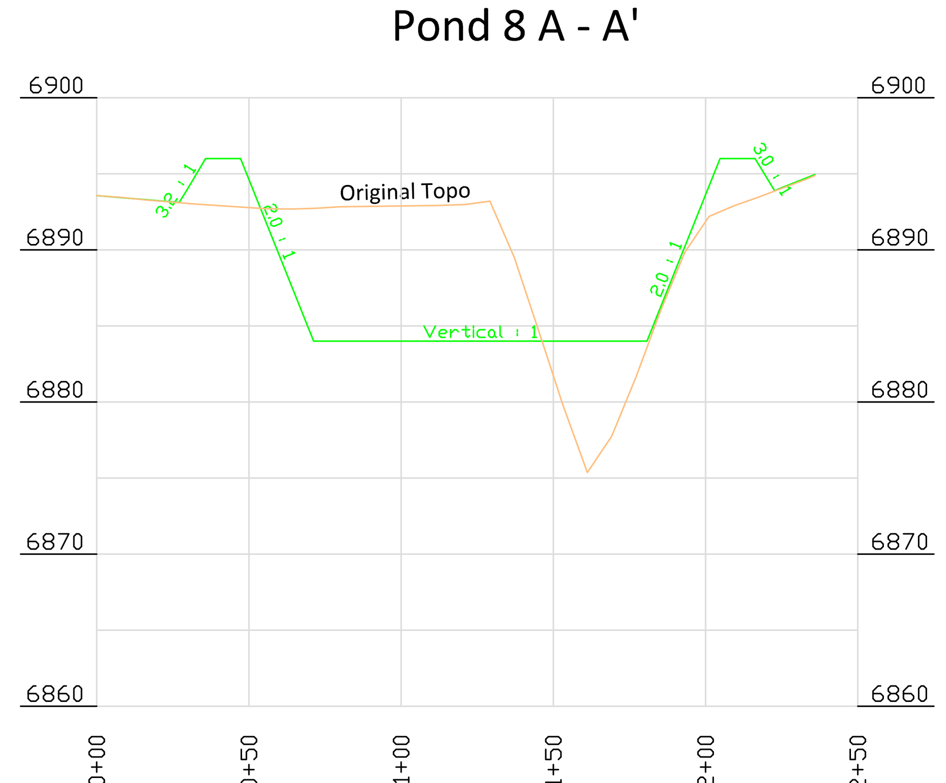


TYPICAL CROSS SECTION
Not to Scale

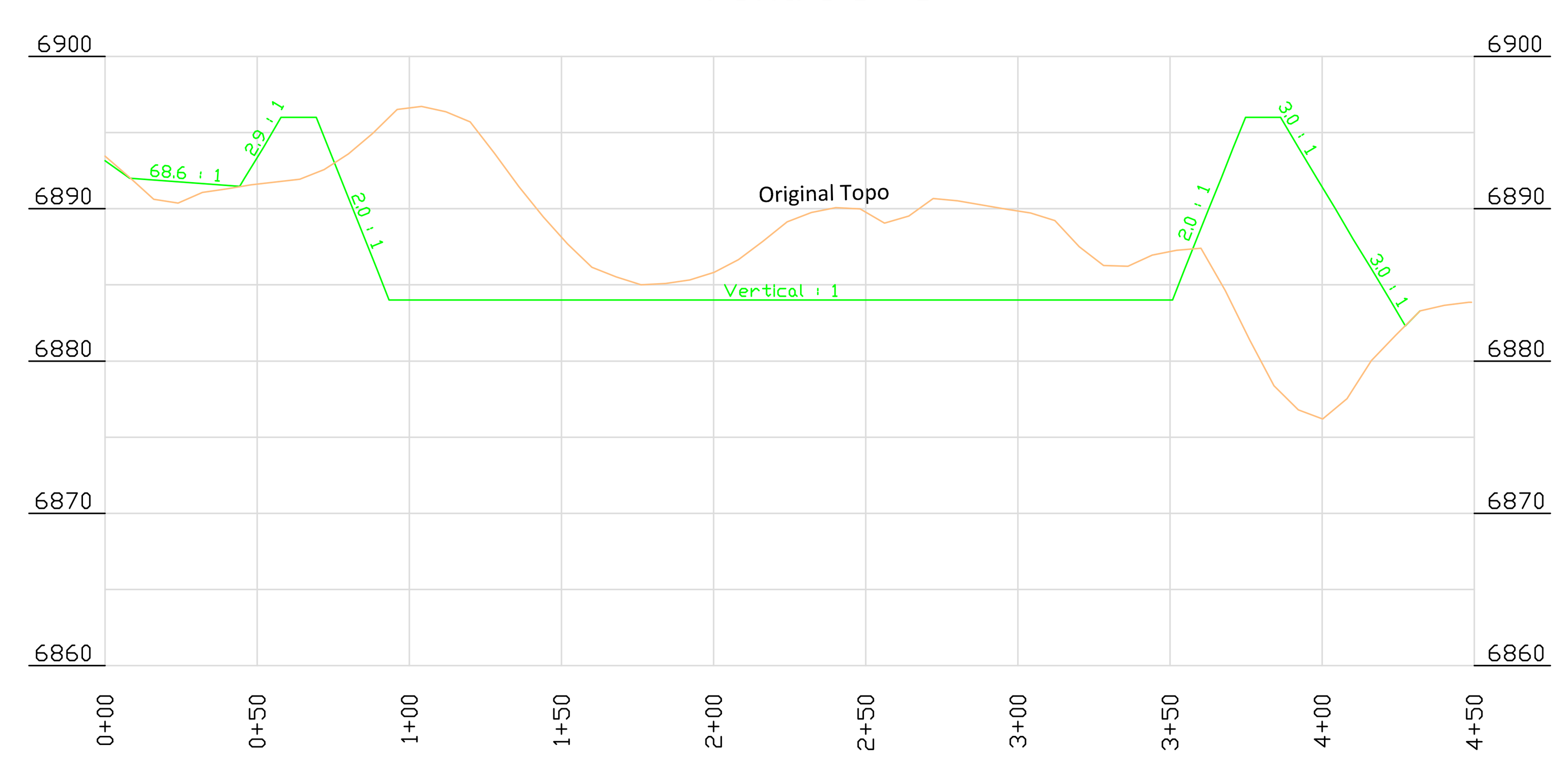
Pond #8

Required Storage for 10 year, 24 hr event = 1.66 acre/ft

Pond 8 A - A'



Pond 8 B - B'



X-Section Scale
1"=10'
1"=50'

Alton Coal Development
Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84720
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Fax (435)867-1192

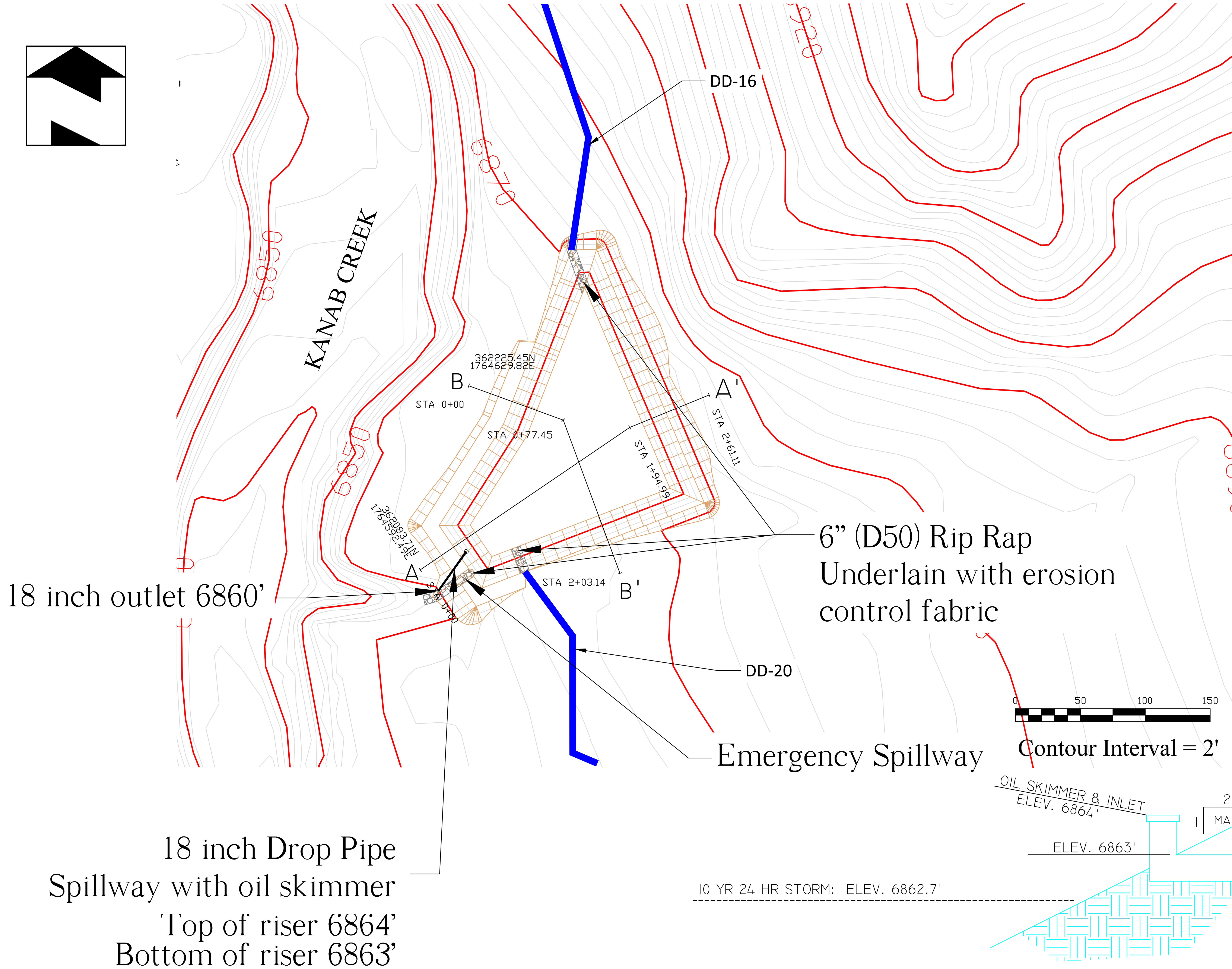
SEDIMENT IMPOUNDMENT 8 DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-70

REVISIONS DATE:	BY:
10/12/15	ARC
12/1/15	ARC
12/15/15	ARC
1/8/16	ARC
8/15/16	ARC
9/7/16	ARC
10/3/16	ARC

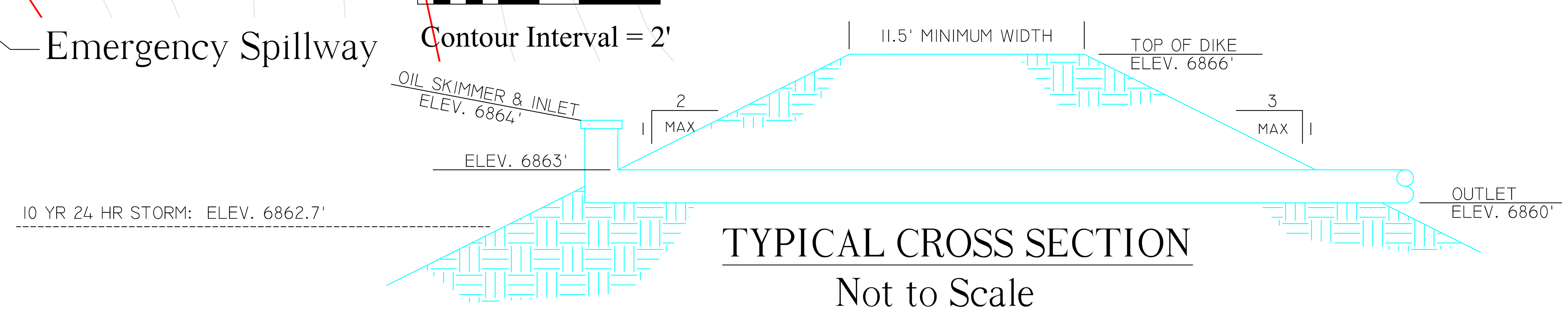
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DRAWING: 5-70
DATE: 4/10/15
SCALE: 1" = 50'
JOB NUMBER: 1400
SHEET



Pond Storage Volumes

Sediment Control Structure No. 9

Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6856	0.273	-	-	-	Bottom Pond
6857	0.334	0.304	0.304	0.304	
6858	0.371	0.353	0.353	0.656	
6859	0.402	0.387	0.387	1.043	60% Sediment Cleanout
6860	0.431	0.417	0.417	1.459	
6860.5	0.446	0.438	0.219	1.678	Max Sediment Level
6861	0.460	0.453	0.226	1.905	
6862	0.489	0.475	0.475	2.379	
6863	0.519	0.504	0.504	2.883	
6864	0.558	0.539	0.539	3.422	Principle Spillway
6865	0.595	0.577	0.577	3.998	Emergency Spillway
6866	0.610	0.603	0.603	4.601	Top of Dike

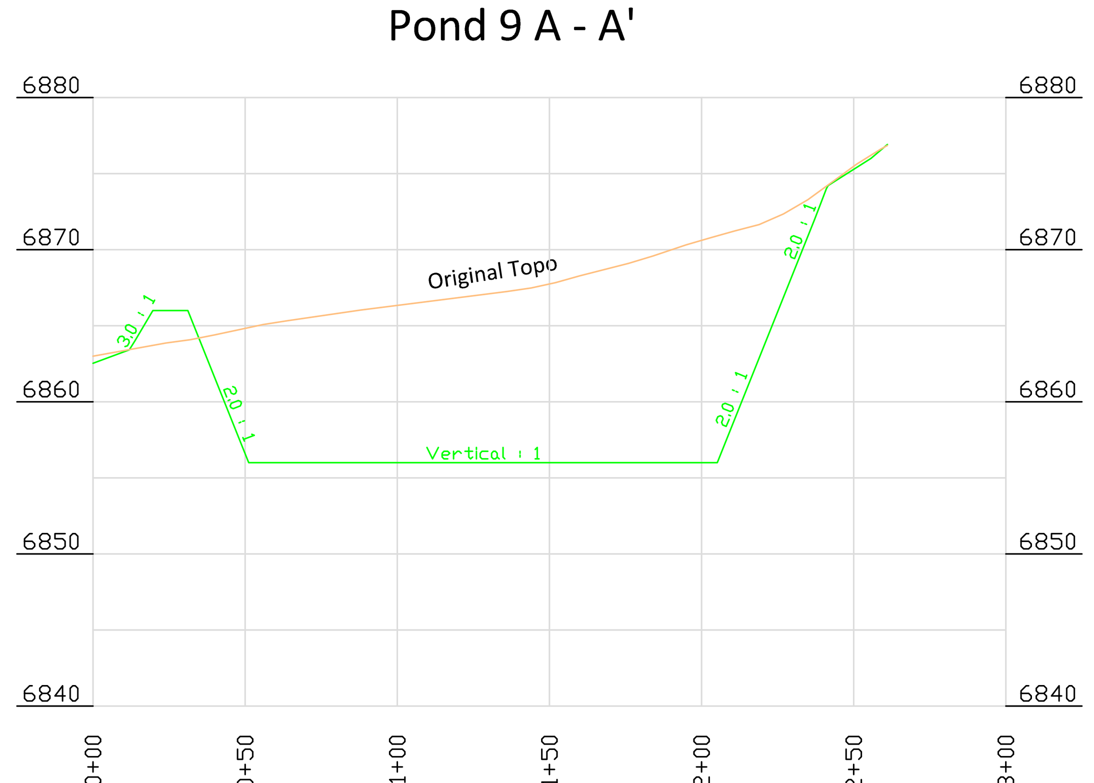


TYPICAL CROSS SECTION
Not to Scale

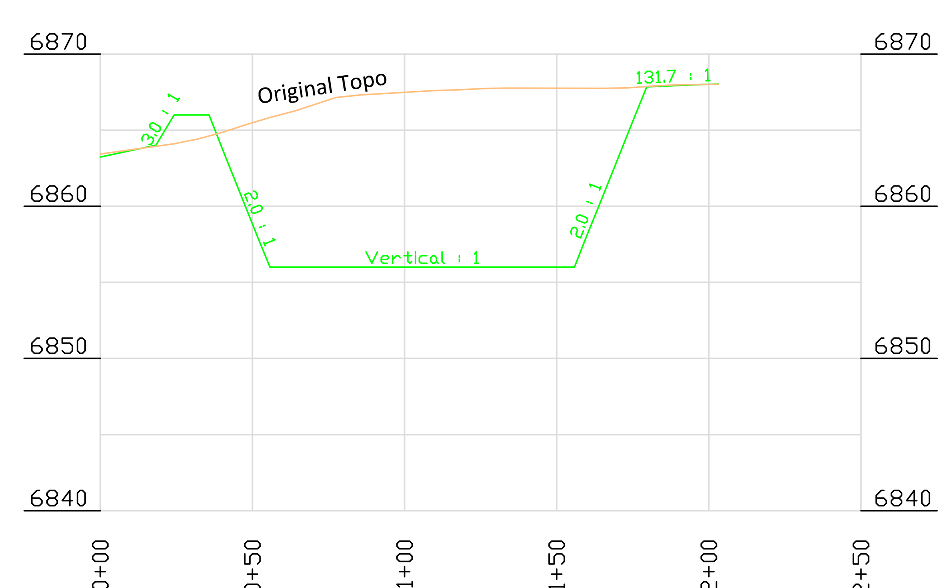
Pond #9

Required Storage for 10 year,
24 hr event = 2.73 acre/ft

Pond 9 A - A'



Pond 9 B - B'



1"=10'
X-Section Scale
1"=50'

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SEDIMENT IMPOUNDMENT 9 DETAILS

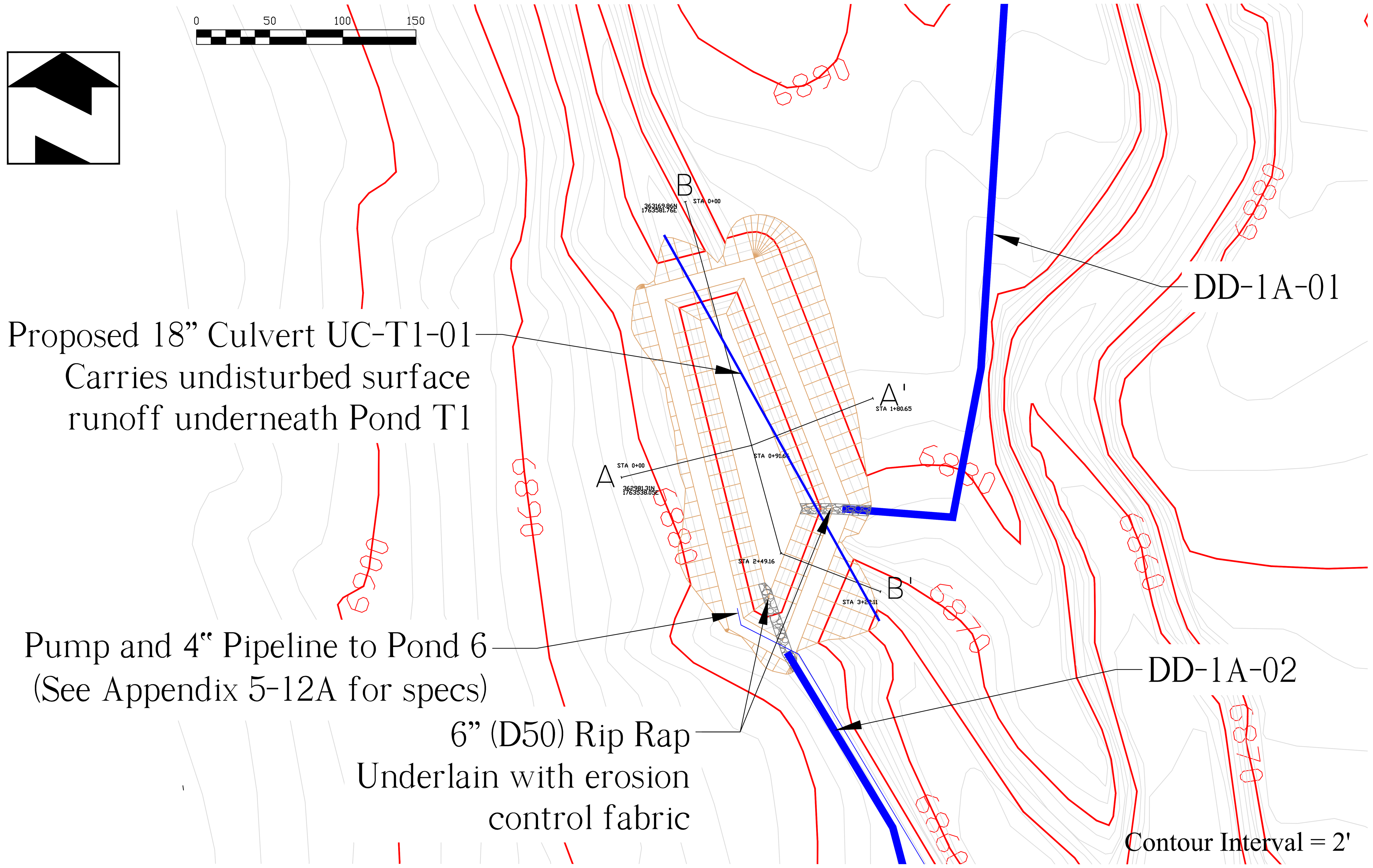
COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-71

REVISIONS

DATE:	BY:
12/1/15	ARC
12/15/15	ARC
1/8/16	ARC
8/15/16	ARC
9/7/16	ARC
10/3/16	ARC
2/2/17	ARC

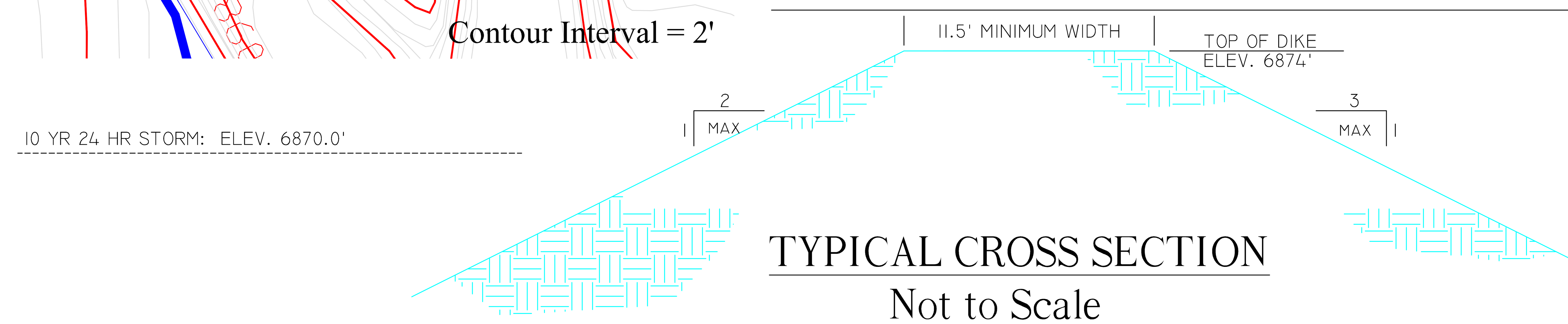
CHECKED BY: DG
DATE: 4/10/15
SCALE: 1" = 50'
SHEET
DRAWN BY: A. CHRISTENSEN
DRAWING: 5-71
JOB NUMBER: 1400



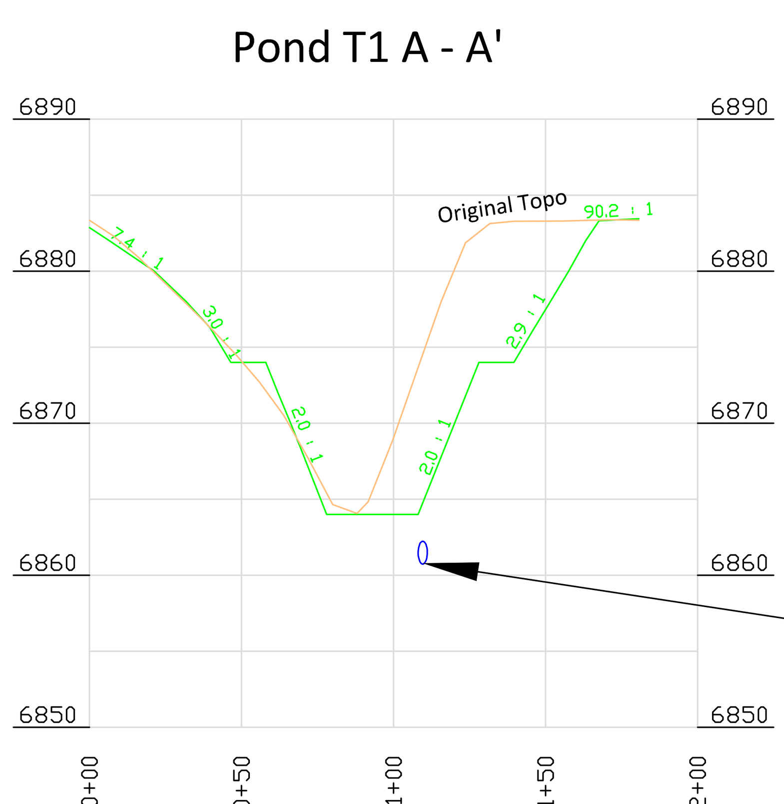
Pond Storage Volumes

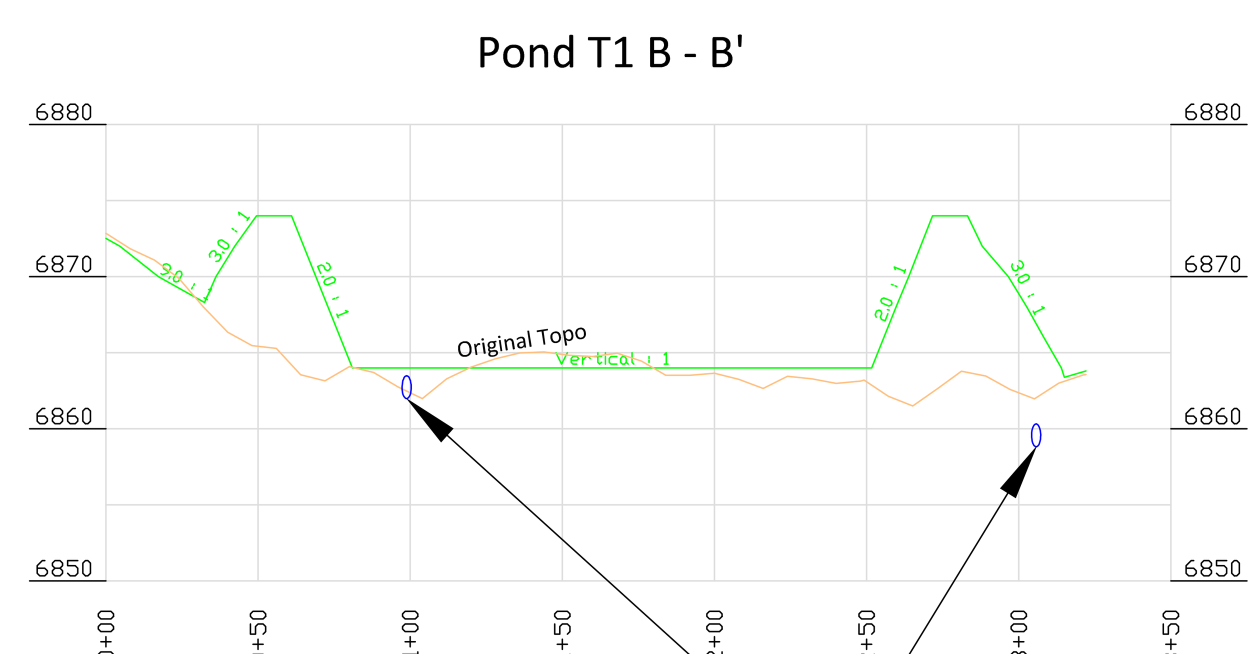
Sediment Control Structure T1-A

Water Elev (ft)	Area (Acres)	Average Area	Volume (Acre-Ft)	Accumulated Volume (Acre-Ft)	Stage
6864	0.079	-	-	-	Bottom Pond
6865	0.124	0.102	0.102	0.102	
6865.3	0.138	0.131	0.039	0.141	Max Sediment Level
6866	0.152	0.145	0.101	0.242	
6867	0.175	0.164	0.164	0.406	
6867.8	0.186	0.181	0.144	0.550	Pumping Level
6868	0.197	0.192	0.038	0.588	
6869	0.219	0.208	0.208	0.796	
6870	0.244	0.232	0.232	1.028	
6871	0.270	0.257	0.257	1.285	
6872	0.301	0.286	0.286	1.571	Minimum Freeboard
6873	0.335	0.318	0.318	1.889	
6874	0.341	0.338	0.338	2.227	Top of Dike



TYPICAL CROSS SECTION
Not to Scale

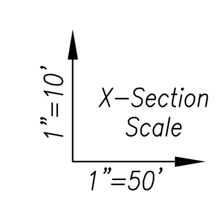




UC-T1-01

Pond T1

Required Storage for 10 year, 24 hr event = 1.02 acre/ft



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463 North 100 West, Suite 1
Cedar City, Utah 84720
Phone (435)867-5331
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SEDIMENT IMPOUNDMENT T1 DETAILS

COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-71A

REVISIONS DATE:	BY:
10/3/16	AC
2/2/17	AC

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DG
DATE: 9/7/16
SCALE: 1" = 50'
DRAWING: 5-71A
JOB NUMBER: 1400
SHEET

Geology Section C-C'
Geology Section G-G'
Geology Section F-F'
NE 1/16 CORNER
SEC 13
USACE Pre-Mining
Delineated Wetland
SPK-2011-01248
Geology Section D-D'
13
G'
Geology Section G-G'
Geology Section E-E'
Under any final circumstance that disallows continuation of mining from the extension of Area 1 into Areas 2 and 3, the final pit void remaining in Pits 8 and 9 will be backfilled from backfill borrow upgradient to the West while achieving AOC in both areas.
QUARTER CORNER
13-18
Section Lines for Drawing 5-75
Contour Interval = 2'
0 100 200 300
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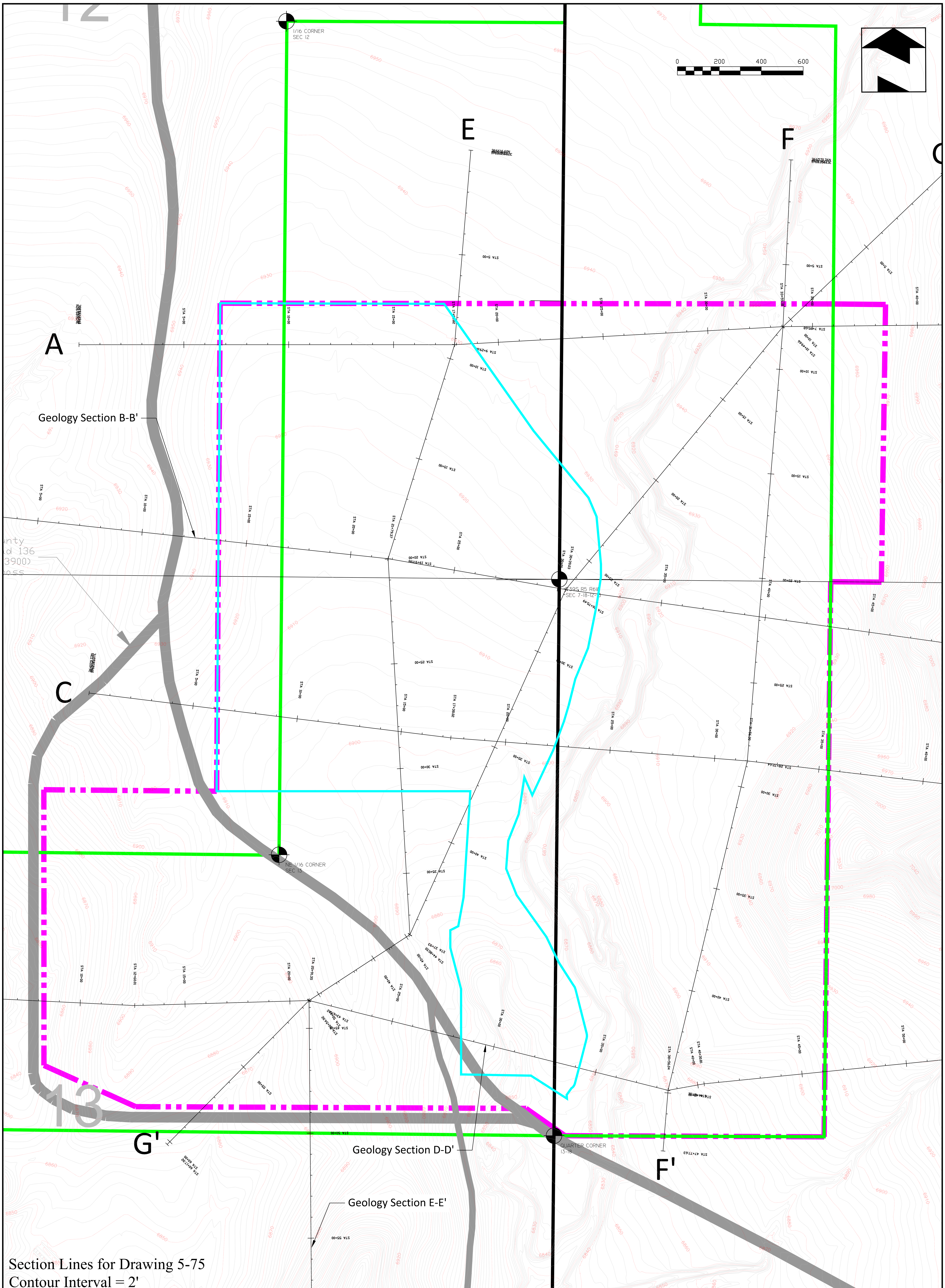
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192
POST MINING TOPOGRAPHY AREA 1
NORTH COAL HOLLOW PROJECT
ALTON, UTAH
DRAWING: 5-74A
REVISIONS
DATE: BY:
1/8/16 AC
8/15/16 AC
9/7/16 AC
10/3/16 AC
2/2/17 AC
5/4/17 AC
DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 5-74A
DATE: 12/15/15
SCALE: 1" = 100'
JOB NUMBER: 0001
SHEET
LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
AREA 1 BOUNDARY
SECTION LINE
SECTION CORNER
FOUND SECTION CORNER
FOUND PROPERTY CORNER



LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
AREA 2 BOUNDARY
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING:	DATE:
5-74B	12/15/15
	SCALE:
	1" = 200'
JOB NUMBER:	SHEET
0001	

REVISIONS

DATE:	BY:
1/8/16	AC
8/15/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

POST MINING TOPOGRAPHY AREA 2

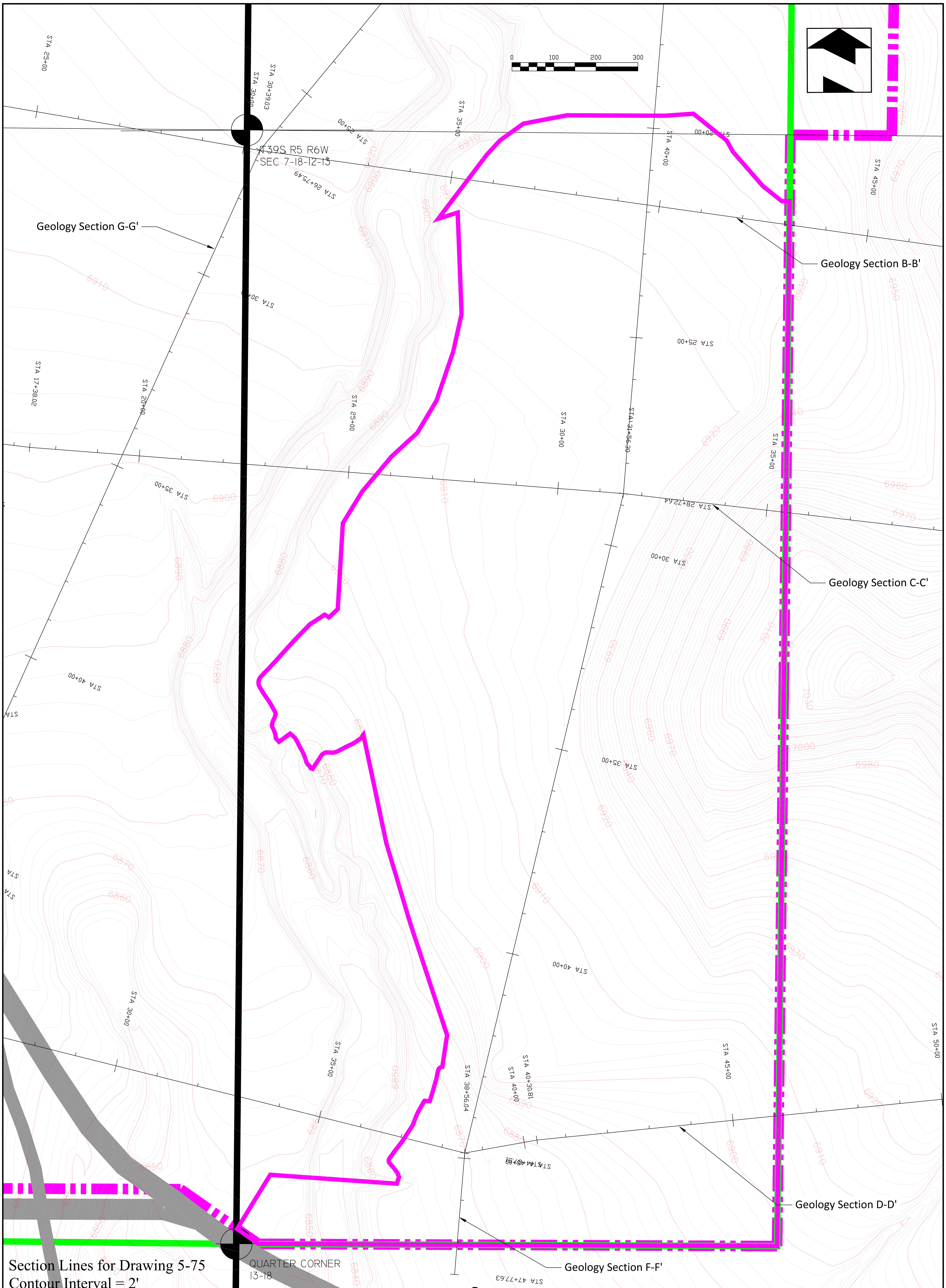
NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-74B

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- AREA 3 BOUNDARY
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-74C	DATE: 12/15/15
	SCALE: 1" = 100'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

POST MINING TOPOGRAPHY AREA 3

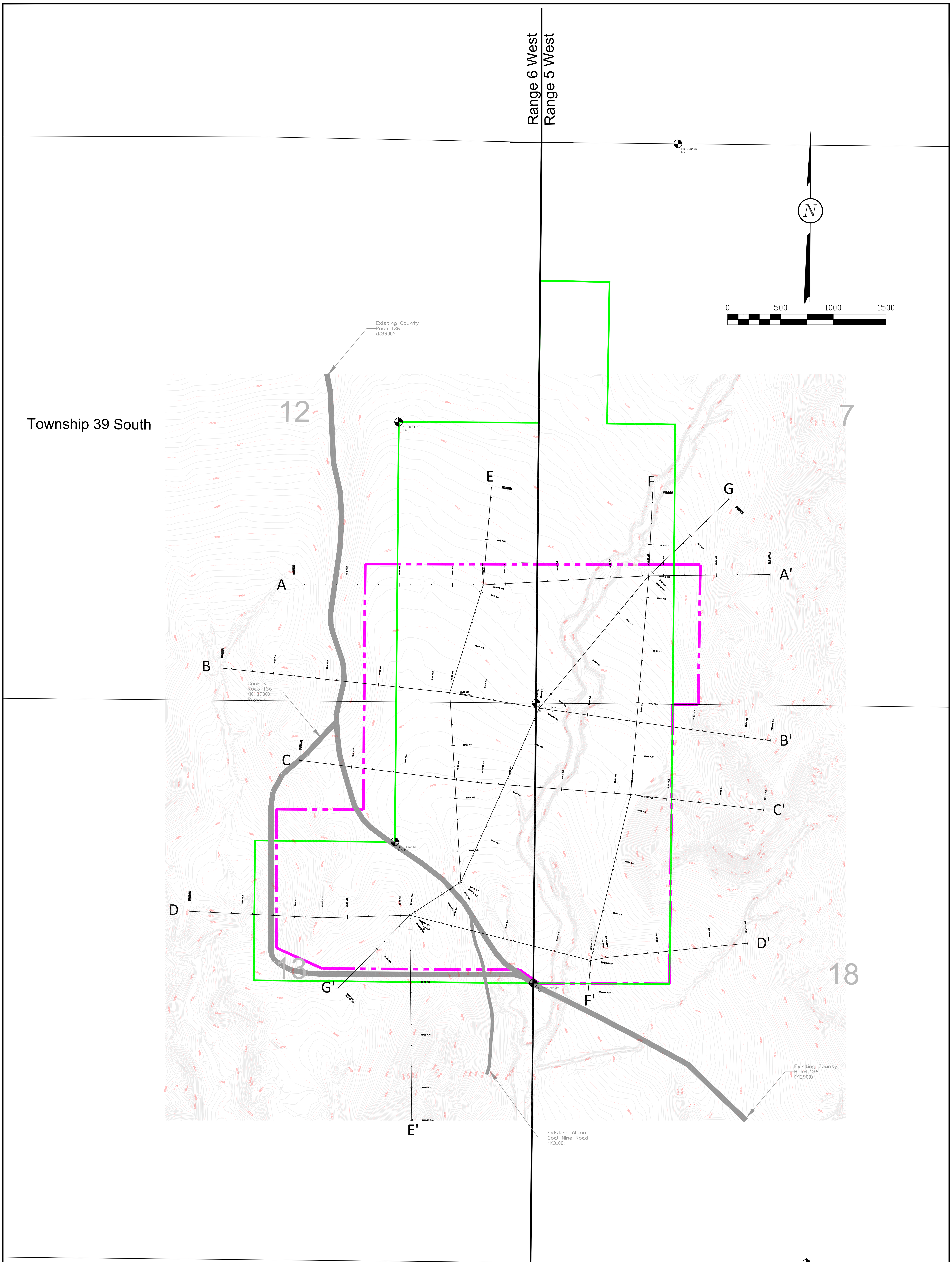
NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-74C

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Section Lines for Drawing 5-75
Contour Interval = 2'

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING:	DATE:
5-74	4/10/15
	SCALE:
	1" = 400'
JOB NUMBER:	SHEET
0001	

REVISIONS	
DATE:	BY:
10/12/15	AC
12/15/15	AC
1/8/16	AC
8/15/16	AC
5/4/17	AC

POST MINING TOPOGRAPHY

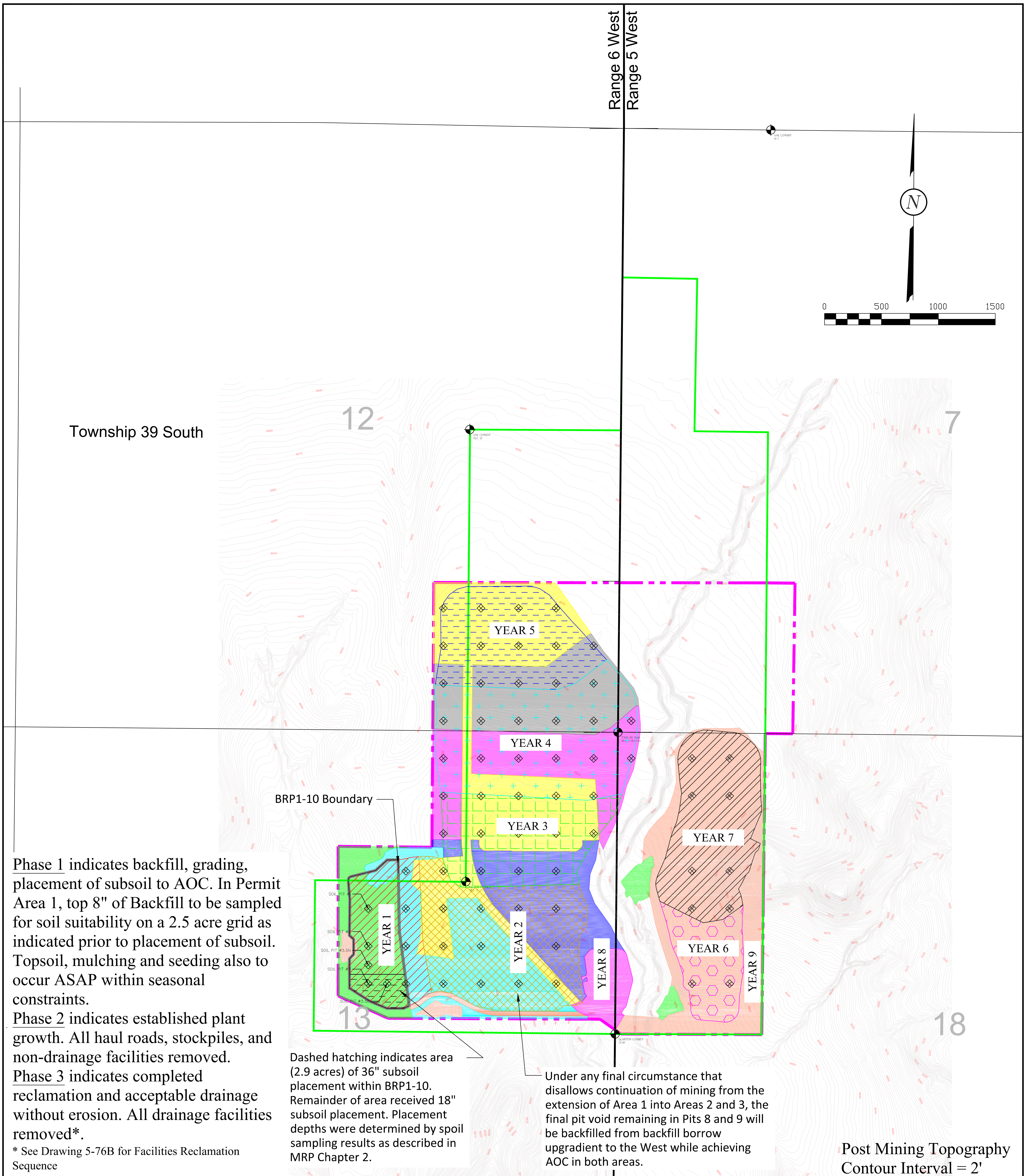
NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-74

UTAH REGISTERED PROFESSIONAL ENGINEER
#154168
DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Phase 1 indicates backfill, grading, placement of subsoil to AOC. In Permit Area 1, top 8" of Backfill to be sampled for soil suitability on a 2.5 acre grid as indicated prior to placement of subsoil. Topsoil, mulching and seeding also to occur ASAP within seasonal constraints.

Phase 2 indicates established plant growth. All haul roads, stockpiles, and non-drainage facilities removed.

Phase 3 indicates completed reclamation and acceptable drainage without erosion. All drainage facilities removed*.

* See Drawing 5-76B for Facilities Reclamation Sequence

Dashed hatching indicates area (2.9 acres) of 36" subsoil placement within BRP1-10. Remainder of area received 18" subsoil placement. Placement depths were determined by spoil sampling results as described in MRP Chapter 2.

Under any final circumstance that disallows continuation of mining from the extension of Area 1 into Areas 2 and 3, the final pit void remaining in Pits 8 and 9 will be backfilled from backfill borrow upgradient to the West while achieving AOC in both areas.

Phase 1 Reclamation:

- Year 1 Reclaim = 17.9 Acres
- Year 2 Reclaim = 34.7 Acres
- Year 3 Reclaim = 24.1 Acres
- Year 4 Reclaim = 39.3 Acres
- Year 5 Reclaim = 24.3 Acres
- Year 6 Reclaim = 11.6 Acres
- Year 7 Reclaim = 26.4 Acres
- Year 8 Reclaim = 00.0 Acres
- Year 9 Reclaim = 00.0 Acres

Total Ph. 1 Reclamation = 178.4 Acres

Phase 2/Surface Mulch & Seeding:

- Year 1 Seeding = 16.2 Acres
- Year 2 Seeding = 25.0 Acres
- Year 3 Seeding = 22.3 Acres
- Year 4 Seeding = 22.2 Acres
- Year 5 Seeding = 23.8 Acres
- Year 6 Seeding = 49.3 Acres
- Year 7 Seeding = 57.8 Acres
- Year 8 Seeding = 5.8 Acres
- Year 9 Seeding = 2.5 Acres

Total Ph. 2 Reclamation = 224.9 Acres

Phase 3 Reclamation to be completed and released within the 10 year timeframe from Phase 1.

LEGEND:
- PERMIT BOUNDARY
- PRIVATE COAL OWNERSHIP
- SECTION LINE
- FOUND SECTION CORNER
- FOUND PROPERTY CORNER
- BACKFILL SAMPLE PIT

DRAWN BY: A. CHRISTENSEN
CHECKED BY: DWG
DRAWING: 5-76A
DATE: 4/16/15
SCALE: 1" = 400'
JOB NUMBER: 0001
SHEET

REVISIONS

DATE:	BY:
9/7/16	AC
10/3/16	AC
12/14/16	AC
1/5/17	AC
2/2/17	AC
3/31/17	AC
5/4/17	AC

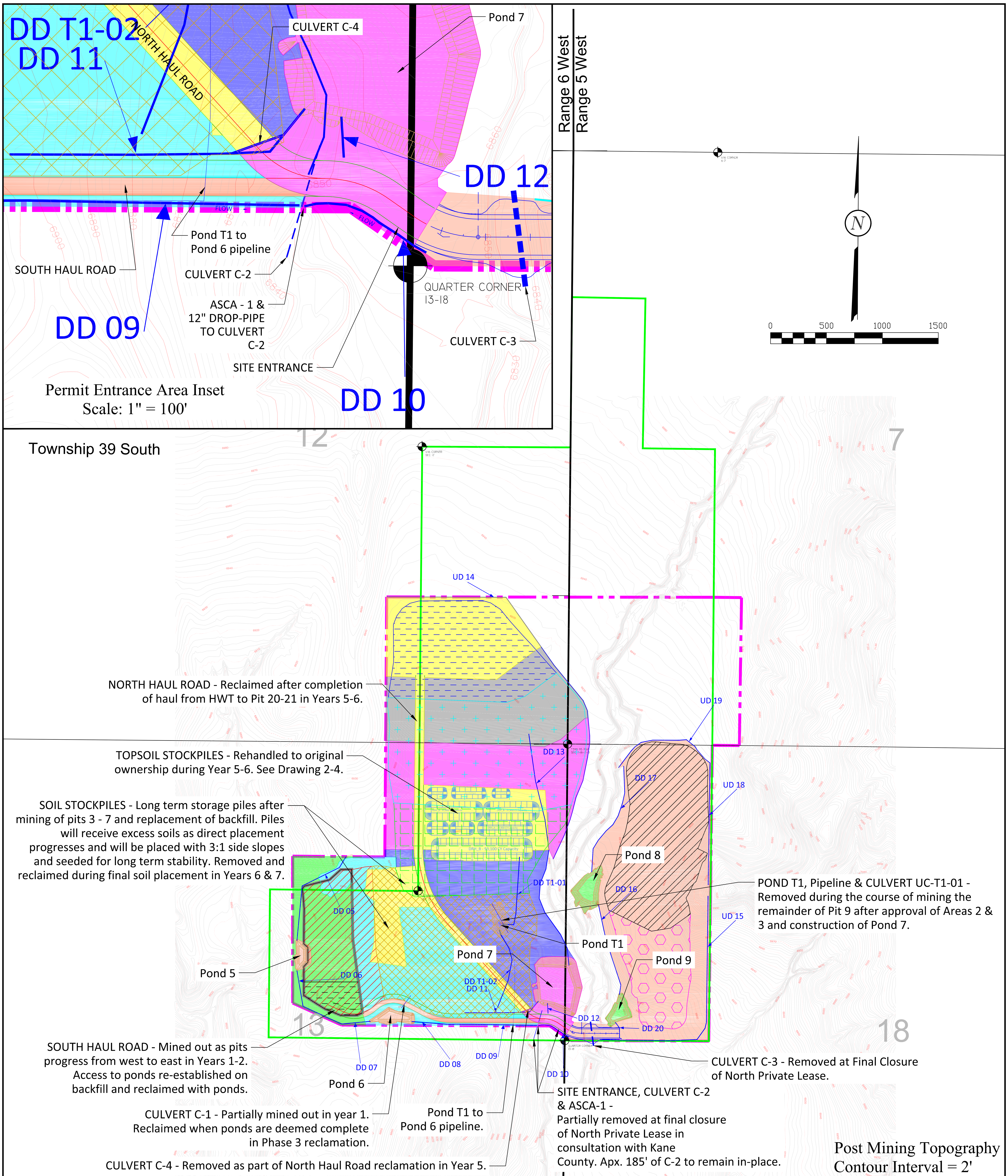
EARTHWORKS RECLAMATION SEQUENCE

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-76A

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY

Coal Hollow Project
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192



Phase 1 Reclamation:

Year 1 Reclaim = 17.9 Acres
Year 2 Reclaim = 34.7 Acres
Year 3 Reclaim = 24.1 Acres
Year 4 Reclaim = 39.3 Acres
Year 5 Reclaim = 24.3 Acres
Year 6 Reclaim = 11.6 Acres
Year 7 Reclaim = 26.4 Acres
Year 8 Reclaim = 00.0 Acres
Year 9 Reclaim = 00.0 Acres
Total Ph. 1 Reclamation = 178.4 Acres

Phase 2/Surface Mulch & Seeding:

Year 1 Seeding = 16.2 Acres
Year 2 Seeding = 25.0 Acres
Year 3 Seeding = 22.3 Acres
Year 4 Seeding = 22.2 Acres
Year 5 Seeding = 23.8 Acres
Year 6 Seeding = 49.3 Acres
Year 7 Seeding = 57.8 Acres
Year 8 Seeding = 5.8 Acres
Year 9 Seeding = 2.5 Acres
Total Ph. 2 Reclamation = 224.9 Acres

Phase 3 Reclamation to be completed and released within the 10 year timeframe from Phase 1. **Ponds, culverts and ditches (except Area 1 extension)** to be assessed and reclaimed as Phase 3 nears completion. Area 1-A structures will be removed as mining advances.

Contour Interval = 2'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-76B	DATE: 10/12/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
12/15/15	AC
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
3/31/16	AC
5/4/17	AC

FACILITIES RECLAMATION SEQUENCE

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-76B

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Alton Coal Development
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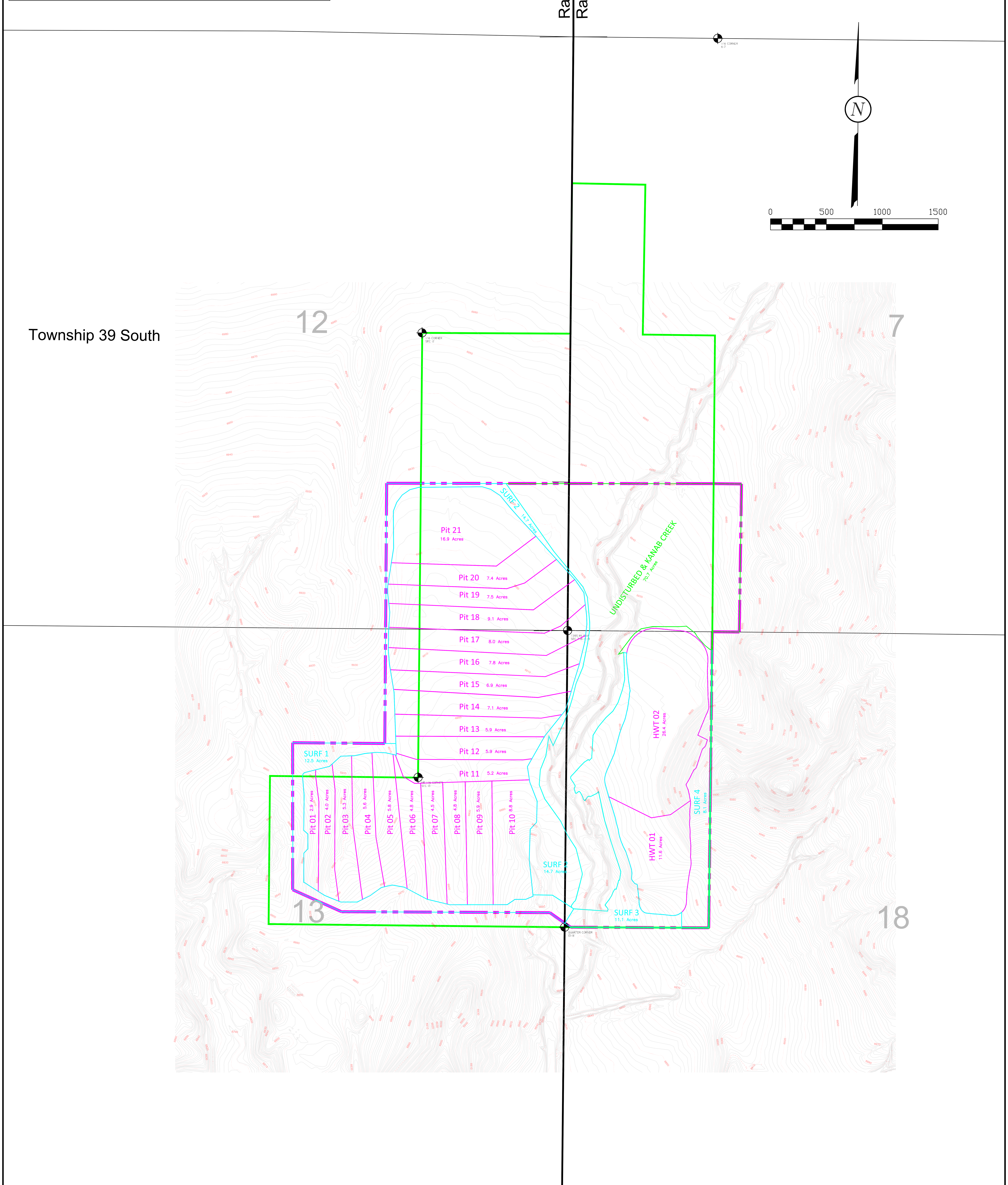
463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

Note:
- Bond polygon pit boundaries represent approximate crest of backfill slope to post-mining topography. Excavation slope crests are depicted in Drawing 5-57.



Undisturbed	=	70.7 Acres
Surface Disturbance	=	46.5 Acres
Open Pit Disturbance	=	178.4 Acres
Total Disturbance	=	224.9 Acres

Contour Interval = 2'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING: 5-77	DATE: 4/10/15
	SCALE: 1" = 400'
JOB NUMBER: 0001	SHEET

REVISIONS

DATE:	BY:
10/12/15	AC
12/1/15	AC
1/8/16	AC
8/15/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

BOND POLYGONS

NORTH COAL HOLLOW PROJECT
ALTON, UTAH

DRAWING: 5-77

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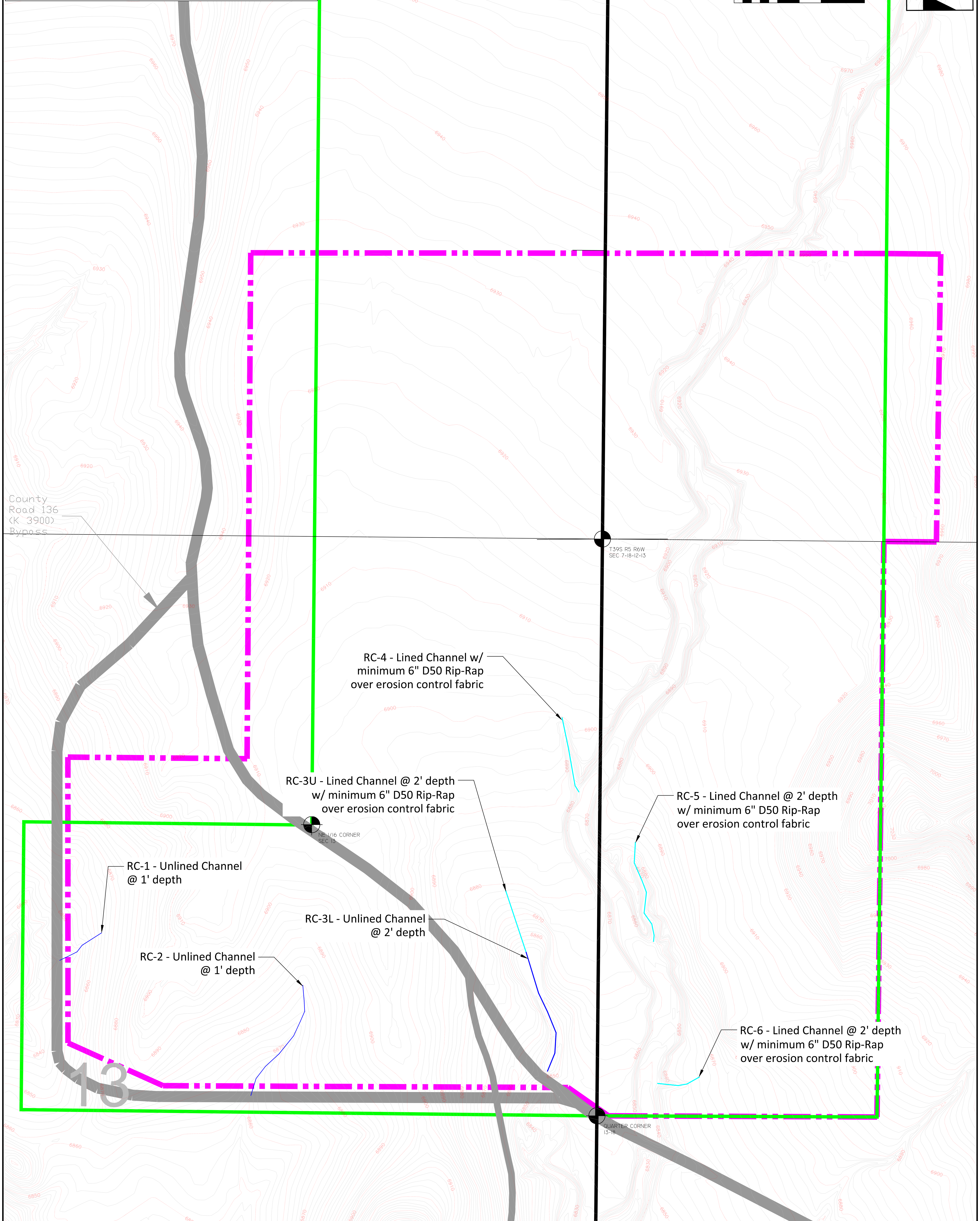
Fax (435)867-1192

Notes:
- See Appendix 5-12 for channel calculations
- See Drawings 5-72 & 5-73 for typical channel sections



Contour Interval = 2'

LEGEND:
PERMIT BOUNDARY
PRIVATE COAL OWNERSHIP
SECTION LINE
FOUND SECTION CORNER
FOUND PROPERTY CORNER
RECLAIMED CHANNEL

DRAWN BY:	CHECKED BY:
A. CHRISTENSEN	DWG
DRAWING:	DATE:
5-79	12/15/15
	SCALE:
	1" = 200'
JOB NUMBER:	SHEET
0001	

REVISIONS	
DATE:	BY:
1/8/16	AC
8/15/16	AC
9/7/16	AC
10/3/16	AC
2/2/17	AC
5/4/17	AC

POST MINING SURFACE HYDROLOGY

NORTH
COAL HOLLOW
PROJECT
ALTON, UTAH

DRAWING: 5-79

UTAH REGISTERED PROFESSIONAL ENGINEER
#154168
DAN W. GUY

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

TABLE OF CONTENTS

Chapter 7

R645-301-300

HYDROLOGY

DRAWINGS

TABLES

APPENDICES

CHAPTER 7

R645-301-700. HYDROLOGY

711. **GENERAL REQUIREMENTS**

711.100 – 711.500 Contents

This chapter provides a description of the hydrology and hydrogeology of the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area and the proposed North Private Lease area). Specifically, this permit section includes descriptions of existing hydrologic resources according to R645-301-720, proposed operations and potential impacts to the hydrologic balance according to R645-301-730, methods and calculations utilized to achieve compliance with the hydrologic design criteria and plans according to R645-301-740, applicable hydrologic performance standards according to R645-301-750, and reclamation activities according to R645-301-760.

This information is presented in subsequent sections of this chapter and in Appendix 7-1. Appendix 7-1 includes a comprehensive characterization of groundwater and surface-water systems in the Coal Hollow permit and adjacent areas (including the 85.88-acre Dame Lease IBC), recommendations for groundwater and surface-water monitoring, and the results of a field investigation regarding the potential for alluvial valley floors in the Coal Hollow Mine permit and adjacent area. It should be noted that Appendix 7-1 may be updated periodically in the future as additional hydrologic and hydrogeologic data become available. A characterization of groundwater and surface-water systems in the proposed North Private Lease area is presented in Appendix 7-16 (Petersen Hydrologic, 2015). Appendix 7-16 also includes recommendations for groundwater and surface-water monitoring in the proposed North Private Lease area. Appendix 7-18 provides further characterization of alluvial groundwater systems in the North Private Lease area.

712 **CERTIFICATION**

All cross sections, maps, and plans have been prepared per R645-301-512. Compliance with this section has been completed and certifications are available on all Drawings. The cross sections and maps that are included in this permit application and are required to be certified have been prepared by or under the direction of a qualified, registered, professional engineer or a professional geologist, with assistance from experts in related fields such as hydrology, geology and landscape architecture.

713 **INSPECTION**

Impoundments will be inspected as described under R645-301-514.300. Designs for impoundments in the Coal Hollow permit area are shown in Drawings 5-25 through 5-31 and Appendices A5-1 and A5-2. Designs for proposed impoundments in the North Private Lease are shown in Drawings 5-65 through 5-71A. No impoundments or sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) exist or are planned within the Coal Hollow Mine permit area including the proposed North Private Lease area.

A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments. Inspections will be made regularly during construction, upon completion of construction, and at least yearly until removal of the structure or release of the performance bond. The qualified registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. A copy of the report will be retained at or near the mine site.

720 **ENVIRONMENTAL DESCRIPTION**

721 **GENERAL REQUIREMENTS**

The existing, pre-mining hydrologic resources within the permit and adjacent areas that may be affected by coal mining and reclamation operations (including the 85.88-acre Dame Lease IBC and the proposed new North Private Lease area) are described in Appendix 7-1, Appendix 7-16 and Appendix 7-18 ~~Appendix 7-1 and Appendix 7-16~~ and are summarized below.

Groundwater Resources

A spring and seep survey of the Coal Hollow Mine permit and surrounding area (that includes the 85.88-acre Dame Lease IBC) has been conducted by Petersen Hydrologic, LLC (see sub-appendix B of Appendix 7-1). The locations of springs and seeps in the permit and adjacent area are shown on Drawing 7-1. The results of a spring and seep survey conducted by Petersen Hydrologic in the new North Private Lease area are presented in Appendix 7-16. Seasonal discharge and field water quality measurements for springs and seeps in the Coal Hollow Mine permit and adjacent area have been submitted electronically to the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (UDOGM, 2007). Baseline discharge and water quality data for groundwater resources in the Coal Hollow Mine permit and adjacent area are have also been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007). Locations of baseline monitoring stations are shown on Drawing 7-2. Locations of water rights in and adjacent to the Coal Hollow Mine permit area (including the 85.88-acre Dame Lease IBC area) are shown on Drawing 7-3. Locations of water rights in the North Private Lease and adjacent area are shown on Drawing 7-3N. Water rights data from the Coal Hollow Mine permit and adjacent area are detailed in Appendix 7-3. Water rights data from the proposed North Private Lease and adjacent area are shown in Appendix 7-3N. A plot showing potentiometric levels in alluvial groundwater systems in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC) is presented in Drawing 7-13. Potentiometric levels and the direction of shallow groundwater flow in the alluvial groundwater systems in the proposed North Private Lease area are presented in Appendix 7-16 and Appendix 7-18.

There are no domestic water supply springs or wells in the mine disturbance area. However, springs that provide water for domestic and livestock use are located on and adjacent to the permit area (See Drawing 7-2 and Appendix 7-3). Spring SP-23 (Spring House Spring) is located on the eastern boundary of the Coal Hollow Mine permit area. Spring SP-23 is a groundwater seepage area with both discrete and diffuse flow with a total discharge that is usually about one gallon per minute or less. Historically, this seepage area was used as a domestic water source for the Pugh property (personal communication, Burton Pugh, 2008). However, water from SP-23, which is not developed, has not been used for this purpose for many years.

Spring SP-35 is located along the eastern boundary of the Coal Hollow Mine permit area. Discharge from SP-35 averages less than 0.25 gallons per minute and is occasionally used for drinking water during camping trips or visits to the Pugh property (personal communication, Burton Pugh, 2008). However, there is apparently no associated domestic water right associated with this spring.

Two additional springs, which are located more distant from the proposed mining areas are also used for domestic water supply sources. These include SP-40, which is located at the Sorensen property, and SP-33, which is located at the Johnson property. Springs with stockwatering rights are listed in Appendix 7-3.

As described in Appendix 7-16, only one spring has been identified within the proposed North Private Lease permit area. This spring (Coyote Seep) discharges from the alluvial groundwater system at less than one gallon per minute. There is no water right associated with this spring. There are no Utah state appropriated groundwater rights within the North Private Lease area.

Some lands east of and adjacent to the Coal Hollow Mine permit area have historically been irrigated using water from alluvial springs. However, irrigation from these springs was apparently limited to home gardens and a few fruit trees. No irrigation of these lands (other than some yard watering at the Swapp Ranch house) is currently occurring nor has it occurred in at least the past 10 years (Personal communication, Burton Pugh, 2008; Richard Dames, 2007). Additionally, limited irrigation of lands occurs east of the Coal Hollow permit area using surface waters derived from runoff from the adjacent Paunsaugunt Plateau area. Irrigation of these lands is largely limited to years with appreciable precipitation and stream runoff (Personal communication, Darlynn Sorensen, 2008).

Groundwater discharge occurs from springs and seeps in the upland areas of the Paunsaugunt Plateau east of the permit area (Tilton, 2001; Appendix 6-3). However, these springs discharge from rock strata that are topographically and stratigraphically up-gradient of and considerable distances from the Coal Hollow Mine permit area and the North Private Lease area. Consequently, groundwater systems in these areas will not be impacted by mining activities and these are not considered further here.

Groundwater resources in the Tropic Shale and underlying Dakota Formation in the permit and adjacent area and the North Private Lease area are not appreciable. During drilling activities in the Coal Hollow Mine permit and adjacent area, appreciable groundwater inflows were not encountered in the Tropic Shale. Other than a single seep (SP-37; Drawing 7-1) which discharges at a rate of less than 0.05 gpm from an apparent fracture system in a sandy horizon along the eastern margin of lower Sink Valley, no springs or seeps with measurable discharge have been identified in the Tropic Shale. The lack of appreciable groundwater discharge in the Tropic Shale is a result of the poor water transmitting properties of the marine shale unit. While sandstone units occur stratigraphically higher in the Tropic Shale in the surrounding area, in areas proposed for surface mining, the unit present consists of a fairly uniform sequence of soft shale, silty shale, and claystone with minor siltstone horizons. Competent sandstone strata in the Tropic Shale overlying proposed mining areas were not observed during drilling. The Tropic Shale acts as a barrier impeding downward migration of groundwater in the Coal Hollow Mine permit and adjacent area where it is present. The unit also forms a basal confining layer for alluvial groundwater systems in the permit area. Similar hydrogeologic properties in the Tropic Shale were noted during drilling activities in the proposed North Private Lease area.

Groundwater discharge from the Dakota Sandstone in the permit and adjacent area is also meager. The Dakota Formation consists of shaley strata interbedded with lenticular, fine- to medium-grained sandstone and coal. Because of the pervasiveness of interbedded low-permeability horizons in the formation and the vertical and lateral discontinuity of sandstone horizons, the potential for vertical and horizontal movement of groundwater is limited. While no springs discharge from the Dakota Formation in the permit area, a spring with a discharge of about 1 gpm and displaying little seasonal variability in discharge (SP-4; Drawing 7-1) discharges from an apparent fault zone in the Dakota Formation approximately 1.1 miles south of the existing Coal Hollow permit area. Additionally, two seeps with discharges of less than 0.05 gpm (SP-27 and SP-34; Drawing 7-1) seep from the Dakota Formation in lower Sink Valley more than ½ mile south of the Coal Hollow Mine permit area. The results of slug testing performed on wells screened in the Smirl coal seam indicate relatively low values of hydraulic conductivity for the coal seam (Table 7-8). In much of the mining area, the coal seam is dry (UDOGM, 2007). Thus, appreciable migration of groundwater through the Smirl coal seam is not anticipated.

In the proposed North Private Lease area, there are no springs or seeps discharging from the Dakota Formation (Appendix 7-16). The lack of springs in the Dakota Formation is likely attributable to 1) the presence of Tropic Shale bedrock overlying the formation, which limits the potential for vertical recharge to the formation, 2) the limited surface exposure of the formation, and 3) the overall poor water transmitting potential of the Dakota Formation (Appendix 7-1).

It should be noted that there are springs that discharge below irrigated fields near the town of Alton, Utah west of the proposed North Private Lease mining areas (Appendix 7-16). These springs, which are isolated from the proposed mining areas by upland areas of low-permeability Tropic Shale bedrock, discharge at locations that are stratigraphically near the Tropic Shale/Dakota Formation contact. The bedrock in these areas has apparently been altered as a result of near-surface burning of the Smirl coal seam, which can alter the water bearing and water transmitting characteristics of the bedrock relative to the unaltered bedrock petrology. Appreciable faulting associated with the Sevier Fault Zone has also been mapped in the area to the west of the spring discharge locations (Tilton, 2001).

No water wells are known to exist in the Tropic Shale or Dakota Formation in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area and the proposed North Private Lease area), demonstrating the inability of these formations to transmit useful quantities of water to wells. Groundwaters from the Tropic Shale and Dakota Formation do not contribute measurable baseflow to streams in the Coal Hollow Mine permit and adjacent area and the North Private Lease area (at least at the surface in stream channels).

Groundwater discharging from springs below the town of Alton, Utah do contribute to the baseflow discharge in the Simpson Hollow tributary to Kanab Creek (Appendix 7-16) west of the proposed North Private Lease area.

Natural groundwater discharge in the existing Coal Hollow Mine permit and adjacent area occurs primarily from alluvial sediments. Alluvial discharge occurs both as discrete springs and seeps (Drawing 7-1) and also locally as diffuse seepage to the surface. Groundwater discharge areas in the Coal Hollow Mine permit and adjacent area are shown on Drawing 7-4 (see also photograph section). The area of most appreciable alluvial groundwater discharge occurs in central Sink Valley in the northwest quarter of Section 29, T39S, R5W (see Drawing 7-4; groundwater discharge area A). The alluvial groundwater system in this area exists under artesian conditions, resulting from the presence of a considerable thickness of sloping, low permeability clayey sediments overlying coarser, water-bearing alluvial sediments at depth (See Drawing 6-3). The artesian alluvial groundwater system in Sink Valley is likely recharged via mountain-front-recharge along the flanks of the Paunsaugunt Plateau to the east and north of the Coal Hollow Mine permit area. This artesian alluvial groundwater system that exists along the eastern margins of Sink Valley is likely continuous from near mountain-front recharge areas southward along the eastern margins of Sink Valley to the lower portion of Sink Valley. Discharge from the alluvial groundwater systems in and adjacent to the Coal Hollow Mine permit area occurs primarily in two areas (Drawing 7-4). In the northwest quarter of Section 29, T39S, R5W, considerable natural discharge from the alluvial groundwater system occurs through springs and seeps (Drawing 7-4; groundwater discharge area A). Minor discharge from several flowing artesian wells also occurs in this area. The artesian alluvial groundwater system in eastern Sink Valley also likely provides recharge to the clayey alluvial sediments in the southwestern portion of the valley in the Coal Hollow Mine permit area. Discharge from the alluvial groundwater system in groundwater discharge area A area results in decreases to the amount of water in storage in the alluvial groundwater system and also decreases in artesian hydraulic pressure in the aquifer.

Appreciable discharge from the alluvial groundwater system also occurs in lower Sink Valley in the northwest quarter of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). Sink Valley constricts markedly in this area, which forces shallow alluvial groundwaters flowing down the valley to discharge at the land surface as springs, seeps, and diffuse discharge to the surface (i.e., there is a significant decrease in the cross-sectional area of the alluvial sediments). Groundwater discharge in this area occurs from diffuse seepage to the surface and also as discharges to two springs and several small seeps (Drawing 7-1).

Much of the alluvial groundwater in Sink Valley likely ultimately leaves the valley via evapotranspiration. This conclusion is based on the observation that there is very rarely any discharge of surface water (at least at the surface in the channel) in Sink Valley Wash below Sink Valley (See site SW-9; Drawing 7-2; UDOGM, 2007). The clayey, low-permeability sediments present at the surface over most of Sink Valley also impede appreciable infiltration of precipitation and snowmelt waters into the deeper subsurface. Hence, groundwater recharge to the lower half of the Sink Valley sediments (including the Coal Hollow Mine permit area) likely occurs primarily via horizontal migration of alluvial groundwaters from up-gradient areas.

Flowing artesian groundwater conditions are also observed in monitoring wells screened near the base of the alluvial sediments in the northwest corner of Section 32 T39S, R5W. It is probable that the artesian alluvial groundwater system in Section 29, T39S, R5W is continuous with that in the northwest corner of Section 32. It should be noted that within the Coal Hollow permit area, artesian conditions were not observed in monitoring wells. While the thickness of the alluvial sediments in the artesian groundwater system east of the Coal Hollow permit area range up to 150 feet thick, the thickness of alluvium overlying areas with mineable coal in the Coal Hollow permit area generally does not exceed about 50 feet and in many locations it is considerably thinner.

Natural discharge of alluvial groundwater in the Robinson Creek drainage area is meager. This condition is largely due to the presence of the elevated ridge of impermeable Tropic Shale bedrock associated with the Sink Valley Fault that dissects and effectively isolates the alluvium east of the fault from that west of the fault (See Drawing 6-1). Because of the low permeability of the Tropic Shale, this condition apparently forces alluvial groundwater east of the Tropic Shale ridge to flow to the south toward Sink Valley that would otherwise report to the Robinson Creek drainage. During high flow conditions in the alluvial groundwater system east of the Tropic Shale ridge, minor amounts of groundwater “overtop” the bedrock ridge and drain via surface flow over the Tropic Shale bedrock, where it either recharges shallow alluvial sediments to the west of the fault or is lost to evapotranspiration. The influence of the Tropic Shale ridge is readily evident in field observations, with marked differences in vegetation and soil moisture being apparent on opposite sides of the ridge. During low-flow conditions, discharge from the overtopping of the bedrock ridge has generally not been observed. Isolated areas of soil wetness and shallow perched alluvial groundwater systems that exist west of the bedrock ridge in the northeast corner of Section 30 and the southeast corner of Section 19, T39S, R5W are likely sourced via this mechanism.

Seepage of alluvial groundwater into the deeply incised lower Robinson Creek stream channel occurs near the contact with the underlying Dakota Formation in the southeast quarter of Section 19, T39S, R5W. This water is likely related to saturated alluvial deposits underlying the Robinson Creek stream channel. The alluvial groundwater emerges near where the stream channel intersects the alluvial groundwater system. It is noteworthy that the location of the emergence of alluvial water in the channel has varied somewhat over time. The bank seepage water is likely alluvial groundwater that seeps to the surface where the incised stream channel intersects the potentiometric surface of the alluvial groundwater system. Typically, this is near the contact with the underlying Dakota Formation bedrock in the bottom of the stream channel. Because of the seasonal changes in the elevation of the potentiometric head in the alluvial groundwater system, the location of the bank seepage is variable over time (i.e. the variability in the bank seepage locations are likely controlled primarily by temporal variability in potentiometric levels in the alluvial groundwater system rather than by fixed, permeability-controlled groundwater preferential pathways in the aquifer skeleton). Consequently, the bank seepage locations are not well-defined point sources, but rather dynamic seepage fronts along this general reach of the stream.

The Robinson Creek stream channel above this location is almost always dry (except for in direct response to torrential precipitation events or during the springtime runoff season during wet years. This seepage of alluvial water in the Lower Robinson Creek channel is typically about 5 to 10 gpm or less and is routinely monitored at monitoring station SW-5 (Drawing 7-2).

Information on water quality for groundwaters and surface-waters has been uploaded into the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007) and is summarized and described in Appendix 7-1.

Appreciable spatial variability exists in water quality in groundwaters and surface waters in the Coal Hollow permit and adjacent area. Stiff diagrams depicting solute compositions and overall water quality for groundwaters and surface waters in the Coal Hollow Mine permit and adjacent area are shown in Appendix 7-1. Important water quality characteristics for groundwaters are summarized below.

Groundwater Source	Chemical type	TDS (mg/L)
Alluvial groundwaters, coarse-grained system east of permit area	Calcium-magnesium-bicarbonate	380 mg/L to 500 mg/L typically, Little seasonal variability
Alluvial groundwaters in south sink valley	Variable, magnesium-bicarbonate sulfate, calcium-magnesium-bicarbonate	450 mg/L to 3,600 typically, Highly variable based on season and climate for shallow systems, less variability in deeper system
Dakota Formation, fault groundwater system south of permit area	Sodium-bicarbonate	500 mg/L to 600 mg/L typically, Little seasonal variability

Water quality characteristics for groundwaters in the proposed North Private Lease area are summarized in Appendix 7-16 as well as Appendix 7-18. It is apparent that the overall water quality of alluvial groundwater degrades from the mountain-front recharge water to the artesian groundwater system east of the Coal Hollow permit area to the non-artesian shallow alluvial groundwater systems located in the more distal portions of Sink Valley. These changes are due to groundwater interaction with soluble minerals in the primarily Tropic Shale-derived sediments that make up the shallow alluvial materials in the permit area.

This down-gradient degradation in water quality is shown graphically on Drawing 7-5. In Drawing 7-5, the average specific conductance values in μS/cm for representative springs and seeps in the Sink Valley drainage are plotted on the map as circles with the circle areas being proportional to the specific conductance average for the spring or seep. The specific conductance information used in generating Drawing 7-5 has been submitted electronically to the Division's hydrology database (UDOGM, 2007). It is readily apparent from Drawing 7-5 that the specific conductance (which is a reflection of the dissolved solids concentration) is degraded from the mountain-front recharge water (represented by stream SW-8) to the artesian alluvial groundwater system in the northwest quarter of Section 29, T5W, R39S, to the alluvial groundwaters in the southern portion of Sink Valley below the Coal Hollow Mine permit area.

Specific conductance values were used for plotting in Drawing 7-5 because specific conductance values are available for all springs and seeps, while laboratory chemical analyses are available for only some of the springs and seeps. Stiff (1951) diagrams for selected springs along this geochemical evolutionary pathway are shown on Figure 14 of Appendix 7-1. It is apparent from the Stiff diagrams and from geochemical information submitted to the Division (UDOGM, 2007) that the mountain-front recharge water (represented by monitoring site SW-8 in upper Swapp Hollow) is of the calcium-magnesium-bicarbonate chemical type with an average TDS concentration of 333 mg/L. Groundwater downgradient of the mountain-front recharge areas in the artesian alluvial groundwater system in Section 29, T5W, R39S, is also of the calcium-magnesium-bicarbonate chemical type, with an average TDS concentration at artesian well Y-61 of 400 mg/L. Further downgradient in the artesian alluvial groundwater system in Section 29, the geochemical composition at SP-8 is of the calcium-magnesium-bicarbonate chemical type with a somewhat increased TDS concentration of 425 mg/L. In the lower portions of Sink Valley in Section 32, T5W, R39S, the chemical quality of the alluvial groundwater is appreciably degraded relative to that in the upper portions of the groundwater system. At spring SP-6, the composition of the alluvial groundwater is seasonally variable and is of the magnesium-bicarbonate-sulfate, or calcium-magnesium-bicarbonate-sulfate chemical type. The TDS concentrations at SP-6 average 970 mg/L. The chemical composition of alluvial groundwater at SP-33 is of a geochemical type similar to that at SP-6, although TDS concentrations are somewhat lower, averaging 795 mg/L. The spatial variability apparent in the TDS concentrations in the alluvial groundwater in Section 32 is likely related to flushing effects resulting from higher groundwater fluxes through zones of increased permeability in the alluvium. It is noteworthy that groundwater in the gravelly zones in the deeper alluvium east of the permit area in Section 32 monitored at the 85-foot deep well LS-85 is considerably lower in TDS concentration with an average of 457 mg/L. The lower TDS concentrations of artesian alluvial groundwater in the deeper, coarser-grained portions of the alluvium are likely attributable to the isolation of these groundwaters from the shallow, clayey, Tropic Shale derived alluvial sediment in the near-surface alluvial groundwaters.

The appreciable temporal variability in the solute geochemical compositions of the shallow alluvial groundwaters in Section 32 is likely attributable to seasonal and climatic variability in the groundwater flux rate through these systems and corresponding variability in rock/water ratios and residence time in the evaporate mineral rich Tropic Shale derived shallow alluvial sediments present in this portion of Sink Valley. Alluvial groundwaters in the deeper portions of Sink Valley to the east in Section 32 are part of a larger, more continuous groundwater system that is hydraulically isolated from overlying shallow recharge sources, and consequently have not exhibited similar temporal variability in solute geochemical composition.

Surface Water Resources

Surface-water resources in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC) are described in Appendix 7-1 and are summarized below. Surface-water resources in the proposed North Private Lease area are described in Appendix 7-16 and Appendix 7-18.

Surface waters in the Coal Hollow Mine permit and adjacent area and the proposed North Private Lease area are tributary to Kanab Creek. Surface waters in the northern portion of the existing permit and adjacent area drain into the Robinson Creek and upper Kanab Creek drainages. Surface waters in the southern portion of the permit and adjacent area drain into the Sink Valley Wash drainage which is tributary to Kanab Creek about 6 miles below the Coal Hollow Mine permit area. Surface-water drainages in the permit and surrounding areas are shown in Appendix 7-1. Surface-water drainages in the proposed North Private Lease area are shown in Appendix 7-16. Surface-water baseline monitoring stations are shown on Drawing 7-2. Locations of surface-water water rights in and adjacent to the Coal Hollow Mine permit and adjacent area are shown on Drawing 7-3. Locations of surface-water rights in and adjacent to the proposed North Private Lease are shown on Appendix 7-3N. Water rights data from the Coal Hollow Mine permit and adjacent area are detailed in Appendix 7-3. Water rights data from the proposed North Private Lease and adjacent area are detailed in Appendix 7-3N. Information regarding alluvial groundwater systems and Kanab Creek in the North Private Lease are presented in Appendix 7-18.

Information on water quality for groundwaters and surface-waters has been uploaded into the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007) and is summarized and described in Appendix 7-1 and Appendix 7-16, Appendix 7-16 and Appendix 7-18.

Surface waters in Kanab Creek are used for stock watering and crop irrigation in the irrigable lands adjacent to Kanab Creek west of the Coal Hollow Mine permit area. Discharge in Kanab Creek measured near the town of Alton (SW-1) is seasonally dependent and largely influenced by upstream water use. Discharge in Kanab Creek monitored at SW-1 typically ranges from 10 cfs or less during the springtime runoff period to 1 cfs or less during the summertime.

Discharge in Lower Robinson Creek drainage is meager. Other than during the springtime runoff event in wet years or during torrential precipitation events, flow has not been observed at monitoring stations SW-4 and SW-101 (Drawing 7-2). Discharge at the lower monitoring site on Lower Robinson Creek (SW-5; Drawing 7-2) is meager. The small discharge occasionally present at SW-5 is derived from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel between monitoring sites SW-101 and SW-5.

Tributaries to the Sink Valley Wash drainage in the Coal Hollow Mine permit and adjacent areas include (from north to south) Water Canyon, an unnamed drainage south of Water Canyon in Section 21 T39S, R5W, and Swapp Hollow. Discharge rates in these drainages are highly seasonally dependent (UDOGM, 2007; Appendix 7-1). Discharges in the Water Canyon and Swapp Hollow drainages are intermittent or perennial in nature with discharge peaks occurring during the springtime runoff season and much lower flows occurring during the late summer and fall months. Discharge in the unnamed drainage in Section 21 T39S, R5W is ephemeral.

The water quality and discharge characteristics of surface waters in the Coal Hollow Mine permit and adjacent area are presented in UDOGM (2007) and described in Appendix 7-1. The water quality and discharge characteristics of surface waters in the proposed North Private Lease area are described in Appendix 7-16 and Appendix 7-18. Solute compositions of stream waters are also depicted graphically as Stiff diagrams in Appendix 7-1 and Appendix 7-16. The solute compositions of surface waters in the Coal Hollow Mine permit and adjacent area are summarized below. Solute compositions of surface waters in the proposed North Private Lease and adjacent areas are summarized in Appendix 7-16. Information regarding groundwater-surface-water interactions along Kanab Creek in the North Private Lease is presented in Appendix 7-18.

Source	Chemical type	TDS (mg/L)
Robinson Creek/Dry Fork	Calcium-magnesium-bicarbonate	300 mg/L typical
Lower Robinson Creek	Variable, magnesium-sulfate-bicarbonate	300 – 3,500 mg/L typical, dependent on discharge
Swapp Hollow	Calcium-magnesium-bicarbonate	250-350 mg/L typical
Kanab Creek	Magnesium-calcium-bicarbonate-sulfate during high flow, variable during low-flow, variability likely due largely to interaction with Tropic Shale soils and irrigation return flows	500-1,300 mg/L typical, Variable dependent on season and irrigation use
Sink Valley Wash	Magnesium-calcium-bicarbonate	600 -1,500 mg/L typical, variable dependent on discharge

Considerable seasonal variability exists in the solute compositions of stream waters in Kanab Creek in the Coal Hollow Mine permit and adjacent area (UDOGM, 2007; Appendix 7-1). During low-flow conditions, interactions between stream waters and Tropic Shale or Tropic Shale-derived alluvial sediments likely result in increased TDS concentrations. Return flow from irrigated fields and interactions with soils rich in soluble minerals also likely contribute to increased TDS concentrations in the summertime. During the spring runoff season, high surface-water flows that originate from the adjacent upland areas dominate the flow in the channel. The TDS concentrations of Kanab Creek waters during high-flow conditions are thus lower than during the low-flow season. Much less seasonal variability in solute content in surface water flows from the mountain stream in Swapp Hollow (UDOGM, 2007; Appendix 7-1). This condition is likely attributable to the fact that the stream in Swapp Hollow, which originates on geologic formations overlying the Tropic Shale, has considerably less contact with the Tropic Shale than does Kanab Creek. Additionally, there are no known irrigation diversions or returns above the stream monitoring point (SW-8; Drawing 7-2) in Swapp Hollow.

722 **CROSS SECTIONS AND MAPS**

722.100 A map showing the locations of springs and seeps in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area) is presented in Drawing 7-1. A map showing the locations of springs and seeps in the North Private Lease area is provided in Appendix 7-16. A map showing potentiometric levels in alluvial groundwater systems in the Coal Hollow and adjacent areas (including the 85.88-acre Dame Lease IBC) is presented in Drawing 7-13. A Map showing potentiometric levels in the North Private Lease area is provided in Appendix 7-16. Additional information from the alluvial groundwater system in the North Private Lease is provided in Appendix 7-18. It is important to note that the alluvial groundwater potentiometric contours depicted in Drawing 7-13 are not representative of a laterally or vertically continuous groundwater system. Within the Coal Hollow Mine permit and adjacent area, appreciable portions of the alluvial sediments are not saturated. Additionally, perched groundwater conditions are present in many locations in the alluvium in the area. In other words, the alluvial groundwater systems in the Coal Hollow Mine permit and adjacent area are not a single, interconnected aquifer. Rather, there exist several areas of saturated alluvium, which may or may not be in good hydraulic communication with adjacent areas. Consequently, it is not possible or meaningful to construct a true potentiometric contour map in the strict sense. Consequently, it is not appropriate to evaluate regional potentiometric trends over large distances or to infer precise groundwater flow directions or hydraulic gradients in the alluvial groundwater system based on Drawing 7-13. The alluvial groundwater system potentiometric map presented in Drawing 7-13 is useful for evaluating approximate local potentiometric conditions and general saturation trends.

722.200 Location of surface water bodies

Within the Coal Hollow Mine permit and adjacent area, no significant natural ponds or lakes occur. The locations of springs and streams are shown in Drawing 7-1. The locations of springs and streams in the North Private Lease area are shown in Appendix 7-16. Many small earthen impoundments and ponds have been created to store surface-water runoff and spring discharge water for stock watering and irrigation use. Some of these impoundments were created by constructing straight or semi-circular berms across ephemeral surface water drainages to impound surface runoff. Because of the character of the alluvial sediments, some of the ponds have become filled with sediment over time and the holding capacities have diminished. The locations of ponds and associated conveyance ditches are shown on Drawing 7-7.

722.300 Baseline monitoring stations

Baseline monitoring stations are shown on Drawing 7- 2. A map showing the locations of monitoring wells in the Coal Hollow permit and adjacent area is presented in Drawing 7-12 and on Figure 12 of Appendix 7-1. The locations and completion details of monitoring wells in the North Private Lease area are provided in Appendix 7-16 and Appendix 7-18. Drawing-7-12 also shows monitoring stations from which baseline hydrologic data were collected in previous studies. Monitoring station locations, elevations, and other details are presented in Table 7-1 and Appendix 7-16 Appendix 7-18.

722.400 Location of water wells

Water well locations are shown in Drawing 7-2 and Drawing 7-12. Well construction details and locations are presented in Table 7-2. Locations and construction details of water wells in the North Private Lease area are shown in Appendix 7-16 and Appendix 7-18.

722.500 Contour map(s) of disturbed area(s)

Surface contours representing the existing land surface configuration of the Coal Hollow permit area (including potentially disturbed areas) are shown on Drawing 5-1 and the post mining land configuration is shown on 5-~~35~~37. Cross sections with both these landforms are shown on Drawing 5-37A. Surface contours representing the existing land surface configuration of the North Private Lease permit area (including potentially disturbed areas) are shown on Drawing 5-45 and the post mining land configuration is shown on 5-74. Cross sections with both these landforms are shown on Drawing 5-75. The premining landform, with exception of the Facilities area and Lower Robinson Creek, are from an aerial flight that was limited to a five foot contour interval. Therefore, contours have been interpolated down to a 2 foot level using the available aerial flight information. This interpolation provides accuracy for the Division to make the necessary determinations. The Facilities area and portions of Lower Robinson Creek are actual survey data to the accuracy of 2-foot contours.

723 SAMPLING AND ANALYSIS

Water quality sampling and analyses have been and will be conducted according to the "Standard Methods for the Examination of Water and Wastewater" or EPA methods listed in 40 CFR Parts 136 and 434. Information regarding laboratory analytical methods utilized in performing water quality analyses at the analytical laboratories has been submitted to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007).

724 BASELINE INFORMATION

Baseline groundwater, surface-water, geologic, and climatologic data (including information for the 85.88-acre Dame Lease IBC area) are described in Appendix 7-1 and summarized below. Baseline information for the North Private Lease area are provided in Appendix 7-16 and Appendix 7-18.

724.100 Groundwater Information

The location of wells and springs in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC) are shown on Drawings 7-1 (Spring and seep survey map), 7-2 (Baseline monitoring locations), and 7-12 (Monitoring well location map). Groundwater rights in and around the Coal Hollow Mine permit area are shown on Drawing 7-3 and tabulated in Appendix 7-3. Groundwater rights information for the North Private Lease area are provided in Appendix 7-3N and shown on Drawing 7-3N.

Seasonal quality and quantity of groundwater and usage is presented in Appendix 7-1 and UDOGM (2007). Baseline discharge and water quality data have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality (UDOGM, 2007).

Baseline monitoring of groundwater resources in and around the Coal Hollow permit area have been carried out by several entities. Previous hydrologic studies of the region have been made in the Alton Coal Field area by Goode (1964, 1966), Sandberg (1979), Cordova (1981), and Plantz (1983). Selected hydrologic data collected in conjunction with these studies have been incorporated into the hydrologic analysis and baseline data included in this permit application.

During the 1980's, extensive monitoring of groundwater resources in the permit and surrounding areas was performed by Utah International, Inc. Utah International Inc.'s groundwater monitoring activities included the construction of numerous groundwater monitoring wells, aquifer testing activities, and the performance of discharge, water level, and field and laboratory water quality monitoring of springs, seeps, and wells. These baseline monitoring activities were performed as part of a proposed coal mine permitting action in the Alton Coal Field. Ultimately, the proposed coal mining action did not proceed. Relevant monitoring information from the Utah International, Inc. baseline monitoring activities have been included as supplemental baseline data included in this permit application.

Commencing in the 2nd quarter of 2005, regular quarterly baseline monitoring of groundwater resources has been commissioned by Alton Coal Development, LLC. Baseline monitoring of springs, seeps, and groundwater wells in and around the Coal Hollow Mine permit area have been routinely performed. Data collected in the baseline monitoring activities have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007).

Baseline potentiometric information from wells has been input into the DOGM database. For non-flowing-artesian wells, this information has been input in a depth-to-water-relative-to-the-top-of-the-well-casing format using units of feet. For wells experiencing flowing artesian conditions, the potentiometric data are reported to the database in feet as a height-of-the-potentiometric-surface-above-the-top-of-the-well-casing format expressed as a negative number (which makes the flowing-artesian and non-flowing-artesian potentiometric measurements directly comparable). For both conditions, the reported measurements can be directly converted to an absolute water elevation by subtracting the reported value from the elevation of the top of the well casing.

The potentiometric head in monitoring wells experiencing flowing-artesian conditions is measured either 1) by temporarily extending the height of the well casing and allowing the water level to stabilize and the performing a height of the water column measurement (where the artesian pressure is small), or 2) by using a pressure gauge to measure the shut-in artesian pressure in the well and then converting that number to an equivalent height in feet.

During December 2006 and January 2007 an extensive drilling and monitoring well construction program was implemented. This hydrogeologic program included the installation of 30 groundwater monitoring wells in and adjacent to the Coal Hollow Mine permit area. The focus of the drilling program was to characterize the stratigraphy and hydrogeologic properties of alluvial groundwater systems in and adjacent to mining areas. Aquifer characterization of the alluvial groundwater system was also performed using pump testing and slug testing techniques. Investigative methods utilized and the results of the analysis of the data are described in Appendix 7-1.

Descriptions of alluvial groundwater systems in the mine permit and surrounding areas, including information on quantity and quality of alluvial groundwaters, are presented in Appendix 7-1. Estimated rates of alluvial groundwater inflow into the mine are presented in Table 7-9. Additional information on alluvial groundwater inflows is provided in Section 728.333.

As indicated in the Alluvial Groundwater Management Plan for the Coal Hollow Mine (See Appendix 7-9), the land surface overlying proposed alluvial groundwater interceptor drains will be contoured to match the existing surrounding topography. Accordingly, alterations of existing surface-water drainage patterns should not occur.

Water monitoring information provided to the Division demonstrates that water levels in shallow alluvial groundwater systems in the Coal Hollow Mine area do respond to seasonal and climatic variability. However, as described in Appendix 7-1, the shallow alluvial sediments in the Coal Hollow Mine area are dominated by silts, clays, and fine-grained sands which generally do not have appreciable hydraulic conductivity. Because of the overall pervasiveness of silts, clays, and fine-grained sands in the alluvial system in the mine permit area, rates of alluvial groundwater migration are generally not rapid (See information provided in Table 7-9). (It should be emphasized that alluvial groundwater flow velocities in the coarser-grained alluvial systems in areas adjacent to proposed mining areas generally to the east and south are known to be appreciably greater). In cross-sectional exposures of saturated alluvial deposits in the up-gradient highwalls at the Coal Hollow Mine, only modest quantities of groundwater discharge have been observed. Although the alluvial sediments are largely saturated, where the saturated alluvial sediments have been exposed, sustained discharges of alluvial groundwater of more than a few gallons per minute are generally not observed. While discharges on the magnitude of a few gallons per minute have been observed in a fluvial channel system intercepted by the mine (which deposits contained sands, silts, and gravels), the much more pervasive fine-grained alluvial sediments where exposed were observed to weep only very minor, un-measurable quantities of water through the highwall. During a site visit on June 2, 2011, Petersen Hydrologic (2011) estimated that the total flow from the 600-foot-long exposure of clayey, silty alluvium in the mine highwall was less than 1 gpm. The total discharge from the exposed fluvial channel system was measured at 5.5 gpm. The total flow from a recently constructed, 870-foot-long up-gradient alluvial groundwater intercept trench was only 13.4 gpm. What this demonstrates is that, while the alluvial sediments adjacent to the mine openings are largely saturated, the presence of low permeability sediments in the alluvium limits the potential for the alluvial groundwaters to rapidly flow into the mine pit areas.

It should be emphasized here, however, that although highly permeable, saturated, coarse-grained alluvial sediments have not been intersected at the Coal Hollow Mine to date, the potential for intercepting such sediments is always present in heterogeneous mountain-front alluvial deposits. Appreciably greater inflow volumes are possible from such sediments were they to be encountered unexpectedly at the Coal Hollow Mine.

The overall low hydraulic conductivity of most of the alluvial sediments in proposed mining areas generally precludes the effective dewatering of saturated alluvial deposits adjacent to proposed mining areas through the use of vertical dewatering wells. For this reason, as described in the proposed alluvial groundwater management plan for the Coal Hollow Mine, horizontal drain systems (with large, long horizontal "screened" intervals in targeted strata to collect intercepted alluvial groundwater) are proposed for use in dewatering the alluvial sediments adjacent to proposed mining areas.

724.200 Surface Water Information

The locations of streams, stock watering ponds, and conveyance ditches in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area) are shown on Drawing 7-7. Surface-water information for the North Private Lease area are provided in Appendix 7-16 and additionally in Appendix 7-18. Surface-water rights in and adjacent to the Coal Hollow Mine permit area are shown on Drawing 7-3 and tabulated in Appendix 7-3. Surface-water rights information for the North Private Lease area are provided in Appendix 7-3N and shown on Drawing 7-3N. Surface-water discharge rates and water quality data have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality Database (UDOGM, 2007). Additional surface-water information is provided in Appendix 7-1.

It is not anticipated currently that discharge from the Coal Hollow Mine will be necessary. Where necessary, alluvial groundwater that may be intercepted by mining will be placed in drains and diverted away from disturbed areas and discharged (i.e., as groundwater dewatering). However, a Utah UPDES discharge permit will be obtained so that if discharge of mine water becomes necessary, it can be discharged in accordance with the UPDES discharge permit. The exact locations of mine water discharge points will be established upon issuance of the UPDES discharge permit. Any mine discharge water will be placed in either the Lower Robinson Creek drainage or the Sink Valley Wash drainage. Both of these drainages are tributary to Kanab Creek.

As described in R645-301-728.320, acid drainage is not expected from the proposed mining operation (including the proposed operations in the North Private Lease area). This is due to the pervasiveness of carbonate minerals in the mine environment that will neutralize any acid produced.

Seasonal quality and quantity of groundwater and usage is described herein and in Appendix 7-1~~ and~~, Appendix 7-16 and Appendix 7-18. Baseline discharge and water quality data have been submitted electronically to the Utah Division of Oil, Gas and Mining, Utah Coal Mining Water Quality (UDOGM, 2007).

Baseline monitoring of surface-water resources in and around the Coal Hollow permit area have been carried out by several entities. Previous hydrologic studies of the have been made in the Alton Coal Field area by Goode (1964, 1966), Sandberg (1979), Cordova (1981), and Plantz (1983). Selected hydrologic data collected in conjunction with these studies have been incorporated into the baseline data as part of this permit application.

During the 1980's, extensive monitoring of surface water resources in the permit and surrounding areas was performed by Utah International, Inc. Utah International Inc.'s ~~groundwater~~ surface-monitoring activities included the operation of continuous recording stations on selected streams, and the performance of routine surface-water discharge measurements and field and laboratory water quality analyses. These baseline monitoring activities were performed as part of a proposed coal mine permitting action in the Alton Coal Field. Ultimately, the proposed coal mining action did not proceed. Relevant monitoring information from the Utah International, Inc. baseline monitoring activities have been included as supplemental baseline data as part of this permit application. Commencing in the 2nd quarter of 2005, regular quarterly baseline monitoring of surface-water resources has been commissioned by Alton Coal Development, LLC. Baseline monitoring of surface-waters in and around the Coal Hollow permit area, including surface-water discharge measurements and field and laboratory water quality analyses, have been routinely performed.

All surface waters in the Coal Hollow Mine permit (including the proposed North Private Lease area) and adjacent area are tributary to the Kanab Creek drainage. Surface-water monitoring stations from which baseline data have been collected are shown on Drawing 7-2 and include the following:

Sink Valley Wash drainage

SW-8 (Swapp Hollow above proposed mining areas), SW-7 (unnamed drainage in Section 21, T39S, R5W), RID-1 (irrigation diversion of water from Water Canyon drainage above proposed mining areas), SW-6 (headwaters of unnamed tributary to lower Sink Valley Wash), SW-9 (Sink Valley Wash below proposed mining areas), SW-10 (unnamed tributary to Sink Valley Wash approximately 1.7 miles south of proposed mining areas), SVWOBS-1 (Sink Valley Wash above proposed mining areas, and SVWOBS-2 (Sink Valley Wash east of proposed mining areas).

Lower Robinson Creek drainage

SW-4 (Robinson Creek above proposed mining areas), SW-101 (Lower Robinson Creek near proposed mining areas), BLM-1 (Lower Robinson Creek adjacent to proposed mining areas) and SW-5 (Lower Robinson Creek below proposed mining areas).

Kanab Creek drainage

SW-1 (Kanab Creek near Alton, Utah; above proposed mining areas), SW-3 (Kanab Creek above proposed mining areas), and SW-2 (Kanab Creek below Lower Robinson Creek and below proposed mining areas). Additionally baseline hydrologic data from Lamb Canal, which is an irrigation ditch that conveys water from a diversion in Kanab Creek to irrigated lands adjacent to Kanab Creek west of proposed mining areas, is also collected.

724.300 Geologic Information

Geologic information in sufficient detail to determine the probable hydrologic consequences of mining and determine whether reclamation as required by R645 can be accomplished is given in Chapter 6 of this permit application package and in Appendix 7-1, ~~and~~ Appendix 7-16 and Appendix 7-18.

724.400 Climatological Information

Climatological information, including temperature and precipitation data, have been routinely measured and recorded at the Alton, Utah weather station (420086) since 1928. The station is located in the town of Alton, approximately two miles north of the Coal Hollow Mine permit area. Climatological data collected at the Alton station for the 77 year period from 1928 to 2005 are summarized in Table 7-3. Climatological data from the Coal Hollow Mine permit and adjacent area are plotted in Drawing 7-8.

An automated weather station was installed in the Coal Hollow Mine permit area in December 2005. The station is configured to continuously monitor and record temperature, wind velocity, and wind direction data. The station is also configured to continuously measure and record precipitation, although the tipping rain-gauge is not operative during winter months. Climate data from the Coal Hollow Mine and adjacent area are also presented in Appendix 7-6.

724.411 Seasonal precipitation

Precipitation data from the Alton, Utah weather station indicates average annual precipitation of 16.38 inches per year. Doelling (1972) reports average annual precipitation in the Alton Coal Field area ranging from 9 to 20 inches annually with slightly higher increments likely in the higher parts of the plateau (Doelling, 1972). There are generally two annual wet periods in the region. During the wintertime, cyclonic storms bring precipitation (mainly snowfall) to the region. During the summertime, storms originating from convection of air from the Gulf of Mexico or the Pacific Ocean bring rains to the region. Of the two annual wet cycles, the summer rainfall is most reliable. Average monthly precipitation at the Alton station ranges from a low of 0.57 inches in June to a maximum of 1.80 inches in February. Daily temperature and precipitation data recorded at the Coal Hollow Project weather station during 2006 and early 2007 are presented in Appendix 7-6.

The Palmer Hydrologic Drought Index (PHDI; NCDC, 1997) indicates long-term climatic trends for the region. The PHDI is a monthly value generated by the National Climatic Data Center (NCDC) that indicates the severity of a wet or dry spell. The PHDI is computed from climatic and hydrologic parameters such as temperature, precipitation, evapotranspiration, soil water recharge, soil water loss, and runoff. Because the PHDI takes into account parameters that affect the balance between moisture supply and moisture demand, the index is a useful for evaluating the long-term relationship between climate and groundwater recharge and discharge. A plot of the PHDI for Utah Region 4 (which includes the Coal Hollow Mine permit and surrounding area) is shown in Drawing 7-9. It is apparent in Drawing 7-9 that the region has experienced cyclical periods of drought and wetness since 1980. Baseline hydrologic monitoring performed by Utah International, Inc in 1987 and 1988 occurred during a period of near normal wetness. Recent baseline hydrologic monitoring conducted in 2005 and 2006 occurred during a period of moderate to severe wetness, with 2005 being wetter than 2006.

724.412 Wind direction and velocity

Wind data have been collected at the Coal Hollow Project weather station since December 2005. Monthly wind data from the Coal Hollow Project weather station are available from January 2006 through March 2006, and from November 2006 through May 2007. Monthly wind data are plotted as wind rose diagrams, which depict the average direction and velocity of prevailing winds, in Appendix 7-1. Based on recent data from the Coal Hollow Project weather station, it is apparent that the predominant wind direction in the Coal Hollow Mine permit area (during the months for which data are available) are from the northeast, with secondary peaks from the north and south-southwest (Appendix 7-6). Surface winds recorded at the Coal Hollow Project weather station averaged about 6.4 miles per hour. Tabulated hourly wind data from the Coal Hollow Project weather station are maintained on file at Alton Coal Development, LLC.

Wind data have also been collected historically at nearby locations by governmental and other entities. The regionally predominant direction of winds in the region is southwest through west. Secondary peaks are from southeast and northwest. Surface winds in the area average approximately 8 miles per hour. Higher wind speeds are associated with fronts and storms and generally occur during the springtime.

724.413 Seasonal temperature ranges

Temperature data from the region are summarized in Table 7-3. Temperatures in the permit area vary greatly. Temperature data from the Alton station (1928-2005) indicate that monthly average low temperatures are below freezing for the 6-month period from November to April. Monthly average minimum temperatures range from a low of 15.1 °F during January to a high of 49.8 °F in July. Monthly average maximum temperatures range from a low of 39.5 °F in January to a high of 82.6 °F in July. Daily maximum and minimum temperature data collected at the Coal Hollow Project weather station during 2006 through August 2015 are presented in Appendix 7-6. The maximum temperature recorded during this period was 94.1 °F in June 2013. The minimum temperature recorded during this period was -8.4 °F in January 2011.

724.500 Supplemental Information

Other than the possible short-term diminution in discharge rates from alluvial groundwater systems, including the potential short-term diminution of discharge rates from some springs and seeps in Sink Valley, adverse impacts to the hydrologic balance, either on or off the permit area are not expected to occur. Significant adverse impacts to the hydrologic balance in the North Private Lease are likewise not anticipated, although one seep that discharges at less than 1 gpm is planned to be intercepted by the mine workings. It is not anticipated that acid- and toxic-forming materials will cause significant contamination of groundwater or surface-water supplies in either the existing mine area or at the proposed North Private Lease. Any discharges of mine waters to surface-water systems will be regulated under and meet the criteria of a UPDES discharge permit. The mining and reclamation plan for the existing mine area and the proposed North Private Lease has been designed to minimize the potential for disturbance or disruption of the hydrologic balance and to protect groundwater and surface-water resources in the area.

If substantial alluvial groundwater inflows into mining areas occur as mining progresses in close proximity to alluvial springs and seeps in the eastern ¼ of Section 30, T39S, R5W and the northwest ¼ of Section 29, T39S, R5W or in close proximity to coarse-grained alluvial sediments in the artesian groundwater system along the eastern side of Sink Valley, Alton Coal Development, LLC will evaluate hydrogeologic conditions at the time such may occur. It should be noted that very large discharges into mine workings are not anticipated based on the results of recent drilling and aquifer testing performed in these areas (see Appendix 7-1). Based on the hydrogeologic conditions encountered, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine, which may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to protect groundwater resources up-gradient of mining activities. The potential for success of such protective measures in minimizing drainage of alluvial deposits up-gradient of proposed mining areas is believed to be good, given that the thickness of the alluvium in these areas is generally on the order of about 20 to 50 feet and these sediments are directly underlain by essentially impermeable Tropic Shale in proposed mining areas. It is important to note that while temporary impacts to groundwater discharge rates from alluvial springs and seeps could possibly occur, these impacts will likely be short-lived. This conclusion is based on the fact that individual mine pits in most instances will remain open for no more than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled). The variability in the time individual pits remain open is related to the thickness of overburden at the pit and the state of the overall spoil balance. It should be noted that these times could be somewhat greater if the mining production rate is less than the currently anticipated rate (in the event that contracts for the full 2 million tons of coal per year are not in place). However, the backfilling and rough grading requirements of R645-301.553 will be met (except where a variance to this regulation has been requested to assist with the transition to the adjacent federal coal reserves in the south pits area). After mine pits are backfilled and reclaimed, the potential for appreciable continued drainage of up-gradient alluvial groundwater through the backfilled pits in that area is low. When mining is complete in an area, seasonal recharge to alluvial groundwater systems will gradually replenish groundwater to the alluvial groundwater system. Large-scale dewatering of the alluvial groundwater system, such that appreciable compaction of the aquifer skeleton could occur, is not anticipated (see Appendix 7-1).

If diminution of discharge rates from seeps and springs does occur as a consequence of mining and reclamation activities in either the existing mining area or the proposed North Private Lease, any lost water will be replaced according to all applicable Utah State laws and regulations using the water replacement source specified in R645-301-727. The quantity and quality of replacement water detailed in R645-301-727 will be suitable for the existing premining uses and approved postmining land uses.

It should be noted that the Coal Hollow Mine plan calls for the temporary diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of groundwater or surface-water resources, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

If excess groundwater were to be encountered during mining operations in the existing permit area or in the proposed North Private Lease such that it could not be adequately managed or discharged in compliance with the Utah UPDES discharge permit (which is considered unlikely), Alton Coal Development, LLC may when necessary and with the approval of the Utah Division of Oil, Gas and Mining construct supplemental containment and settlement ponds in which mine discharge waters may be held for treatment (where necessary) and subsequent discharge through UPDES discharge points in compliance with the UPDES discharge permit.

Mining in the Coal Hollow project area will be a combination of surface mining, either open pit or highwall mining, and underground mining. Both the highwall mining and underground mining are designed such that subsidence is not expected to occur or have a negative impact on renewable resources lands.

724.700 Alluvial Valley Floor Determination

A field investigation has been performed in the Coal Hollow Mine permit and adjacent area to provide to the Division the information required to make an evaluation regarding the existence of a probable alluvial valley floor in the Coal Hollow Mine permit and adjacent area. The results of this field investigation and related information is provided in Appendix 7-1. Additional information regarding potential alluvial valley floors in the area is provided in Appendix 7-7.

A report detailing the findings of a previous field investigation performed by Water Engineering & Technology, Inc., entitled "Geomorphological and sedimentological characteristics of Sink Valley, Kane County, Utah" is included as Appendix 7-4.

A field investigation has been performed in the North Private Lease Area and adjacent area to provide to the Division the information required to make an evaluation regarding the existence of a probable alluvial valley floor in the North Private Lease permit and adjacent area. The results of this field investigation and related information is provided in Appendix 7-17.

725 BASELINE CUMULATIVE IMPACT AREA INFORMATION

Appendix 7-1 contains the results of a comprehensive investigation of groundwater and surface-water systems in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area and the proposed North Private Lease area). Appendix

7-1 also includes information regarding the probable hydrologic consequences of coal mining in the Coal Hollow Mine permit area and recommendations for hydrologic monitoring. Appendix 7-1 also includes the results of a field investigation performed in the Coal Hollow Mine permit and adjacent area to provide to the Division of Oil, Gas and Mining the information required to make an evaluation regarding the existence of a probable alluvial valley floor in the Coal Hollow Mine permit and adjacent area. This Information together with the information submitted herein can be used to assess the probable cumulative hydrologic impacts of coal mining and reclamation operations in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area) as required by R645-301-729. The results of a field investigation regarding potential alluvial valley floors in the proposed North Private Lease area was previously provided to the Division and is included in the MRP as Appendix 7-17. The AVF report includes baseline information for the North Private Lease area including groundwater and surface-water quality information . The report also includes geologic information including maps of geology and geomorphology of the North Private Lease and Adjacent area.

Information on groundwater and surface-water systems in the North Private Lease area at the North Private Lease area is provided in Appendix 7-16 (Petersen Hydrologic, 2015) and Appendix 7-18. Appendix 7-16 includes a map showing hydrologic baseline monitoring locations as well as a map showing spring and seep locations in the North Private Lease and adjacent areas. A plot of the Palmer Hydrologic Drought Index and a geologic map of the North Private Lease and adjacent area are provided in Appendix 7-16. Appendix 7-16 also provides a series of hydrogeologic cross-sections through the North Private Lease and adjacent area that show water levels under seasonal conditions. Discharge hydrographs for springs and streams and water level hydrographs for wells are provided in Appendix 7-16. Baseline water quantity and water quality data for springs, streams, and wells in the North Private Lease and surrounding areas are tabulated in Appendix 7-16. A map showing Stiff diagrams that depict solute geochemical compositions for groundwaters and surface waters in the North Private Lease and surrounding areas is provided in Appendix 7-16. A map showing the locations of ponds and ditches is also provided. Plots of TDS concentrations in Kanab Creek during high flow and low flow conditions are provided in Appendix 7-16, as is a graph of discharge rates plotted versus TDS in the creek. A water table map is also provided in Appendix 7-16. Monitoring well details for wells in the North Private Lease area are also provided in Appendix 7-16. A map showing the proposed hydrologic monitoring locations associated with the North Private Lease area is also provided in Appendix 7-16. The results of a comprehensive drilling and well installation program in the alluvial groundwater system in the North Private Lease during 2016 is presented in Appendix 7-18. Monitoring well completion data and geologic borehole logs for North Private Lease alluvial monitoring wells is provided in Appendix 7-18. Water-quality data from the alluvial monitoring wells are also provided in Appendix 7-18.   Appendix 7-18 also includes the results of an aquifer pumping test in the North Private Lease area. Time drawdown plots and tabulated drawdown data for monitored wells from the pumping test are provided in Appendix 7-18. An analytical modeling simulation in the alluvial groundwater system in the North Private Lease was performed to project likely groundwater drawdowns associated with the proposed mining activities in the North Private Lease. The results of these simulations are provided in Appendix 7-18.

A Petersen Hydrologic, LLC report of an investigation of groundwater flow rates in alluvial groundwater systems near the southern permit boundary of the North Private Lease is provided as Appendix 7-19. That investigation incorporated the results of an alluvial groundwater well drilling and well construction program, routine monitoring of alluvial groundwater levels in monitoring wells, and the results of a May 2017 aquifer pumping test conducted in the alluvial groundwater sediment near the southern boundary of the North Private Lease. It was calculated in the Petersen Hydrologic report that, based on an analysis of the available information, the subsurface flow of alluvial groundwater exiting the North Private Lease area beneath the 160-foot wide Kanab Creek stream channel is likely on the order of 5 gallons per minute. The discharge measured in Kanab Creek at monitoring station Kanab Creek @ C.R. at the time of the May 2017 aquifer pumping test was 330 gpm. Thus the total volume of surface-water and groundwater outflow from the area was calculated to be about 335 gpm based on the calculations presented in the Petersen Hydrologic report (Appendix 7-19). From these calculations, it is apparent that the amount of alluvial groundwater subsurface outflow at the time the testing was performed is small relative to the total surface-water outflow (less than 2%). Under low-flow conditions, the alluvial underflow might constitute a more substantial portion of the total surface-water and groundwater outflow from the valley.

The surface-water discharge rates measured at station Kanab Creek @ C.R. and SW-3 on 9 May 2017 were 330 gpm and 316 gpm, respectively. The lack of an appreciable gain in flow between monitoring station Kanab Creek @ C.R. and the down-stream monitoring station SW-3 (Appendix 7-19) supports the conclusion that there was not a large flux of groundwater flowing beneath the stream channel at that time (i.e. no significant quantity of alluvial groundwater upwelled to the surface in the stream drainage for a distance of at least 0.5 miles downstream of the North Private Lease boundary). Rather, the flow at SW-3 was slightly lower (but within the anticipated margin of measurement error) than that measured at Kanab Creek @ C.R. (330).

R645-301-726 Modeling

No numerical models have been created for the permit area~~ nor are any planned~~. Analytical modeling of alluvial groundwater systems in the North Private Lease area was performed. Details of this modeling activity are presented in Appendix 7-18.

The analytical groundwater model will be updated every mid-term. The model update will consider the water levels in backfilled mine pits and the surrounding undisturbed alluvial aquifer to the extent that such information is available. Where such information is not available, reasonable projections will be made. Where feasible, it will also calculate the groundwater recharge rate of backfilled sediments and the surrounding alluvial aquifer. From these activities, in conjunction with all available data, updated estimates of the time it will take for the alluvial aquifer to reach pre-mining aquifer characteristics of water table elevation and recharge/discharge rates will be made.

727 ALTERNATIVE WATER SOURCE INFORMATION

This section provides information on the alternative water source that will be used to replace water from groundwaters or surface waters should they be impacted by mining and reclamation activities in the Coal Hollow Mine permit and adjacent area (including the 85.88-acre Dame Lease IBC area and the North Private Lease area).

The alternative water source is a water production well that was constructed on private land leased by Alton Coal Development, LLC in the northwest quarter of Section 29, Township 39 South, Range 5 West. The location for the well, which is situated within the Coal Hollow Mine permit area, is shown on Drawing 5-8C. The well produces water from the alluvial groundwater system in Sink Valley in locations up-gradient of proposed mining operations. Based on aquifer testing performed in the alluvial groundwater system near the proposed water well (using the existing well Y-61 as a pump testing well), it is believed that adequate water can be produced from the new well to satisfy the potential water replacement needs of the mine. Details of the aquifer testing and information on the hydrogeologic characteristics of the Sink Valley alluvial groundwater system are presented in Appendix 7-1.

Water quality data from the Sink Valley alluvial groundwater system near the location of the new water well have been collected from well Y-102 and have been submitted electronically to the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (UDOGM, 2007). The quantity and quality of water produced from the new water production well has been suitable for the existing premining uses and approved postmining land uses. Well testing performed on the new water well indicated a yield of 150 gpm (see well driller's report for well ID 434305 and water right 85-774 on file at the Utah Division of Water Rights and at waterrights.utah.gov).

It should be noted that the water replacement well source produces water from the coarse-grained alluvial groundwater system in Sink Valley. Nearby springs that could potentially be impacted by mining and reclamation activities are supported by the same alluvial groundwater system. However, while modest decreases in the artesian hydraulic pressures in the alluvial groundwater system could potentially result in diminution of spring flows, the planned new water well will likely be approximately 100 feet deep and will be equipped with an electric well pump giving it the capacity to produce groundwater from the alluvial system even if the hydraulic head in the area were to be diminished such that artesian flow conditions temporarily ceased to exist.

An analysis of the total average discharge of state appropriated groundwaters from the permit and adjacent area has been performed to determine whether the quantity of water that could likely be produced from the new water replacement well will be adequate for potential replacement needs. Based on baseline spring discharge data submitted to the Division (UDOGM, 2007), it is determined that the average discharge of all state appropriated groundwater from groundwater discharge area A (Drawing 7-3, Drawing 7-4) is approximately 35 gpm. The state appropriated waters in groundwater discharge Area A include most of the significant springs in the area and essentially all of the largest springs in the area (Drawing 7-3; Appendix 7-3). The average discharge of all state appropriated groundwater from groundwater discharge area B (Drawing 7-4) is approximately 17 gpm. Using an unlikely worst-case scenario and assuming that all springs with state appropriated waters in both Areas A and B were to cease flowing, a total replacement of approximately 52 gpm would be required. The proposed new water well located in Section 29, Township 39 South, Range 5 West will be designed to produce water at that quantity and, therefore, should be able to provide adequate replacement water in even this worst-case scenario (which is not considered likely). Aquifer analysis described in Appendix 7-1 suggests that the yield of the alluvial groundwater system in which the new water well will be constructed should be capable of sustaining discharges of the required magnitude and for the lengths of time that the need for replacement water would be likely. It should be noted that if the need arises to provide replacement water for impacted state appropriated waters, the duration of the need will likely be of a relatively short duration (see Section 728 below).

Alton Coal Development, LLC has entered into a written agreement with the town of Alton, Utah to transfer the point of diversion for 50 acre-feet of water for use at the Coal Hollow Mine. A copy of this agreement is included in Appendix 7-8 (in confidential binder). This water available for all uses at the mine including potential use for water replacement. The new water well has been constructed on lands currently leased by Alton Coal Development, LLC. Consequently, no new landowner access agreement will be required for the drilling of the well.

728 PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION

This section describes the probable hydrologic consequences of surface coal mining in the Coal Hollow Mine permit area. This determination is based on data presented herein and on information provided in Appendix 7-1. The probable hydrologic consequences associated with proposed highwall mining activities within the 85.88-acre Dame Lease IBC area are presented in Appendix 7-4. The probable hydrologic consequences associated with the proposed underground mining activities at the Coal Hollow Mine are presented in Appendix 7-15. The probable hydrologic consequences of proposed coal mining and reclamation activities in the North Private Lease area are presented in Appendix 7-16 and further characterization and analysis of the alluvial groundwater systems in the North Private Lease are shown in Appendix 7-18. This mining and reclamation plan has been designed to minimize potential adverse impacts to the hydrologic balance. Information regarding pre- and post-mining potentiometric levels and groundwater flow conditions, including the potential for impacts to surrounding groundwater systems, is provided in Appendix 7-20. It should be noted that this PHC and also Appendix 7-1 may be updated periodically as required as additional hydrogeologic information and mining data become available in the future.

728.310 Potential adverse impacts to the hydrologic balance

Other than the possible short-term diminution in discharge rates from alluvial groundwater systems, including the potential short-term diminution of discharge rates from some springs and seeps in Sink Valley, appreciable adverse impacts to the hydrologic balance, either on or off the permit area are not expected to occur. The basis for this determination is discussed below.

As discussed in Section 721 above, minimal groundwater resources exist in the Tropic Shale, which directly overlies the coal reserves in proposed mining areas. Groundwater in the Tropic Shale does not provide measurable baseflow discharge to streams in the area. The lack of appreciable groundwater flow in the Tropic Shale is a result of the poor water transmitting properties of the marine shale unit. Consequently, it is anticipated that little groundwater will be encountered in the Tropic Shale in mining areas. Thus, the potential for adverse impacts to the hydrologic balance resulting from mining through the Tropic Shale in the Coal Hollow Mine permit area is minimal.

Similarly, as described in Section 722 above, groundwater resources in the Dakota Formation underlying the coal seam to be mined are not appreciable. This condition is fundamentally a result of the heterogeneity of the rock strata in the Dakota Formation which impedes the ability of the formation to transmit groundwaters significant distances vertically or horizontally. The presence of the essentially impermeable Tropic Shale on top of the Dakota Formation also minimizes the potential for vertical recharge to the Dakota Formation. Mining operations will remove the overlying Tropic Shale rock strata from the Dakota Formation in addition to the Smirl coal seam deposit at the top of the Dakota Formation in mined areas. However, because the pre-mining hydraulic communication between the Tropic Shale and the underlying Dakota Formation in planned mining areas is believed to be minimal, the removal of the Tropic Shale overburden and Smirl coal seam from the Dakota Formation, followed by the rapid backfilling of pit areas with low-permeability fill materials should not result in adverse impacts to the hydrologic balance in the Dakota Formation (i.e., the post-mining degree of hydraulic communication between the Dakota Formation and the overlying low-permeability backfill material will be similar to that of the pre-mined condition).

It should be noted that the first water-bearing strata underlying the coal seam to be mined in the Coal Hollow Mine permit area from which appreciable quantities of groundwater can be produced is the Navajo Sandstone. The Navajo Sandstone aquifer is of regional significance in that it provides groundwater of good quality to domestic, agricultural, and municipal wells regionally and provides baseflow to springs and streams. The Navajo Sandstone does not crop out in the Coal Hollow Mine permit and adjacent area. The formation is effectively isolated from proposed mining areas by more than 1,000 feet of rock strata of the Dakota and Carmel Formations (which includes large thicknesses of low-permeability shales and siltstones). The Navajo Sandstone aquifer will not be impacted by proposed mining operations. It should be noted that some previously proposed mining operations in the Alton Coal Field have proposed drilling and pumping of large amounts of groundwater from high-capacity production wells in the Navajo Sandstone aquifer for operational use. No such wells are planned in the Coal Hollow Mine permit and adjacent area.

Of primary importance to the hydrologic balance in the Coal Hollow Mine permit and adjacent area are alluvial groundwater systems. As discussed in Section 722 and in Appendix 7-1, alluvial groundwater systems in the area support springs, seeps, diffuse groundwater discharge, and a limited number of wells. The bulk of the alluvial groundwater flux through the area occurs in alluvial sediments that include coarse-grained and finer-grained sediments near the eastern margins of Sink Valley, east of the Coal Hollow Mine permit area. Lesser quantities of alluvial groundwater migrate through finer-grained alluvial sediments (predominantly clays, silts, and sands) in the western portions of Sink Valley and in the Lower Robinson Creek drainage within the Coal Hollow Mine permit area. Discharges from alluvial groundwater systems in Sink Valley do not contribute measurable quantities of baseflow to streams (at least at the surface in the stream channel). Alluvial groundwater systems in the Lower Robinson Creek area are much less extensive than the alluvial groundwater systems in Sink Valley. Other than the emergence of small quantities of alluvial groundwater from the stream banks where the stream channel intersects the alluvial groundwater system, discharge from the alluvial groundwater system as springs or seeps in Lower Robinson Creek is generally not observed. Perched groundwater conditions exist locally in the alluvial groundwater system in the Lower Robinson Creek drainage.

In the general sense, surface coal mining activities in the Coal Hollow Mine permit area have the potential to impact groundwater systems primarily through three mechanisms:

1) Where water-bearing strata in proposed mining areas are mined through, groundwater systems within these strata will obviously be directly intercepted,
2) Where groundwater flow paths through mine openings are interrupted, groundwater flow in down-gradient areas could be diminished, and
3) Where mine openings intercept permeable strata, groundwater resources in up-gradient areas could potentially be diminished if appreciable quantities of groundwater were to be drained from up-gradient areas.

The potential for the occurrence of each of these potential impacts are described in the following.

Direct Interception of Groundwater Resources

As discussed above, groundwater resources in the relatively impermeable Tropic Shale in the proposed permit area are meager. Consequently, it is improbable that direct interception of appreciable groundwater in the Tropic Shale will occur. Additionally, because Tropic Shale groundwater systems generally do not support discharges to springs or provide baseflow to streams, the potential interception of limited quantities of groundwater in the Tropic Shale will not adversely impact the hydrologic balance. Similarly, groundwater resources in the Dakota Formation (including within the Smirl coal seam) are meager. While the Smirl coal seam will be extracted through mining operations, the underlying strata of the Dakota Formation will not be disturbed. Consequently, adverse impacts to groundwater systems in the Dakota Formation through direct interception of groundwater resources are not anticipated.

Alluvial groundwater systems in planned mining areas in the Coal Hollow Mine permit area will be directly intercepted by the mine openings. It is not anticipated that the direct interception of shallow alluvial groundwater will adversely impact the overall hydrologic balance in the region. This is because no substantial springs, seeps or other important groundwater resources have been identified in proposed mine pit areas (Drawing 7-1). In the pre-mining condition, any diffuse groundwater discharge to the ground surface that occurs is primarily lost to evapotranspiration and does not contribute appreciably to the overall hydrologic balance in the area.

Because of the prevailing low-permeabilities of the alluvial sediments within the proposed mine disturbance area, it is unlikely that the direct mining of the alluvial groundwater system within these areas could cause impacts to subirrigation and soil moisture contents in up-gradient areas.

It is considered likely that the average hydraulic conductivity of the placed run-of-mine backfill material will be low. This is because of the pervasiveness of low-permeability, clay-rich materials in the mine overburden and the anisotropic nature of the placed fill material. Consequently, the potential for the migration of appreciable quantities of groundwater through the fill is considered low. Accordingly, the potential for impacts to subirrigation and soil moisture in the lands up-gradient of mining areas will be minimized by the placement of the low-permeability backfill.

An engineered low-permeability barrier previously planned for the eastern edge of pit 15 will no longer be necessary and will not be constructed. The original purpose of the proposed engineered barrier was to minimize the potential for long-term impacts to the alluvial groundwater system in Sink Valley up-gradient of mining areas that could occur as a result of the long-term draining of alluvial groundwater into the pit backfill area. Because surface (pit) mining in those areas adjacent to the Sink Valley alluvial groundwater systems (pits13, 14, and 15) is no longer planned, such a barrier will not be necessary.

The potential for short-term impacts to subirrigation and soil moisture in the lands up-gradient of proposed mining areas will be minimized through the implementation of the hydrology resource contingency plan described in Appendix 7-9.

As has been the case generally at previous mining areas at the Coal Hollow Mine, it is anticipated that within the North Private Lease mining areas, that hydraulic conductivity of the placed run-of-mine backfill material will likely be low. This is because of the pervasiveness of low-permeability, clay-rich materials in the mine overburden in the North Private Lease and the nature of the mixed, anisotropic nature of placed backfill material.

As was the case during mining operations at the existing Coal Hollow Mine (south) area, mining in the North Private Lease will include excavating and handling overburden consisting of Tropic Shale bedrock and unconsolidated sediments consisting of clays, silts, sands, and gravels in varying proportions. A mixture of these materials will comprise the material backfilled into the completed surface mining pits. It is anticipated that the composition of the backfill vary from location to location depending on the character of the materials being excavated at active mining areas at the time that the backfilling of the completed mining pits occurs.

Predicted mine pit backfill final aquifer hydraulic properties

In the absence of specific information on the hydrologic properties of future mine pit backfills (i.e. because the backfilled pits do not currently exist), it is difficult to make definitive determinations about what the final hydraulic properties of the placed backfill will be. However, using published ranges of values for various types of rocks and sediments, it is possible to estimate hydraulic conductivity of materials that are anticipated to comprise the material used to backfill mine pits at the North Private Lease area. Based on the pervasiveness of silty and clayey materials in the lease area, and the likelihood that the run-of-mine backfill will contain appreciable quantities of these fine-grained materials, it is anticipated that hydraulic conductivities of the mixed backfill may fall in the lower range of silty sand or the range of silt, which is on the order of perhaps 10^{-5} to 10^{-6} cm/sec (Freeze and Cherry, 1979).

A sample of Tropic Shale bedrock was collected from the Coal Hollow Mine for laboratory testing of hydraulic conductivity. A drilling core consisting of unweathered Tropic Shale was analyzed at the laboratory to determine its hydraulic conductivity. The core sample was remolded and compacted at the laboratory prior to the analysis. The measured hydraulic conductivity of this sample was 8.24×10^{-8} cm per second. This value of hydraulic conductivity likely represents a lower limit to the projected range of hydraulic conductivity for the backfill material (i.e. this could be similar to the hydraulic conductivity of the backfill if it were to be composed entirely of soft Tropic Shale bedrock that became tightly compacted within the backfill – which is considered to be an unlikely occurrence.

It is anticipated that groundwater that may potentially become present within the placed backfill will occur under unconfined or semi-confined conditions. This is because in order for the backfill sediments to become saturated, downward vertical groundwater flow (recharge) of the sediments would need to occur (i.e.

Time to saturate backfilled pit areas

In the absence of specific information on the hydrologic properties of future mine pit backfills (i.e. because the backfilled pits do not currently exist), it is difficult to make definitive determinations of the time it will take for the placed backfill in reclaimed mine pits to become water saturated. However, information useful in making as a first order approximation is presented below.

The rate at which the backfilled mine pits will become saturated is related to the amount of recharge water available, the hydraulic conductivity of the backfill sediments, and the effective porosity of the sediments. As indicated in Section 724.411, precipitation in the Coal Hollow Mine region averages about 16 inches annually. If it is arbitrarily assumed that of this total, 90 percent is lost to surface-water runoff and evapotranspiration in the clayey sediments of the mine environment, 10% (1.6 inches or 0.666 feet) of recharge water could be available to recharge underlying backfilled mine pit area. Assuming that the porosity of the placed backfill could be on the order of 0.15 (in the typical range for unconsolidated deposits), the 1.6 inches of infiltrating precipitation water could saturate a soil thickness of about 10.7 inches (0.89 feet) each year. Using this relationship, a first order approximation of the time to fill a mine pit 100 feet deep could be determined by dividing the total number of feet of backfill thickness by the per-year infiltration rate. In this arbitrary example, the time required to saturate the backfill would be 100 feet of thickness divided by 0.88 feet of infiltration per year, or about 114 years. Similarly, using the same methods, if the average percentage of the annual precipitation water available for groundwater recharge were doubled to 20%, a time to fill for a 100-foot deep mine pit would be 57 years.

In making these rough projections, it is important to consider that other factors may also significantly influence the time required for backfilled pits to eventually re-saturate. Some of these include the existing saturation state of the materials at the time the materials are placed as backfill, and the potential that infiltrating precipitation waters could be held under perched conditions on impermeable strata, or the downward migration rates could be so slow that it could take many years for the water to migrate vertically to the base of the backfilled pit, resulting in discontinuous zones of saturation. Additionally, in low-lying areas where ponding of surface runoff can occur, a greater percentage of the precipitation water could infiltrate into the underlying backfill areas. Contrastingly, in sloped areas where the runoff of precipitation is favored, infiltration rates could be significantly lower.

It is considered unlikely that the backfilled mine pit areas in the North Private Lease will act as “aquifers”. Rather, the heterogeneous mixture of shales, clays, silts, sands, and gravels will more likely as aquitards. Consequently, alluvial groundwaters flowing in close proximity to Kanab Creek will likely tend to remain in the undisturbed sediments adjacent to the stream channel rather than spreading out into the surrounding low-permeability mine backfill areas.

In order to better characterize the actual aquifer conditions in backfilled mine pit areas in the North Private Lease, Alton Coal Development proposes to construct a monitoring well (if it is possible to do so) within the backfill of mine pit 12 when the mining in that area is complete and the pit is backfilled. This well may then be used for the purposes of 1) monitoring the rate at which the backfilled material re-saturates over time, and 2) eventually for the purpose of performance of aquifer testing to determine the aquifer characteristics of the placed backfill material after the sediments have become adequately saturated for such tests to occur.

Diminution of down-gradient groundwater resources

Where groundwater flow paths that convey groundwater to down-gradient areas exist in areas that will be mined, there is the potential that diminution of down-gradient groundwater resources could occur. In the Coal Hollow Mine permit area, it is considered unlikely that appreciable diminution of down-gradient resources will occur as a result of mining and reclamation activities. The basis of this conclusion is presented below.

Groundwater resources in the Tropic Shale are meager and groundwater flow rates are very slow through the marine shale unit. Groundwater systems in the Tropic Shale do not support appreciable spring or seep discharge nor do they provide measurable baseflow to streams down-gradient of mining areas. Consequently, the potential for adverse impacts to the hydrologic balance as a result of mining through Tropic Shale is considered minimal.

Similarly, groundwater resources in the Dakota Formation are meager. The potential for lateral and vertical migration of groundwater through the formation is limited by the pervasiveness of low-permeability shaley strata in the formation and the lateral discontinuity of permeable strata. Groundwater systems in the Dakota Formation do not support appreciable spring or seep discharge nor do they provide measurable baseflow to streams down gradient of mining areas. Additionally, with the exception of the relatively low-permeability Smirl coal seam located at the top of the formation, groundwater systems in Dakota Formation rock strata below the coal seam will not be disturbed by mining and reclamation activities. Consequently, the potential for adverse impacts to the hydrologic balance as a result of mining through Dakota Formation strata is considered minimal. It should be noted that spring SP-4 discharges at about 1 gpm approximately 1.1 miles south of the Coal Hollow Mine permit area from an apparent fault/fracture system in the Dakota Formation that may be related to the Sink Valley Fault. It is unlikely that appreciable migration of groundwater through the Sink Valley Fault system in the relatively impermeable Tropic Shale or shallow alluvium in the Coal Hollow Mine permit area occurs. Consequently, it is considered unlikely that mining and reclamation activities in the Coal Hollow Mine permit area will cause a diminution of discharge from spring SP-4.

Alluvial groundwater systems in proposed mining areas area supported primarily by clays, silts, and fine-grained sands. In proposed mining areas in Sink Valley, appreciable coarse-grained alluvial sediments were not encountered in drill holes or back-hoe excavations. Significant layers of clean coarse alluvium, which could rapidly convey significant amounts of groundwater, were likewise not observed. The results of slug testing performed on wells in and adjacent to proposed mining areas likewise suggest that the potential for rapid migration of groundwaters through alluvial sediments in proposed mining areas is low (Tables 7-8 and 7-9). These data and observations suggest that the flux of groundwater migrating through the alluvial sediments in proposed mining areas in Sink Valley (that could support down-gradient groundwater systems) is not large. Much of the groundwater migrating through the alluvial sediments in proposed mining areas (in the East ¼ of Section 30, T39S, R5W) likely leaves the groundwater system through diffuse discharge to the land surface and is lost evapotranspiration and does not contribute to the overall hydrologic balance in the area. In Sink Valley, a preferential pathway for alluvial groundwaters through deep coarse-grained alluvial sediments likely exists along the east side of Sink Valley. While the thickness of the alluvium in proposed mining areas in Sink Valley generally does not exceed 50 feet (and in many locations is much less), the alluvial sediments along the eastern side of Sink Valley adjacent to proposed mining areas range from about 120 to 140 feet. Of the total flux of groundwater through the alluvial groundwater systems in Sink Valley, most of the flux is likely through this coarse-grained portion of the system. The percentage of the total flux that migrates through clayey and silty alluvial sediments in proposed mining areas along the western flanks of Sink Valley is likely much less.

It should be noted that highly permeable strata were encountered from about 60 to 75 feet depth just above the bedrock interface at the SS well cluster (monitoring well SS-75; Table 7-2). This well is screened in an area of burned or eroded coal (the coal is absent) and consequently, mining will not occur at this location. The coal seam is present at the nearby C9 cluster area. Were mining operations to intercept this highly permeable zone, substantial groundwater inflows into the mine openings could occur. Consequently, prior to surface mining in this area, the boundary between the competent coal seam and the area of burned or eroded coal will be more precisely defined by drilling or other suitable techniques such that mine openings can be designed to avoid these areas of potentially large groundwater inflows.

As discussed in Section 722 above, alluvial groundwater from Sink Valley discharges to several springs and seeps and as diffuse discharge to the ground surface in the northwest ¼ of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). This groundwater discharge is likely a result of the constriction in Sink Valley in this area and the corresponding decrease in the cross-sectional area of the alluvial sediments in the valley, which forces groundwater to discharge at the surface. Most of the groundwater discharge in this area is likely derived from the up-gradient alluvial groundwater systems in the eastern portion of the valley (i.e., the coarse-grained portion of the alluvial groundwater system), which is situated east of the Coal Hollow Mine permit area. This conclusion is based on 1) the substantially larger cross-sectional area of the alluvium in the deeper eastern portion of the valley relative to that in proposed mining areas near the western margins of the valley, 2) the higher hydraulic conductivity of the sediments in the coarse-grained part of the alluvial system, and 3) the lack of other apparent discharge mechanisms for the coarse-grained system further downstream in Sink Valley Wash (i.e., there are no significant alluvial springs or seeps further downstream in Sink Valley Wash and the system apparently does not contribute measurable baseflow to Sink Valley Wash further downstream (at least at the surface in the stream channel, as evidenced by the lack of baseflow in the wash monitored at SW-9).

Because most of the alluvial groundwater discharge supporting springs and seeps in this area is likely not derived from groundwater systems that underlie planned mining areas in the Coal Hollow Mine permit area, it is considered unlikely that discharges from the springs and seeps in northwest ¼ of Section 32 T39S, R5W will be appreciably diminished as a result of the proposed mining and reclamation activities. While considered unlikely, some temporary impacts to discharge rates from springs and seeps in this area are possible. In particular, it should be noted that mining in the southernmost portions of the Coal Hollow Mine permit area has a somewhat greater potential to decrease groundwater discharge rates at spring SP-6, which is located about 600 feet below the southernmost proposed mining areas (Drawing 7-2). SP-6 is an alluvial seep which has been impounded with an earthen dam from which measurable discharge is generally not present.

It is critical to note that individual mine pits in this area will remain open for short lengths of time, generally no more than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled). Mining operations in the vicinity near the alluvial groundwater discharge area in the northwest ¼ of Section 32 T39S, R5W are planned to be completed in about 1 year. Thus, any potential impacts to discharge rates from down-gradient groundwater systems will be short-lived. Following the backfilling and reclamation of mine openings, the potential for interception or re-routing of alluvial groundwater away from the groundwater discharge area in northwest ¼ of Section 32 T39S, R5W will be negligible. As stated above, most of the flux through the Sink Valley alluvial groundwater system that supports springs and seeps in the area occurs in the eastern portion of the valley, which will not be impacted by mining and reclamation activities. Consequently, long-term impacts to discharge rates from springs and seeps in this area are not anticipated. It should also be noted that if increased quantities of groundwater were to be encountered in mine workings in lower Sink Valley such that the water would need to be discharged to surface drainages, the mine water will ultimately be discharged to the Sink Valley Wash drainage (i.e., the water will remain in its drainage basin).

Alluvial groundwater systems in the Lower Robinson Creek area are much less extensive than the alluvial groundwater system in Sink Valley. Perched groundwater conditions exist locally in the alluvial groundwater system in the Lower Robinson Creek drainage. Other than the re-emergence of alluvial groundwater flowing beneath the Lower Robinson Creek stream channel where the stream channel exists directly on bedrock substrate, discharges from the alluvial groundwater system as springs or seeps in Lower Robinson Creek are not observed. Consequently, mining operations in the Lower Robinson Creek drainage will likely not result in diminution of down-gradient groundwater resources.

It should be noted that the Coal Hollow Mine plan calls for the temporary diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of groundwater or surface-water resources, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

If any Utah State appropriated water rights are impacted by mining and reclamation operations in the Coal Hollow Mine, these will be replaced according to all applicable Utah State laws and regulations using the designated water replacement source described in Section 727 above.

Draining of up-gradient groundwater resources

Where surface mining occurs adjacent to up-gradient groundwater systems, there is a potential that draining of groundwater from the up-gradient groundwater system into the mine voids could occur. This condition could occur if a sufficiently large and permeable stratum were to be intercepted that is in good hydraulic communication with the up-gradient groundwater system through which appreciable quantities of water could be transmitted.

To more fully evaluate the potential for draining of up-gradient groundwater resources, a field investigation was performed during the winter of 2006-2007 that was designed to facilitate the characterization of the alluvial groundwater system in the Coal Hollow Mine permit and adjacent area. Specifically, this program was designed 1) to better define the vertical and lateral extent of permeable, coarse-grained sediments in the alluvial groundwater system, 2) to characterize the water bearing and water transmitting properties of alluvial sediments, and 3) to evaluate the degree of hydraulic communication between the coarse-grained portion of the alluvial system in Sink Valley and the clayey alluvial sediments in proposed mining areas.

This field investigation included 1) the drilling and installation of 30 monitoring wells, 2) the performance of a 28-hour pumping and recovery test on the alluvial testing production well Y-61 (which is a 6.625-inch well constructed in 1980 as part of a previous coal mining application for groundwater pumping for alluvial aquifer testing) with contemporaneous measuring of water levels in the monitoring well network and contemporaneous measuring of spring discharge rates at three alluvial springs, and 3) the slug testing of 20 monitoring wells to determine approximate values of hydraulic conductivity. The results of the field investigation including analysis of the data collected in the investigation are presented in Appendix 7-1 and are summarized below.

Other than occasional pebbles or small rocks, coarse-grained sediments (i.e., gravels and coarse sands) were not encountered in the drilling of wells along the eastern margins of proposed mining areas in Sink Valley (C1, C2, C3, and C4 well clusters). (It should be noted that the C2 well cluster is located west of the eastern limit of the mine disturbance. The mine openings will intercept the C2 well cluster and the area to the east to locations west of well Y-102). Rather, the sediments encountered in the drilling of these wells were dominated by clays and silts with subordinate amounts of fine-grained sand. Similarly, coarse-grained deposits were not encountered in well clusters C6, C7, C8, and C9. There was no indication during drilling of any appreciable thickness of highly permeable strata through which groundwater could rapidly be transmitted (although it should be noted that the presence of thin sand layers are difficult to identify in wet auger drilling returns). Similarly, appreciable amounts of high-permeability coarse-grained alluvial sediments were not noted in alluvial sediments investigated in backhoe excavated pits and erosional escarpments in Sink Valley.

The hydraulic heads measured in alluvial monitoring wells near proposed mining areas in Sink Valley (C2, C3, C4, C7, C8, and C9) did not indicate artesian pressures. Rather, marked upward or downward vertical hydraulic gradients were not observed in any of these areas and water levels were consistently within several feet of the ground surface.

The results of pump testing in the alluvial groundwater system demonstrate that the springs in the northwest ¼ of Section 29, T39S, R5W are in direct hydraulic communication with the coarse-grained alluvial groundwater system in which the pumping well Y-61 is screened. Discharge rates (or water levels at Sorensen Spring) measured at each of the four springs (SP-8, SP-14, SP-20, and Sorensen spring) monitored during the 28-hour pumping test responded to pumping at the well. Monitoring wells at clusters C2, C3, and C4 near the easternmost proposed mining areas also showed small, muted responses, with declines measured in water levels during the 28-hour test ranging from about 0.05 to 0.10 feet. Other monitoring wells in proposed mining areas did not respond measurably to pumping at Y-61. It should be noted that after the pumping well was turned off at the end of the 28-hour pumping test, spring discharge rates and water levels in alluvial monitoring wells recovered to approximate pre-testing levels.

The results of slug testing of wells in the Coal Hollow Mine and adjacent area are presented in Table 7-8. Using these hydraulic conductivity values together with measured thicknesses of saturated alluvial sediments determined during drilling, and hydraulic gradient values determined from water levels measured in monitoring wells, rates of estimated groundwater inflows to mine openings have been calculated using Darcy's Law (Table 7-9).

Darcy's Law may be expressed as.

Q = KIA

Where	Q	=	groundwater discharge rate
	K	=	hydraulic conductivity
	I	=	hydraulic gradient
	A	=	cross-sectional area

The values listed in Table 7-9 are reported as inflow rates per 100 lineal feet of mine openings oriented perpendicular to the groundwater flow direction. Calculations at individual locations are adjusted for the thickness of the saturated alluvium at that location. For all calculations in Table 7-9, a gradient of 0.10 has been used, which is considered a conservative estimate for the alluvial groundwater system in the vicinity of the planned Coal Hollow Mine workings. It is important to note that while values for saturated aquifer thickness and local hydraulic gradient in the alluvial groundwater system can be determined relatively precisely, hydraulic conductivity values determined from slug testing methods are generally considered as order-of-magnitude estimates. Consequently, the information from Table 7-9 should be used for general purposes only. The estimated groundwater inflow rates presented in Table 7-9 suggest that copious, unmanageable amounts of alluvial groundwater will likely not be encountered. It should be noted, however, that alluvial sediments located east of the C2 well cluster may contain coarser grained sediments similar to those intercepted in well Y-102. Special mining protocols will be employed (See Appendix 7-9) when mining in this area (pit15; see Section 728.333) to minimize the potential for interception of large groundwater inflows.

As described in Appendix 7-11, Table 7-9 has been updated to reflect the current pit mine-inflow conditions in the Pit #2 and adjacent areas.

As surface mining operations advance toward the alluvial groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A), the information in Table 7-9 suggests that groundwater inflow rates in this area will be modest, generally on the order of a few tens of gallons per minute or less per 100 lineal feet of mine opening. However, it should be noted that, as discussed above, if mine openings in this area were to intersect a substantial thickness of coarse-grained alluvial material that was in good hydraulic communication with the coarse-grained alluvial system located along the eastern margins of Sink Valley, substantially greater rates of groundwater inflow could occur. Based on the information in Tables 7-8 and 7-9, this is not considered likely.

As mining operations advance toward the alluvial groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A) and groundwater discharge from up-gradient alluvial groundwater systems occurs, there is the potential that discharge rates from alluvial springs in this area could be diminished. The magnitude of this potential impact will be largely dependent on the drainage rate and volume of groundwater that may be drained from the up-gradient alluvial groundwater system.

The potential for diminution of discharge from alluvial springs near proposed mining areas near the northwest ¼ of Section 29, T39S, R5W will be minimized because:

1) As mining progresses toward the groundwater discharge area in the northwest ¼ of Section 29, T39S, R5W (see Drawing 7-4, groundwater discharge area A), groundwater inflows into mine openings and discharge rates from the nearby alluvial springs will be closely monitored. If groundwater inflow rates into mine openings are excessive, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, and

2) Individual mine pits in the Coal Hollow Mine will remain open for short lengths of time, generally no more than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled). Consequently, any potential impacts to spring discharge rates in the alluvial groundwater system in this area will likely be short-lived. Because the alluvial groundwater recharge areas are located well up-gradient of proposed mining areas (mountain-front recharge) and will not be impacted, recharge to the alluvial system should continue uninterrupted, it is anticipated that water levels in the artesian groundwater system should recover from any mining-related declines in hydraulic head subsequent to the completion of mining in the area.

Groundwater discharge from the springs in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A) do not contribute any measurable baseflow discharge to streams in the area. This conclusion is based on the lack of any baseflow discharge in streams down-gradient of this area in Sink Valley (see monitoring data for SW-6 and SW-9). Rather, most of this discharge is likely ultimately lost to evapotranspiration as the water migrates across the low-permeability, near-surface clayey sediments in Sink Valley. Consequently, the potential temporary diminution of discharge from alluvial springs in the northwest ¼ of Section 29, T39S, R5W would not result in appreciable adverse impacts to the surrounding hydrologic balance.

It is considered likely that the average hydraulic conductivity of the placed run-of-mine backfill material will be low. This is because of the pervasiveness of low-permeability, clay-rich materials in the mine overburden and the anisotropic nature of the placed fill material. Consequently, the potential for the migration of appreciable quantities of groundwater through the fill is considered low. Accordingly, the potential for impacts to subirrigation and soil moisture in the lands up-gradient of mining areas will be minimized by the placement of the low-permeability backfill.

The potential for short-term impacts to subirrigation and soil moisture in the lands up-gradient of proposed mining areas will be minimized through the implementation of the hydrology resource contingency plan described in Appendix 7-9.

The Coal Hollow Mine has designed a plan to divert upgradient alluvial groundwater through an alluvial groundwater interceptor drain system. This plan is designed to minimize the potential for the interception of alluvial groundwater in the mine pit areas and to protect alluvial groundwater quality. The details of this plan are described in the Coal Hollow Mine Alluvial Groundwater Management Plan, which is presented in Appendix 7-9.

If any Utah State appropriated water rights are impacted by mining and reclamation operations in the Coal Hollow Mine, these will be replaced according to all applicable Utah State laws and regulations using the designated water replacement source described in Section 727 above.

728.320 Presence of acid-forming or toxic-forming materials

Chemical information on the acid- and toxic-forming potential of earth materials naturally present in the proposed permit area are presented in Appendix 6-2. Chemical information on the low-sulfur Smirl coal seam proposed for mining is presented in Appendix 6-1 (confidential binder). Based on laboratory analytical data, it is apparent that acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the Coal Hollow Mine permit and adjacent area are generally not present.

Total selenium (with a 5 mg/kg laboratory lower detection limit) was not detected in any of the samples from the Coal Hollow Mine permit area. Water-extractable selenium concentrations were also generally low (see Section 728.332 below). Likewise, concentrations of water-extractable boron were also low, being less than 3 mg/kg in all samples analyzed. The pH of groundwaters in and around the Coal Hollow Mine permit area are moderately alkaline (UDOGM, 2007). Data in Appendix 6-2 likewise indicate moderately alkaline conditions in sediments in the permit area. The solubility of dissolved trace metals is usually limited in waters with alkaline pH conditions. Consequently, high concentrations of these metal constituents in groundwaters and surface waters with elevated pH levels are not anticipated. Additionally, most of the materials that will be handled as part of mining and reclamation activities in the Coal Hollow Mine area are of low hydraulic conductivity (i.e. clays, silts, shales, siltstones, claystones, etc.). Consequently, it is anticipated that groundwater seepage volumes through low-permeability backfill and reclaimed land surfaces in reclaimed mine pit areas and excess spoils storage areas will not be large. Additionally, reclaimed areas will be regraded, sloped, and otherwise managed to minimize the potential for land erosion, to restore approximate surface-water drainage patterns, and also to minimize the potential for ponding of surface waters on reclaimed areas (other than “roughening” or “gouging” of some areas to enhance reclamation). Thus, the potential for interactions between large amounts of disturbed earth materials and groundwaters and surface waters, which could result in leaching of chemical constituents into groundwater and surface-water resources, will be minimized.

Additionally, the mining plan calls for the emplacement of 40 inches of suitable cover material over backfilled areas made up of material types which could appreciably impact vegetation (materials with elevated SAR ratios or other physical or chemical characteristics that could adversely impact vegetation).

The neutralization potential greatly exceeded the acid potential in all overburden and underburden samples analyzed, with the neutralization potential commonly exceeding the acid potential by many times, suggesting that acid-mine-drainage will not be a concern at the Coal Hollow Mine (see Section 728.332 below for a further discussion) Acid-forming materials in western coal mine environments often consist of sulfide minerals, commonly including pyrite and marcasite, which, when exposed to air and water, are oxidized causing the liberation of H^+ ions (acid) into the water. Oxidation of sulfide minerals may occur in limited amounts in the mine pits where oxygenated water encounters sulfide minerals. However, the acid produced by pyrite oxidation is quickly consumed by dissolution of abundant, naturally occurring carbonate minerals (Appendix 6-2). Dissolved iron is readily precipitated as iron-hydroxide in well aerated waters, and consequently excess iron is not anticipated in mine discharge water.

Other acid-forming materials or toxic-forming materials have not been identified in significant concentrations nor are such suspected to exist in materials to be disturbed by mining.

Because of the overall low-permeability of the rock strata and sediments surrounding the mine workings (primarily the shales and claystones of the lower Tropic Shale), the potential for seepage of mine water outward into adjacent stratigraphic horizons is low. Additionally, because the floors of the mine pits need to be accessible in order to extract the coal, the mining operations will be carried out in such a manner that the accumulation of large amounts of water in the mine pits will be avoided.

728.331 Sediment yield from the disturbed area.

Erosion from disturbed areas will be minimized through the use of silt fences and other sediment control devices. Surface runoff occurring on disturbed areas will be collected and treated as necessary to remove suspended matter. Four diversion ditches along with four sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

The smallest practicable area, consistent with reasonable and safe mine operational practices will be disturbed at any one time during the mining operation and reclamation phases. This will be accomplished through progressive backfilling, grading, and prompt revegetation of disturbed areas. The backfilled material will be stabilized by grading to promote a reduction of the rate and volume of runoff in accordance with the applicable requirements. The excess spoil and fill above approximate original contour will be graded to a maximum 3h:1v slope and revegetated to minimize erosion.

Cut ditches will be established on the shoulders of all primary roads to control drainage and erosion. Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles. The location and details for roads can be viewed on Drawings 5-3 and 5-22 through 5-24.

Through the implementation of these sediment control measures, it is anticipated that sediment yield from disturbed areas in the Coal Hollow Mine permit area will be minimized.

728.332 Impacts to important water quality parameters

As discussed above, appreciable quantities of groundwater are not anticipated to be intercepted in the Tropic Shale overlying proposed mining areas. Consequently, discharge of Tropic Shale groundwaters from mining areas is not anticipated. Because of the very low hydraulic conductivity of the marine Tropic Shale unit which immediately overlies the coal in proposed mining areas, the lateral migration of appreciable amounts of groundwater outward from proposed mine pit areas is not anticipated. Therefore, no impacts to important water quality parameters in surrounding groundwater and surface-water resources that could result from the interception of Tropic Shale groundwaters are anticipated.

Similarly, appreciable quantities of groundwater are not expected to emanate from the Dakota Formation in the mine floor into the mine openings. This conclusion is based on the fact that 1) vertical and horizontal groundwater flow in the Dakota Formation is impeded by the presence of low-permeability shales that encase the interbedded lenticular sandstone strata in the formation (i.e., the formation is not a good aquifer), 2) appreciable natural discharge from the Dakota Formation in the surrounding area to springs or streams is not observed, supporting the conclusion that the natural flux of groundwater through the formation is meager, and 3) mining will commence near the truncated up-dip end of the formation, minimizing the potential for elevated hydraulic head in the Dakota Formation. The results of slug testing performed on wells screened in the Smirl coal seam indicate relatively low values of hydraulic conductivity for the coal seam (Table 7-8). In much of the proposed mining area, the coal seam is dry. Thus, large inflows of groundwater from the coal seam into mine workings are not anticipated. Likewise, the potential for seepage out of mine pits through the coal seam is minimal. Consequently, impacts to important water-quality parameters in the Dakota Formation potentially resulting from mining operations are not anticipated, nor are impacts to important water-quality parameters in surrounding groundwater and surface-water systems anticipated as a result of interactions with intercepted Dakota Formation groundwater.

The water quality of groundwaters in the alluvial groundwater system up-gradient of mining operations will likely not be impacted by mining and reclamation activities in the Coal Hollow Mine. Were alluvial groundwaters intercepted by mine openings allowed to flow into the mine pits, there would be the potential for substantially increased TDS concentrations as the water interacts with the marine Tropic Shale and the Smirl coal seam. This occurrence will be avoided.

As groundwater naturally migrates through the shallow, fine-grained alluvial sediments in the Coal Hollow Mine permit and adjacent area (most evident in Sink Valley), the quality of the water is naturally degraded (see Appendix 7-1). In the distal portions of Sink Valley, most notably concentrations of magnesium, sulfate, and bicarbonate are elevated in the alluvial groundwater.

The potential for TDS increases associated with interaction of waters with the Tropic Shale can be minimized by avoiding contact where practical between water sources and earth materials containing soluble minerals. Where possible, in the existing mine area and in the proposed North Private Lease, groundwater that will be encountered in alluvial sediments along the margins of mine pit areas will be routed through pipes, ditches or other conveyance methods away from mining areas via gravity drainage so as to prevent or minimize the potential for interaction with sediments disturbed by mining operations (including contact with the mined coal seam). If diverted alluvial groundwater were allowed to interact extensively with the Tropic Shale bedrock or Tropic Shale-derived alluvial sediments, similar increases in magnesium, sulfate, bicarbonate, and TDS concentrations would be anticipated. Consequently, where intercepted groundwaters will be routed around disturbed areas through pipes or well-constructed and maintained ditches, it is anticipated that detrimental impacts to important water quality parameters in these waters will be minimal.

The pumping and discharging of mine water from mine pits at the Coal Hollow Mine permit area is not anticipated. The impoundment of substantial quantities of water within the mine pits would likely result in degradation of groundwater quality and is also not compatible with the proposed surface mining technique (the coal extraction operations occur at the bottom of the mine pit and thus they cannot be performed in flooded mine pits). As discussed above, the only likely foreseeable source of appreciable quantities of groundwater is from the alluvial groundwater systems overlying the low-permeability Tropic Shale in proposed mining areas. Where this alluvial groundwater is encountered in mining areas, it will be diverted away from mine workings prior to significant interaction with sediments in disturbed areas. Any discharge from the mine pits that does occur will be regulated under a Utah UPDES discharge permit.

Acid mine drainage is not anticipated at the Coal Hollow Mine permit area. This is due primarily to the relatively low sulfur content of the coal (see Appendix 6-1; confidential binder) and rock strata in the permit and adjacent area, and to the pervasiveness of carbonate minerals in the soil and rock strata which neutralize the acidity of the water if it occurs. If sulfide mineral oxidation and subsequent acid neutralization via carbonate dissolution were to occur, increases in TDS, calcium, magnesium, sulfate, and bicarbonate concentrations (and possibly also sodium concentrations via ion-exchange with calcium or magnesium on exchangeable clays) would be anticipated.

An analysis of the acid/base potential of samples collected from the overburden and underburden in the proposed mining area indicates that acid mine drainage will be unlikely to occur at the Coal Hollow Mine. The results of laboratory analysis of the acid/base potential of samples collected from the overburden, underburden, and Smirl coal zone are presented in Appendix 6-2. None of the overburden or underburden samples were acid forming, as each of the intervals sampled showed excess neutralization potential. Taken as a whole, the un-weighted composite average acid/base potential of the 57 overburden and underburden samples indicates a net neutralization potential of 174 tons per kiloton. The neutralization potential of the composite overburden/underburden (180 tons per kiloton) exceeds the acid potential (5.5 tons per kiloton) by more than 32 times. A general consensus opinion mentioned by the National Mine Land Reclamation Center (OSM, 1998) is that if the net acid/base potential exceeds 30 tons per kiloton, and the ratio of neutralization potential to acid potential exceeds two, then *alkaline* water will be generated and acid mine drainage will not occur. The acid/base characteristics of composite overburden and underburden in the Coal Hollow Mine area greatly exceed both of these two criteria, suggesting the strong likelihood that acid mine drainage will not be an issue at the Coal Hollow Mine.

Because of the net neutralization potential of the composite overburden/underburden in the Coal Hollow Mine area described above, the pH values of groundwater in fill areas will likely be neutral to alkaline. Accordingly, the solubility of dissolved trace metal species in the alkaline water will likely be low. Consequently, the potential for the mobilization and transport of trace metals in groundwater in the fill will likely also be low. Concentrations of total selenium, water extractable selenium, water extractable boron and other important chemical species in the overburden samples from the Coal Hollow Mine area are generally low. Water extractable selenium concentrations in the analyzed Dakota Formation underburden samples range from 0.05 to 0.2 mg/kg (see Appendix 6-2). Water extractable boron concentrations in the Dakota Formation underburden in a single location (CH-08; 6.5 mg/kg) marginally exceed the Division standard of 5 mg/kg. The limited quantities of material containing water extractable selenium and boron in these concentration ranges in backfill materials are not anticipated to result in appreciably elevated selenium or boron concentrations in groundwater or surface water supplies. Because the hydraulic conductivity of the composite run-of-mine backfill material (which will be rich with clays, silts, and shale) is expected to be low, the flux of groundwater that might migrate through the backfilled pit areas is likely to be low. Additionally, the reclaimed land surface will be graded to promote runoff of surface waters overlying backfilled areas, thus minimizing the potential for infiltration of surface waters into backfilled areas. Consequently, the potential for acid mine drainage or toxic drainage from backfilled areas to surrounding groundwater and surface-water supplies will be minimized.

Similar conditions are anticipated to occur within mining areas at the North Private Lease area. The hydraulic conductivity of the composite run-of-mine backfill material in the North Private Lease (which will be rich with clays, silts, and soft, waxy shale) is expected to be low. Consequently, the flux of groundwater that might migrate through the backfilled pit areas is likely to be low. Lateral migration of groundwaters that could potentially accumulate in reclaimed mine pit areas outward into surrounding aquifers will be minimized by the presence of Tropic Shale bedrock where it is present in the pit walls. The Tropic Shale is the bedrock unit that overlies the Smirl coal seam to be mined and is known to be of low hydraulic conductivity. The presence of undisturbed Tropic Shale bedrock where it is present in mine pit walls will tend to contain accumulating groundwaters in the backfilled pits and prevent lateral migration of these waters to surrounding aquifers.

Reclaimed land surfaces in the North Private Lease will be graded to promote runoff of surface waters overlying backfilled areas, thus minimizing the potential for infiltration of precipitation waters into backfilled areas.

To further minimize the potential for water quality in North Private Lease alluvial groundwaters to become degraded as a result of interactions with soluble minerals in the run-of-mine backfill material in reclaimed mine pit areas, Alton Coal Development, LLC will, where reasonably feasible, place low-permeability materials (likely clayey alluvium or Tropic Shale bedrock) along the margins of the mine pits adjacent to Kanab Creek alluvium. It is anticipated that the TDS concentrations of groundwaters that may accumulate in the reclaimed mine pits will be higher than those of surrounding alluvial groundwater systems. Through the placement of a low-permeability barrier along the margins of the mine pit areas, alluvial groundwaters in the undisturbed alluvial groundwater systems near the Kanab Creek stream channel will be largely isolated from the reclaimed mining areas. In other words, the potential for lateral migration of undisturbed alluvial groundwaters away from the Kanab Creek stream channel into higher-TDS pit backfill areas (or flow from the higher TDS backfill areas towards Kanab Creek) will be minimized.

As outlined in the topsoil and subsoil sampling plan in Chapter 2 of this MRP, materials with poor quality SAR, elevated selenium or boron concentrations, or poor pH as defined by Division guidelines will not be placed in the upper four feet of the reclaimed surface. These materials will also not be placed in the backfill within the top four feet of ephemeral drainages with 100 year flood plains, or in the top four feet in surface water impoundments, or in the top four feet in intermittent or perennial drainages including 100 year flood plains as outlined in the Division guidelines. Materials placed in the top four feet will be sampled to ensure that only suitable materials are placed in the top four feet of the reclaimed surface.

It is noteworthy that in the neighboring state of Wyoming, a water extractable selenium standard of 0.3 mg/kg is considered suitable for topsoil and topsoil substitutes, with concentrations ranging from 0.3 to 0.8 mg/kg being considered marginally suitable for topsoil and topsoil substitute.

As is typical with coal seams regionally, laboratory analyses of coal samples from the Coal Hollow Mine area indicates that there is a net acid forming potential in the coals of the Smirl coal zone (see Appendix 6-2). However, the mining plans call for the mining and removal of 95% of the total coal seam thickness from mining areas, leaving only minor amounts of coal in backfilled areas. Consequently, the potential contribution to the overall acid/base potential of the composite backfill material would be small. Assuming a worst-case-scenario – that all the coal would be retained in the backfill material – the calculated acid/base potential of the composite backfill material is still well within the limits suggested by OSM (1998) to indicate that alkaline discharge without acid mine drainage would be likely.

As described in Chapter 5, Section 532, surface runoff that occurs on disturbed areas will be treated through sedimentation ponds or other sediment-control devices and particulate matter will be allowed to settle prior to the discharging of the water to the receiving water, thus controlling suspended solids concentrations.

At any mining operation there is the potential for contamination of soils, surface-water and groundwater resources resulting from the spillage of hydrocarbons. Diesel fuels, oils, greases, and other hydrocarbons products will be stored and used at the mine site for a variety of purposes. A spill Prevention Control and Countermeasure Plan will be implemented that will help minimize any potential detrimental impacts to the environments.

Spill control kits will be provided on all mining equipment and personnel will be trained to properly control spills and dispose of any contaminated soils in an appropriate manner.

Based on these findings, it is concluded that the potential for mining and reclamation activities in the Coal Hollow Mine permit area to cause detrimental impacts to important water quality parameters is minimal.

728.333 Flooding or streamflow alteration

As described above, appreciable groundwater inflow from the Tropic Shale and Dakota Formation into mine pits at the Coal Hollow Mine are not anticipated. Appreciable groundwater inflows are anticipated only from the relatively thin, overlying alluvial groundwater systems. The thicknesses of the alluvium adjacent to mine openings in the proposed mining areas is generally less than 40 to 50 feet. The hydraulic conductivities of the predominantly clayey and silty alluvial sediments are low, and consequently, very large or sudden groundwater inflows into mine openings are not anticipated. Where appreciable alluvial groundwater is encountered adjacent to mine openings, it will be routed away from mining areas through ditches or other conveyance mechanisms.

Details of the Coal Hollow Mine Alluvial Groundwater Management Plan are provided in Appendix 7-9. Consequently, discharge of mine water from the mine pits is not anticipated. The rates of alluvial groundwater drainage that could occur will likely not be of a magnitude that could potentially cause flooding or streamflow alteration in either the Sink Valley Wash or Lower Robinson Creek drainages.

If excess groundwater were to be encountered during mining operations at the existing mine area or in the proposed North Private Lease such that it could not be adequately managed or discharged in compliance with the Utah UPDES discharge permit (which is considered unlikely), Alton Coal Development, LLC may when necessary construct supplemental containment and settlement ponds in which mine discharge waters may be held for treatment (where necessary) and subsequent discharge through UPDES discharge points in compliance with the UPDES discharge permit, minimizing the potential for flooding or streamflow alteration in areas adjacent to mining.

When coal mining near the eastern edge of the Coal Hollow Mine permit area occurs (mine pits 13-15), special measures will be taken to minimize the potential for the interception by the mine openings of large quantities of groundwater from artesian groundwater system in the northwest ¼ of Section 29, T5W, R39S, and to adequately deal with groundwater inflows if such occur. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

When mining operations advance toward the eastern edge of the permit boundary in pit 15, material excavating in the alluvial sediments will be performed incrementally and with caution. As excavation proceeds, if coarse, water-bearing alluvial sediments (gravels) are encountered, overburden removal in that area will be stopped. The excavation equipment operator will recover the exposed gravel zone with local impermeable sediments (abundant in the alluvium in the area) to halt groundwater inflow if possible. The hydrogeologist will be called to the site to access the hydrogeologic conditions. An investigation of the situation will be performed and a suitable work plan will be developed prior to the resumption of overburden removal in that area. The work plan will be designed to minimize the potential for intercepting unacceptably large inflows of groundwater into the mine pits. The work plan will most likely involve trenching in the alluvium in zones up-gradient of the mine pit area and the emplacement of a low-permeability cut-off wall. The cut-off wall would be emplaced in the excavated trench using acceptable native low-permeability materials. The cut-off wall would be designed to isolate the mine openings from the coarse-grained alluvial groundwater system sufficient to decrease mine inflows to acceptable levels (i.e. so as to minimize the potential for detrimental impacts to the hydrologic balance and to minimize the potential for flooding of mine pits or causing flooding or stream alteration).

As a temporary measure to manage any potential large groundwater inflows that may occur in these areas prior to the installation of a suitable up-gradient hydraulic barrier, the intercepted alluvial groundwaters would be routed along mine benches that "daylight" to the natural land surface in areas to the south. The water would be diverted into pond 4 which has an appreciable storage capacity and discharge structure.

It should be noted that the interception of moderate amounts of groundwater from shallow alluvial groundwater systems in these areas is considered likely. Modest inflows of shallow groundwater intercepted by the mine workings in these areas would be manageable and not of significant concern. The objective of the work plan would be to ensure that strong hydrodynamic communication between the coarse-grained artesian alluvial groundwater systems in the eastern portion of Sink Valley with the Coal Hollow Mine workings is not established.

The rate at which alluvial groundwater will be intercepted by the Coal Hollow Mine will be variable by location and time in permit area. Because of the heterogeneity inherent in most alluvial deposits, the quantifying of precise aquifer parameters in the various mining areas is not straightforward. Additionally, the geometry of the mine openings including the horizontal lengths and heights of mine pit faces adjacent to saturated groundwater systems that are exposed at any point in time are dynamic variables in the surface mining environment. Consequently, precise quantifications of mine groundwater interception rates are not readily obtainable. However, using the estimated mine pit groundwater inflow rates presented as discharge per linear foot of open pit in Table 7-9, it is considered likely that mine interception will be on the order of a few tens of gallons per minute in dry areas and at times when open pit sizes are small, to several hundred gallons per minute in wetter areas and at times when the open pit size is large. It is important to note that inflows into individual pit areas will be short lived, as the individual pits will commonly remain open for a few weeks to a few months.

The reasonably foreseeable maximum quantity of water that could be intercepted by the Coal Hollow Mine is largely a function of the manner in which coal mining operations are conducted in areas where the potential for encountering appreciable groundwater inflows is greatest. If large areas of water-bearing coarse-grained sediments were to be rapidly exposed in mine pit areas, large quantities of water would be anticipated (likely several thousands of gallons per minute). However, as described above, mining operations will be carried out in these areas using the special mining protocols described above. Consequently, large cross-sectional exposures of water-bearing coarse-grained alluvial sediments will not be allowed to be exposed to the mine pits and large inflows of groundwater on that magnitude are not anticipated.

In the unanticipated event that excessive quantities of water were to flow into the mine pits by any mechanism, the water would be pumped from the pits using a suitable pump and piping equipment that will be located on-site at the Coal Hollow Mine for such a contingency. Such water would be managed appropriately as required by all applicable State and Federal regulations. It should be noted that it is not in the mine's interest to allow excessive water to flow into the mine pits. All reasonable efforts will be taken to minimize the potential for flooding of the mine pits (an event that is not considered reasonably foreseeable or probable to occur).

Through the implementation of the above described mining protocols in areas where potentially large groundwater inflows could reasonably be anticipated to occur, the potential for the interception of large quantities of water by the mine is minimized. Consequently, the potential for flooding or streamflow alteration that could occur as a result of intercepting and discharging large quantities of water will be minimized and is considered unlikely.

The principal surface-water drainages in and adjacent to the Coal Hollow Mine permit area are in many locations not stable in their current configurations (see photograph section). Currently, these stream drainages are actively eroding their channels during precipitation events, resulting in down-cutting and entrenchment of stream channels, the formation of unstable near-vertical erosional escarpments adjacent to stream channels (which occasionally spall off into the stream channel), aggressive headward erosion of stream channels and side tributaries, and the transport of large quantities of sediment associated with torrential precipitation events. These processes are currently actively ongoing in the proposed permit and adjacent area and the upper extents of these erosional processes are in many locations migrating upward in stream channels, resulting in increasing lengths of unstable stream channels.

Hereford (2002) suggests that the valley fill alluviation in the southern Colorado Plateau occurred during a long-term decrease in the frequency of large, destructive floods, which ended in about 1880 with the beginning of the historic arroyo cutting. Hereford (2002) further suggests that the shift from deposition to valley entrenchment coincided with the beginning of an episode of the largest floods in the preceding 400-500 years, which was probably caused by an increased recurrence and intensity of flood-producing El Nino Southern Oscillation events beginning at ca. A.D. 1870.

The exact causes of the entrenchment of stream channels and the creation of the numerous arroyos currently in existence in the southwestern United States are not completely understood. Vogt (2008) suggests that three primary factors resulted in the arroyo formation. These factors included 1) changes in climate that produced heavy rainfall, 2) land-use practices such as livestock grazing, and 3) natural cycles of erosion and deposition caused by internal adjustments to the channel system. The temporal coincidence of the causes may have magnified the effect of each factor.

Each of these factors likely contributed to the formation of the entrenched stream drainages and arroyos in the Coal Hollow Project area. Gregory (1917) states that historical evidence indicates that the cutting of Kanab Creek began when a large storm occurred on 29 July 1883, and that unusually large amounts of precipitation were received in 1884-85. In this period the Kanab Creek channel was down-cut by 60 feet and widened by 70 feet for a distance of about 15 miles. The lowering of Kanab Creek may have resulted in a lowering of the local base level and consequent incision of both Sink Valley Wash and Lower Robinson Creek. As suggested by Vogt (2008), other factors, such as the heavy livestock grazing in the local area, which was occurring contemporaneously with the heavy thunderstorm events, likely also contributed to the overall conditions that brought about the stream down-cutting episode in the late 1800s.

While the precise sequence of events and conditions that triggered the arroyo formation and stream entrenchment in the principle surface drainages in and adjacent to the Coal Hollow Project area is not known, it is readily apparent that the principle surface water drainages are not currently in a condition of equilibrium. Stream head-cutting (headward erosion), bank erosion, and spalling of the steep stream channel walls are ongoing processes in the Coal Hollow Project area.

The mining and reclamation plan for the Coal Hollow Mines has been designed to minimize the potential for sediment yield and erosion in the mine permit areas. Accordingly, the mining and reclamation plan minimizes the potential for stream channel erosion and instability within the permit area. No mining-related activities are planned that would likely result in a worsening of the current instability of the surface water drainages in the permit and adjacent area.

The Coal Hollow Mine mining and reclamation plan calls for reclamation activities concurrent with mining progression, which results in the smallest disturbed area footprint and minimizes the length of time that the land surface is susceptible to erosion. The plan also calls for soil tackifiers to be used as a temporary soil stabilizer on reclamation areas prior to seeding. Seeded areas will be mulched. Vegetation established in final reclamation areas will minimize the potential for sediment yield and stream erosion in the long term.

The potential for erosion on the planned excess spoils pile will likewise be minimized. The design plans for the excess spoils pile call for the side slopes exceeding 60 feet in height to be constructed with concave slopes to promote slope stability and to minimize the erosion potential. The excess spoils pile will also be revegetated to minimize the erosion potential.

The Lower Robinson Creek reconstruction will likewise be constructed to promote stability and resistance to erosion. Details of the Lower Robinson Creek reconstruction are shown on Drawings 5-20A and 5-21A. The construction of the channel will include riprap of the channel bottom and the inclusion of an inner flood plane to minimize erosion during flooding events. The stream channel will be revegetated to minimize erosion potential. The Lower Robinson Creek reconstruction is designed to leave the drainage in a condition at final bond release that is at least as stable as the current pre-mining condition.

Following reclamation, stream channels will be returned to a stable state to the extent possible given the currently unstable state of natural drainage channels in the area. Stream channels will be designed to withstand anticipated storm events, thus minimizing the potential of flooding in the reclaimed areas.

The overall condition of the land surface and the surface-water drainages within the permit area at final bond release will likely meet or exceed the current pre-mining conditions. However, it should be noted that Alton Coal Development, LLC will have no control over the land management practices and landowner activities that may be implemented on the privately owned lands of the reclaimed Coal Hollow Mine area after final bond release. Accordingly, the degree of erosional stability and overall conditions in the reclaimed lands and stream drainages in the post bond-release period is not in the control of Alton Coal Development, LLC.

The existing principle surface-water drainages adjacent to the Coal Hollow Mine permit area have large discharge capacities (lower Sink Valley Wash below the County Road 136 crossing, Lower Robinson Creek, and Kanab Creek). These drainages periodically convey large amounts of precipitation runoff water associated with torrential precipitation events. The anticipated discharge rates from alluvial groundwater drainage and the maximum reasonably foreseeable amount of mine discharge water that could potentially be required to be discharged from mine pits is much less than that periodically occurring during major torrential precipitation events. The addition of modest amounts of sediment-free water into these stream channels has the potential to cause minor increases in channel erosion. However, the magnitude of this potential impact will likely be small relative to that occurring during torrential precipitation events.

Most precipitation waters falling on disturbed areas will be contained in diversion ditches and routed to sediment impoundments that are designed to impound seasonal water and storms. Sediment control facilities will be designed and constructed to be geotechnically stable. This will minimize the potential for breaches of sediment control structures, which if they occur could result in down-stream flooding and increases in stream erosion and sediment yield. Emergency spillways will be part of the impoundment structures to provide a non-destructive discharge route should capacities ever be exceeded.

Details associated with these structures at the existing Coal Hollow can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2, the structures at the North Private Lease can be viewed on Drawing 5-67 through 5-71 and Appendix 5-12.

It should be noted that during the startup and construction phase of the mine operation, while the ditches and sediment control ponds are being constructed, temporary silt control measures will be utilized. These measures may include the use of silt fences or other appropriate sediment control measures as necessary.

As shown on Drawing 5-26 for the Coal Hollow Mine, there are two sediment impound watershed areas within the mine permit area (Watershed 5 and Watershed 6) from which precipitation runoff water will not be routed through sediment ponds.

Watershed 5 area includes 28 acres near the Sink Valley Wash/Lower Robinson Creek drainage divide. The land surface in Watershed 5 is relatively flat, sloping at about a one percent grade. Because of the flatness of the land surface in Watershed 5, it is not practical to construct ditches to convey water from this area to a sediment pond. Consequently, control of sediment in runoff water from Watershed 5 will be accomplished through the use of a silt fence or other appropriate sediment control measure placed along the western permit boundary adjacent to Watershed 5 (see Drawing 5-26). Precipitation water falling on Watershed 5 will be retained as soil moisture, retained in the lowest portions of the watershed and allowed to evaporate or infiltrate or, after treatment with silt fences or other appropriate sediment control measures, allowed to flow down gradient onto lower lying adjacent areas.

Watershed 6 includes 19 acres located within the permit boundary east of the proposed Lower Robinson Creek reconstruction (see Drawing 5-26). The land surface in this area slopes gently toward the west at an approximately three to four percent grade. The Watershed 6 area will be isolated from a sediment pond by the reconstructed Lower Robinson Creek stream channel. Control of sediment in Watershed 6 will be accomplished through the installation of a silt fence or other appropriate sediment control measure along the margin of the watershed as shown on Drawing 5-26. The soils on the post-mining land surface in Watershed 6 will initially be stabilized with the use of tackifiers. Subsequent revegetation of the land surface in Watershed 6 will minimize the potential for erosion. After treatment with silt fences or other appropriate sediment control measures, precipitation water falling on Watershed 6 will be allowed to flow down-gradient toward adjacent lands or toward the Lower Robinson Creek stream channel.

The potential for flooding or streamflow alteration resulting from mining and reclamation activities at the Coal Hollow Mine permit area is considered minimal.

728.334 Groundwater and surface water availability

Groundwater use in the Coal Hollow Mine permit and adjacent area is generally limited to stock watering and domestic use in Sink Valley. Some limited use of spring discharge water for irrigation has occurred in Sink Valley, although such irrigation is not occurring presently nor has it occurred in at least the past 10 years. The areas of groundwater use in the Coal Hollow Mine permit and adjacent area are located in the northwest ¼ of Section 29, T39S, R5W (see Drawing 7-4; groundwater discharge area A), and in the northwest ¼ of Section 32, T39S, R5W (see Drawing 7-4; groundwater discharge area B). The likely future availability of groundwater in each of these areas is discussed below.

Groundwater discharge area A (Northwest ¼, Section 29, T39S, R5W)

Groundwater use in area A occurs from several alluvial springs and seeps that are used for stock watering and limited domestic use. As described in Section 728.311 above, short-term diminution in discharge rates from springs in northwest ¼ of Section 29, T39S, R5W are possible as mining operations advance toward these springs. This potential impact is associated with the possible drainage of up-gradient alluvial groundwater into mine openings as mining advances toward groundwater discharge area A. Because individual mine pits will typically remain open for less than about 60 to 120 days (measured from the time the mining of the pit is completed to the time the pit is backfilled) before subsequently being backfilled and reclaimed, the potential for long-term drainage of alluvial groundwater into the mine voids is negligible, and thus any potential decreases in alluvial discharge in groundwater discharge area A is anticipated to be short-lived.

If groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities. Consequently, the potential that groundwater could become unavailable in this area is minimal. Additionally, if alluvial groundwater resources were to become unavailable in this area due to mining and reclamation activities in the Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

It should be noted that the proposed water replacement source is a new well that will produce groundwater from the coarse-grained alluvial groundwater system in Sink Valley. Nearby springs that could potentially be impacted by mining and reclamation activities are supported by the same alluvial groundwater system. However, while modest decreases in the artesian hydraulic pressures in the alluvial groundwater system could potentially result in diminution of spring flows, the new well will be equipped with an electric well pump providing the capability to produce groundwater from the alluvial system even if the hydraulic head in the alluvial groundwater system were to be diminished such that artesian flow conditions temporarily ceased to exist.

Groundwater discharge area B (Northwest ¼, Section 32, T39S, R5W)

Groundwater use in groundwater discharge area B occurs at alluvial springs and seeps located southeast of the Coal Hollow Mine permit area that are used for stock watering and limited domestic use. As described in Section 728.311 above, although some temporary and short-lived diminution in discharge rates from springs in northwest ¼ of Section 29, T39S, R5W is possible, this potential impact is not considered likely.

In the event that alluvial groundwater resources were to become unavailable in this area due to mining and reclamation activities in the Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above.

Surface-water availability

Surface-water use in the Coal Hollow Mine permit and adjacent area occurs in the Sink Valley Wash drainage and in Lower Robinson Creek. Surface waters in the Sink Valley Wash drainage (primarily from Water Canyon via an irrigation diversion and from Swapp Hollow; appreciable discharge in Sink Valley Wash below Section 29 T39S, R5W is usually absent) are utilized for both stock watering and limited irrigation use. Stream water in the Sink Valley Wash drainage is derived from runoff from the adjacent Paunsaugunt Plateau area. Because the surface water in the drainage originates from areas up-gradient areas located large distances from proposed mining areas, and because the stream channel is entirely outside the permit area and will not be impacted by mining and reclamation activities, there is essentially no probability that surface water availability in the Sink Valley Wash drainage could become unavailable as a result of mining and reclamation activities.

Discharge in Lower Robinson Creek immediately above the Coal Hollow Mine permit area typically occurs only in direct response to significant precipitation or snowmelt events. Thus, surface-water availability is currently limited in this drainage prior to any mining activities.

Seepage of alluvial groundwater into the deeply incised lower Robinson Creek stream channel occurs near the contact with the underlying Dakota Formation in the southeast quarter of Section 19, T39S, R5W. This water is likely related to saturated alluvial deposits directly underlying the Robinson Creek stream channel and emerges near where the stream channel intersects the alluvial groundwater system. This seepage of alluvial water is usually about 5 - 10 gpm or less and is routinely monitored at monitoring station SW-5 (Drawing 7-2).

It should be noted that the Coal Hollow Mine plan calls for the temporary diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

The information presented above suggests that the potential for significant impacts to groundwater and surface-water availability resulting from mining and reclamation activities in the Coal Hollow Mine permit and adjacent systems in the region is low.

728.340 Whether mining and reclamation activity will result in contamination, diminution or interruption of State-appropriated waters

State appropriated water rights in the Coal Hollow Mine permit and adjacent area are shown on Drawing 7-3 and tabulated in Appendix 7-3.

Appropriated groundwaters include alluvial springs and seeps in the northwest ¼ of Section 29, T39S, R5W (groundwater discharge area A), springs and seeps in the northwest ¼ of Section 32, T39S, R5W (groundwater discharge area B). State appropriated surface waters include reaches of Sink Valley Wash east of the Coal Hollow Mine permit area, and reaches of Lower Robinson Creek.

The potential for mining and reclamation activities at the Coal Hollow Mine permit area to result in contamination, diminution or interruption of State-appropriated water in the Coal Hollow Permit and adjacent area are described in detail in Sections 728.310, 728.320, 728.332, and 728.334.

With the possible exception of short-term diminution in discharge rates from springs and seeps in the northwest ¼ of Section 29, T39S, R5W, Contamination, diminution, or interruption of State-appropriated waters in the Coal Hollow Mine permit and adjacent area are not anticipated. It should be noted that if groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, minimizing the potential for diminution of discharge rates from these springs.

Additionally, it should be noted that the Coal Hollow Mine plan calls for the temporary diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

In the event that any State appropriated waters were to be contaminated, diminished, or interrupted due to mining and reclamation activities in the Coal Hollow Mine permit area, groundwater will be replaced according to all applicable State laws and regulations using the replacement water source described in Section 727 above.

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730 OPERATION PLAN

Coal mining in the Coal Hollow Mine permit area will occur using surface and underground mining techniques. Planned coal mining operations in the North Private Lease area will be conducted using conventional pit surface mining and highwall mining techniques. All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. Operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

In order to maximize the use and conservation of the coal resource, coal will be recovered using a combination of large hydraulic backhoes or front end loaders and off-road trucks, highwall mining and underground mining equipment. Mined coal will be hauled to a central coal processing area for crushing and placement into a stockpile. Coal from the stockpile will be transferred into a bin and loaded into over the road trucks for transport.

The plan, with Drawings, cross sections, narrative, descriptions, and calculations indicates how the relevant requirements will be met. The lands subject to coal mining and reclamation operations over the estimated life of the operations are identified and briefly described. All appropriate information is located in the subsequent sections and Drawings 5-1 through 5-39 and Appendices A5-1 through A5-3.

731 GENERAL REQUIREMENTS

Operations will be conducted to assure protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

Groundwater and Surface-Water Protection

To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acid, toxic, or other harmful infiltration to the groundwater system. Additionally, excavations, and disturbances will be managed to prevent or control discharges of pollutants to the groundwater.

Products including chemicals, fuels, and oils used in the mining process will be stored and used in a manner that minimizes the potential for these products entering groundwater systems. Concrete oil and fuel containments will be constructed as shown on Drawings 5-3 and 5-8.

A facilities spill plan for the Coal Hollow Mine is provided in Appendix 7-5. When operations begin, there will be an EPA SPCC plan available on site for inspection.

The wash bay sump sludge will be removed as necessary and transported off site to an approved hazardous waste disposal facility.

The wash bay at the mine site will include a closed circuit water recycle system. This system will eliminate and store water impurities and reroute water back through the wash bay for cleaning equipment, thus minimizing water consumption the potential for contamination of groundwater resources. Details for this structure can be viewed on Drawings 5-3, and 5-8.

As mining operations approach springs and seeps in the northwest ¼ of Section 29, T39S, R5W (See Drawing 7-4; groundwater discharge area A), there is the potential for drainage of up-gradient into mine openings to cause short-lived diminution of discharge from these springs. If groundwater inflow rates into mine openings in this area are excessive, such that appreciable impacts to the springs and seeps in groundwater discharge area A are likely, where necessary Alton Coal Development, LLC will use a suitable technique to minimize groundwater inflow rates into the mine voids. These techniques may include the use of bentonite or natural clay filled cutoff walls or other means where appropriate to isolate and protect groundwater resources up-gradient of mining activities, minimizing the potential for diminution of discharge rates from these springs. Details of the contingency plan for this occurrence are provided in Appendix 7-9.

The mine will replace loss of water identified for protection in this MRP that are impacted by mining and reclamation operations.

To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic or toxic drainage, prevents to the extent possible, additional contributions of suspended solids to streamflow outside the permit area and otherwise prevents water pollution. Runoff and sediment control measures are described in detail in Chapter 5 of this MRP. The mine will maintain adequate runoff- and sediment-control facilities to protect local surface waters.

Discharge of mine water that has been disturbed by coal mining and reclamation operations is not anticipated. However, any discharges of water from areas disturbed by coal mining and reclamation operations that do occur will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR part 434. Discharge of mine waters will be regulated by a Utah UPDES discharge permit.

Water pollution associated with mining and reclamation activities within the permit areas will be controlled by:

- Construction of berms and/or diversion ditches to control runoff from all facilities areas.
- Roads will be constructed with ditches to capture runoff
- Diversion ditches will be constructed as necessary around active mining and reclamation areas to capture runoff from those areas.
- Sedimentation impoundments will be constructed to control discharges
- In areas where impoundments or diversions are not suitable to the surrounding terrain, silt fence or straw bales will be utilized to control sediment discharge from the permit area.

In order to accomplish these objectives for the Coal Hollow Mine, watershed analysis of the permit and adjacent areas has been completed and specific designs are established for each water pollution control structure. Primary control structures include five sediment impoundments, four diversion ditches and miscellaneous berms. The locations of these structures can be viewed on Drawing 5-3. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-25 through 5-34. In addition, a geotechnical analysis of the impoundments to ensure stability can be viewed in Appendix 5-1. The watershed and structure sizing analysis can be viewed in Appendix 5-2. In addition to these primary structures, temporary diversions and impoundments may also be implemented, as necessary, in mining areas to further enhance pollution controls.

Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760. Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Storm water and snow melt that occurs within the facilities area will be routed to an impoundment that will contain sediment. This impoundment will have a drop-pipe spillway installed that will allow removal of any oil sheens that may result from parking lots or maintenance activities by using absorbent materials to remove the sheen. Details for this impoundment can be viewed on Drawings 5-28.

There are five sediment impoundments proposed for the permit area. These structures will be constructed using a combination of dozers and backhoes. The structures have been designed to contain the required storm events as specified in Appendix 5-2. The structures will have sediment removed as necessary to ensure the required capacities. Details for these structures can be viewed on Drawings 5-25, 5-26 and 5-28 through 5-32. Calculations and supporting text can be viewed in Appendix 5-2.

Six diversion ditches along with five sediment impoundments are proposed for the permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

In order to accomplish these objectives for the North Private Lease, watershed analysis of the permit and adjacent areas has been completed and specific designs are established for each water pollution control structure. Primary control structures include five sediment impoundments, fifteen diversion ditches. The locations of these structures can be viewed on Drawing 5-65. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-67 through 5-71. In addition, a geotechnical analysis of the impoundments to ensure stability can be viewed in Appendix 5-11. The watershed and structure sizing analysis can be viewed in Appendix 5-12. In addition to these primary structures, temporary diversions and impoundments may also be implemented, as necessary, in mining areas to further enhance pollution controls. While approval of Areas 2 and 3 are dependent on the timely approval of permits from the U.S. Army Corps of Engineers, Area 1 extended for pits 7, 8 and 9 will require the use of two temporary diversions and an impoundment. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-65A, 5-71A and 5-73. The watershed and structure sizing analysis can be viewed in Appendix 5-12A. Once approval to proceed into Areas 2 and 3 are acquired, these temporary features will no longer be necessary and will be mined through.

Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760. Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763.

As shown on Drawing 5-64 for the North Private Lease, there is one watershed areas within the mine permit area (ASCA-1) from which precipitation runoff water will not be routed through sediment ponds.

ASCA-1 area includes 3.1acres of access road to the North Private Lease that will not flow to a sediment impoundment. Consequently, control of sediment in runoff water from ASCA-1 will be accomplished by routing runoff from the road to a row of straw bales for treatment. These straw bales surround a drop box to a culvert flowing under the road (see Appendix 5-13).

The smallest practicable area, consistent with reasonable and safe mine operational practices will be disturbed at any one time during the mining operation and reclamation phases. This will be accomplished through progressive backfilling, grading, and prompt revegetation of disturbed areas.

There are no other coal processing waste banks, dams or embankments proposed within the permit area.

Diesel fuels, oils, greases, and other hydrocarbons products will be stored and used at the mine site for a variety of purposes. A spill Prevention Control and Countermeasure Plan will be implemented that will help minimize any potential detrimental impacts to the environments.

Products including potentially hazardous chemicals, fuels, and oils used in the mining process will be stored and used in a manner that minimizes the potential for these products to contaminate surface-water resources. Concrete oil and fuel containments will be constructed as shown on Drawings 5-3 and 5-8.

The wash bay at the mine site will include a closed circuit water recycle system. This system will eliminate and store water impurities and reroute water back through the wash bay for cleaning equipment, thus minimizing water consumption the potential for contamination of surface-water resources. Details for this structure can be viewed on Drawings 5-3, 5-8, and Appendix 5-4. .

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742.400 and R645-301-762. The specific plan for road locations and design are presented in R645-301-534. The location and details for roads can be viewed on Drawings 5-3 and 5-22 through 5-24 for the Coal Hollow Mine and on Drawings 5-47 and 5-58 through 5-64 for the North Private Lease.

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed to control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area; Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under R645-301-751; minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems; and refrain from significantly altering the normal flow of water in streambeds or drainage channels. No acid- or toxic-forming substances will be used in road surfacing.

All roads for the Coal Hollow Mine will be removed and reclaimed according to Drawings 5-37 and 5-37A. The estimated timetable for removing these roads is shown on Drawing 5-38. All roads for the North Private Lease will be removed and reclaimed according to Drawings 5-74 and 5-75. The estimated timetable for removing these roads is shown on Drawing 5-76. Cut ditches will be established on the shoulders of all primary roads to control drainage and erosion. Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles.

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

The locations of wells that are planned to be removed by intercepting mining operations in the North Private Lease are shown on Figure 20 of Appendix 7-16. Monitoring wells to be removed by mining operations in the North Private Lease that are deeper than the depths of the advancing mine working will be plugged and abandoned prior to their interception by the mining operations. Shallow monitoring wells that will be completely excavated by mine disturbance will not be plugged/abandoned because the entire well/borehole length will be removed by mining operations and thus plugging and abandoning these wells serves no purpose.

The six monitoring wells that are planned to be removed by mining operations are not planned to be replaced. Monitoring of the alluvial groundwater system within the North Private Lease after mining is completed will be accomplished using the monitoring wells that are not planned to be intercepted by mining (see Figure 20 of Appendix 7-16) and also using additional monitoring wells proposed for construction in the North Private Lease. As directed by the Division, ACD has proposed the construction of up to 30 additional alluvial monitoring wells in locations within and adjacent to the North Private Lease that are to remain after mining is complete. Monitoring of alluvial groundwater quantity and quality can be accomplished using these wells.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731 and be managed according to the following.

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

If mining and reclamation activities result in the contamination, diminution, or interruption of State appropriated groundwater or surface-water sources, replacement water will be provided using the alternate water source described in R645-301-727.

Seasonal baseline water monitoring information for all water rights that could be affected by mining in the permit and adjacent area have been submitted electronically to the Division's on-line hydrology database.

731.200 Water Monitoring

This section describes the hydrologic monitoring plan (including that for the 85.88-acre Dame Lease IBC). The hydrologic monitoring plans for groundwaters and surface waters in the proposed North Private Lease area are provided in Appendix 7-16 and Appendix 7-18. Locations of surface-water and groundwater monitoring sites are indicated on Drawing 7-10. Hydrologic monitoring protocols, sampling frequencies, and sampling sites are described in Table 7-4. Groundwater and surface-water monitoring locations are listed in Table 7-5. Operational field and laboratory hydrologic monitoring parameters for surface water are listed in Table 7-6, and for groundwater in Table 7-7. The hydrologic monitoring plan during reclamation will be the same as during the operational phase. The hydrologic monitoring parameters have been selected in consultation with the Division's directive Tech-006, *Water Monitoring Programs for Coal Mines.*

The groundwater and surface-water monitoring plan is extensive and includes more than 50 monitoring sites. The monitoring plan is designed to monitor groundwater and surface-water resources for any potential impacts that could potentially occur as a result of mining and reclamation activities in the Coal Hollow Mine permit and adjacent area. Each of the sampling locations and their monitoring purpose are described below.

Streams

Kanab Creek will be monitored at sites SW-3 (above the permit area), and SW-2 (below the permit area). Lower Robinson Creek will be monitored at sites SW-4 (above the permit area), SW-101 (within the permit area), and SW-5 (below the permit area above the confluence with Kanab Creek). The irrigation water near SW-4 will also be monitored at site RID-1. Swapp Hollow creek will be monitored above the permit area at site SW-8. Sink Valley Wash will be monitored at SW-6 (a small tributary to the wash immediately below the permit area) and at SW-9, located in the main drainage below the permit area. All of these locations, with the exception of RID-1) will be monitored for discharge and water quality parameters specified in Table 7-6 quarterly, when reasonably accessible. Additionally, Lower Robinson Creek will be monitored at site BLM-1, which is near the location of alluvial groundwater emergence in the bottom of the stream channel. RID-1 will be monitored for discharge and field water quality parameters. BLM-1 will be monitored for discharge and water quality parameters specified in Table 7-6 quarterly. Monitoring sites BLM-1, SW-5, SW-6, and SW-9 will also be monitored for total and dissolved selenium quarterly.

Surface-water monitoring stations from the North Private Lease are included in the Coal Hollow Mine monitoring plan. These include SW-1A, SW-1M, SW-1, Kanab Creek @ C.R., and SW-3 on the main stem of Kanab Creek; Priscilla Creek, April Creek, and SW-15 on Simpson Hollow Creek; RSD-1 and SW-11, which are tributaries to Kanab Creek in and adjacent to the North Private Lease area; and EW-1, which is an ephemeral wash adjacent to the permit area. Monitoring protocols for these surface water monitoring sites are as listed in Tables 7-6. We recommend the monitoring of SW-1, Kanab Creek @ C.R., SW-3, SW-11, April Creek, and SW-15 for discharge rate and field and laboratory water quality measurements. We recommend that monitoring at the other surface-water monitoring sites be for discharge rate and for field water quality parameters only.

Springs

Eight springs from alluvial groundwater area A will be monitored including SP-8, SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring. Spring SP-8 is a developed spring in area A that provides culinary water for the Swapp Ranch house. SP-8 will be monitored for discharge and operational laboratory water quality measurements quarterly when reasonably accessible. Springs SP-14, SP-16, SP-19, SP-20, SP-22, SP-24 and Sorensen Spring springs will be monitored for discharge and field water quality measurements quarterly when reasonably accessible.

Springs SP-4 and SP-6, and SP-33, which are located in Sink Valley below the proposed mining area, will also be monitored. SP-6 is an area of diffuse seepage above an earthen impoundment in the wash immediately below the permit area. Spring SP-33 is a developed spring that discharges into a pond below the permit area and provides culinary water to two adjacent cabins. Each of these Springs SP-6 and SP-33 will be monitored for discharge and operational laboratory water quality measurements quarterly when reasonably accessible. SP-4 discharges from a fault/fracture system in the Dakota Formation near the canyon margin in Sink Valley Wash below the permit area. Spring SP-4 will be monitored for discharge and field water quality measurements quarterly when reasonably accessible. Spring SP-3 discharges from pediment alluvium in the upland area above Sink Valley Wash more than a mile from the permit area. It is extremely unlikely that discharge rates or water quality at this spring could be impacted as a result of mining-related activities in the mine permit area. However, this spring will be monitored for discharge and field water quality measurements quarterly, primarily to provide background data from springs in the region.

The Coal Hollow Mine monitoring plan includes six springs and seeps in and around the North Private Lease area. These include Coyote Seep (which is located within the lease boundary area), Seep Z, Alkali Seep, and Dakota Seep (which are located adjacent to the lease area), and Pond Spring and Hill Spring (which are located below the town of Alton west of the lease area). Impacts to Coyote Seep are anticipated to occur because the seep area is situated within the planned location of a mine pit. Impacts to the other springs and seeps are not anticipated, but are proposed for monitoring 1) to verify that impacts do not occur, and 2) to document any influence of seasonal variability on water quantity and water quality at these locations. It is noted that upper Dakota Formation strata at Pond Spring and Hill Spring are up-gradient from the elevation of the Dakota Formation strata in proposed mining areas in the North Private Lease area (i.e. the stratigraphic dip is toward the east or northeast). Accordingly, impacts to these springs are not anticipated. However, because these springs are associated with Utah state-appropriated water rights and have importance to agriculture, we recommend the monitoring of these two springs. We recommend the monitoring of Pond Spring and Coyote Seep for discharge rate and field and operational laboratory water quality measurements. The other spring locations are recommended for discharge rate and field water quality measurements only.

Coyote Seep is an alluvial groundwater seepage zone that is located in the bottom of a deeply incised surface-water drainage/erosional scour in the soft alluvial sediments in the North Private Lease. The soils at the Coyote Seep location have been previously excavated, creating a small pool/pond at the seep. The elevation of the pool at Coyote Seep approximately coincides with the local alluvial groundwater elevation, suggesting the likelihood that the pool at Coyote Seep is a surface expression of the local alluvial groundwater surface. Accordingly, to fully monitor groundwater quantity at the seep, discharge monitoring at Coyote Seep will include 1) a measurement of the discharge rate of groundwater outflow from the pool, and 2) a measurement of the water elevation at the Coyote Seep pool using a staff gauge installed at the seep for that purpose. The staff gauge will be surveyed to enable accurate determinations of the water level elevations at the seep.

Wells

Wells Y-98 (Robinson Creek alluvium above the permit area), Y-45 (coal seam well in Swapp Hollow above permit area), Y-102 (flowing alluvial well in alluvial groundwater discharge area A), Y-36 (coal seam well in Sink Valley above the permit area), Y-38 (coal seam well in Sink Valley permit area), Y-61 (alluvial well at the Sorenson Ranch), and C5-130 (new monitoring well in alluvial groundwater discharge A) will be monitored quarterly when reasonable accessible. Well Y-61 will be monitored for groundwater operational laboratory water quality parameters to monitor groundwater quality in alluvial groundwater discharge area A. The other wells will be monitored for water level only.

Additionally, 19 newly constructed monitoring wells constructed in the Sink Valley alluvial groundwater system will be monitored quarterly. These include C2-15, C2-28, C2-40, C3-15, C3-30, C3-40, C4-15, C4-30, C4-50, C7-20, C9-15, C9-25, C9-40, LS-28, LS-60, LS-85, SS-15, SS-30, and SS-75. All of these wells will be monitored quarterly for water level. Additionally, wells LS-85 and SS-30 will be monitored for groundwater operational laboratory water quality measurements.

Additionally two wells in the Lower Robinson Creek alluvium will be monitored for water level and groundwater operational laboratory chemistry. These include UR-70 located above proposed mining locations in the Lower Robinson Creek drainage, and LR-45, located below proposed mining areas adjacent to Lower Robinson Creek. It should be noted that LR-45 is located near a proposed sediment pond impoundment. Consequently, if this well becomes unsuitable for monitoring, an alternate location will be used to monitor the Lower Robinson alluvial groundwater system in this area.

Wells C0-18 and C0-54 are located near the initial proposed mining areas in the Lower Robinson Creek drainage. These will be monitored for water level quarterly.

It should be noted that many of the wells specified for monitoring in this monitoring plan will at some point be destroyed or rendered inoperable as the mine workings precede through the area. These wells will be monitored until such a time as they are destroyed or become inoperable.

The possible need for an additional monitoring well located along the east-west permit boundary in Section 30, T39S, R4W has been evaluated. As described in Section 728.332, based on the laboratory analyses of acid and toxic forming materials in the overburden, coal seam, and underburden, it has been determined that discharges from the mine areas will likely be alkaline in character and acid mine drainage will likely not occur. Similarly, the potential for toxic drainage is not anticipated (see Section 728.332). Additionally, given the general east to northeasterly direction of the bedrock dip in the mine area, groundwater migrating through the pit backfill areas after mining will likely migrate down slope in those same directions (to the east). Because the lower portions of the highwalls surrounding the mine pit areas consist of relatively impermeable Tropic Shale bedrock, the potential for migration of appreciable quantities of groundwater from the mine pit fill areas into surrounding unmined areas is low (see Section 728.320). Shallow alluvial groundwater that could potentially migrate to the west is monitored for laboratory water quality parameters at well LR-45. Surface runoff from these areas is monitored for laboratory water quality parameters at site SW-5, which is located in Lower Robinson Creek below the proposed mining areas. For these reasons, the installation and monitoring of an additional monitoring well is not deemed necessary at this time.

Monitoring wells in the North Private Lease and adjacent areas are included in the monitoring plan for the Coal Hollow Mine. The monitoring wells are monitored quarterly when reasonably accessible. These include Y-103, NLP-1, NLP-2, NLP-3, NLP-4, NLP-5, NLP-6, NLP-7, NLP-8, NLP-9, NLP-10, NLP-11, CN0-60, CN1-43, CN1-58, CN2-70, CN3-69, CN3-80, CN3-81, CN3-93, CN3-98, CN4-49, CN5-52, CN5-58, CN7-70, CLEM-1, CLEM-2, CLEM-3, and CLEM-4 which are monitoring wells completed in the alluvial groundwater system in the Kanab Creek valley in and around the permit area. Monitoring well NLP-13 is located in the Simpson Hollow drainage below mining areas and is also included in the mining plan. Of these wells, Y-103, NLP-4, NLP-5, CN0-60, CN1-58, CN2-70, CN3-98, CN4-49, and CN7-70 will be monitored for water levels and field and operational laboratory water quality measurements. The other alluvial monitoring wells are to be monitored for water level measurements only. Monitoring wells Y-53, Y-55, Y-69, and Y-70 monitor groundwater in the Smirl coal seam. These wells will be monitored for water level only.

The post-mining monitoring network will include a minimum of one backfill monitoring well. Alton Coal Development, LLC will, if possible, construct a new monitoring well in a suitable backfilled mine pit area east of Kanab Creek in the North Private Lease. The proposed future well is designated as BW-1 in the Coal Hollow Mine monitoring plan. The projected location of the backfill monitoring well is in Pit 12. The proposed construction designs for BW-1 include drilling the borehole to the base of the backfilled area and constructing the well with the screens extending upward from the bottom of the well.

If upon completion of the mining and backfilling in the Pit 12 area it is determined by ACD that the Pit 12 area is not a suitable location for BW- well, an alternate site will be selected in consultation with the Division of Oil, Gas and Mining.

Alton Coal Development will provide an updated map of potentiometric levels in the alluvial groundwater system in the North Private Lease and adjacent area during operational and reclamation phases at least every three years. The map will be an update to the map included as Figure 18 of Appendix 7-16. The alluvial groundwater contour map will be updated using all available monitoring data, which will include potentiometric data collected from wells completed in the alluvial groundwater systems within and adjacent to the North Private Lease, potentiometric data collected from the proposed mine pit backfill well BW-1 (when it becomes available), and any other relevant potentiometric data that may be available at the time of the map update

Groundwater and surface-water monitoring will continue through the post-mining periods until bond release. The monitoring requirements, including monitoring sites, analytical parameters and the sampling frequency may be modified in the future in consultation with the Division if the data demonstrate that such a modification is warranted.

85.88-acre Dame Lease IBC

In conjunction with highwall mining activities within the 85.88-acre Dame Lease IBC, supplemental water monitoring activities will be performed at selected nearby springs and wells. This will include weekly monitoring of spring discharge rates at sites SP-8, SP-14, SP-20, SP-22, and SP-40, and weekly measurements of water levels in monitoring wells C4, C2, C3, C5, and Y-61. The weekly monitoring at these sites will begin one month prior to the commencement of highwall mining in the 85.88-acre Dame Lease IBC and will continue until one month after highwall mining in the IBC is concluded. Following the period of weekly monitoring, the above specified stations will be monitored monthly for a period of six months. The flow and water level data generated during this period of accelerated monitoring will be sent to the Division of Oil, Gas and Mining as a spreadsheet via e-mail at the end of each month.

In accordance with R645-302.245.230 all holes discharging water will be sealed within 72 hours after completion with impervious and noncombustible material. However, in the approved Ground Control Plan for CHM, MSHA requires the adjacent hole remain open for monitoring of the web. Thus, if an adjacent hole is discharging water and needs to be kept open for web monitoring then the discharge will be tested to determine if it contains acid or toxic-forming material and approval to keep this hole open for web monitoring will be requested from the Division in accordance with R645-302.245.230.

In order to verify that the highwall mining holes excavated into the 85.88-acre Dame Lease IBC do not cause depletion of the overlying shallow alluvial groundwater systems, the groundwater discharge rate (if any) that occurs from the mouths of the holes within the Dame Lease IBC will be monitored daily. The daily monitoring will commence upon completion of the hole excavation and continue until the hole is sealed. Where it is reasonably possible to do so, the discharge rate measurements will be performed using an appropriate field flow measurement technique (i.e. pipe and a calibrated container, flume, weir, etc.). In areas where the performance of a field discharge measurement is not reasonably possible (i.e. under diffuse seepage conditions or where unconcentrated dispersed flow conditions exist) the discharge rate will be estimated. Discharge rate measurements from the highwall holes will not be performed in areas where such measurements cannot be performed safely. In those areas where the discharge rates cannot safely be measured, this will be noted in the flow record and, where possible, a visual estimate of the discharge rate will be made. Upon approval from the Division, at times when no discharge is occurring from any of the open highwall mining holes in the Dame Lease IBC, discharge measurements will be performed daily on those days that the mine is operating (generally Monday through Friday). Under conditions where measurable flows are present at any open highwall mining hole in the 85.88-acre Dame Lease IBC, the flow measurements will be performed on a continuous daily basis (7 days a week) until the hole is sealed. The flow data for each hole will be sent to the Division as a spreadsheet via e-mail at the end of each month.

The details of the hydrologic monitoring plan for the North Private Lease area are provided in Appendix 7-16 and are summarized in Tables 7-4, 7-5, 7-6 and 7-7. The locations of surface-water and groundwater monitoring sites in the North Private Lease are shown in Appendix 7-16.

Instruction for the use of the groundwater and surface-water monitoring plans

The hydrologic monitoring plans for groundwaters and surface-waters at the Coal Hollow Mine (including the North Private Lease area) may be used to detect potential impacts to groundwater and surface-water systems that could occur as a result of the proposed operations. Prior to the performance of coal mining and reclamation activities at the mine, baseline monitoring of groundwater and surface-water resources was performed. This has included monitoring water quantity (stream and spring discharge rates and water levels in wells), and water quality (both field and laboratory water quality measurements). The monitoring data may be used by comparing the water quantity and water quality characteristics of groundwaters and surface-waters measured during the operational mining and post-mining periods with that measured during the baseline monitoring period for any parameter of interest to evaluate the nature and magnitude of any potential impacts (i.e. changes would be indicated by differences between the baseline data and the operational or reclamation phase data). In evaluating potential impacts, it is important that all potential factors which could potentially cause variability in water quantity and/or water quality characteristics be considered. These factors could include short-term or long-term variability in climatic conditions (which may conveniently be evaluated using the Palmer Hydrologic Drought Index as described in Appendix 7-1), changes in land use practices over time, or several other factors. A convenient way to evaluate the water quality characteristics and detect potential impacts to water quality of groundwaters and surface waters is through the use of Stiff diagrams (see Appendix 7-1 for further explanation). Information is also provided by the Utah Division of Oil, Gas and Mining regarding the use of Stiff diagrams (Utah.gov).

731.300. Acid- and Toxic-Forming Materials.

At the existing Coal Hollow Mine and the proposed North Private lease area, drainage from acid- and toxic-forming materials and underground development waste into surface water and ground water will be avoided by identifying and burying and/or treating, when necessary, materials which may adversely affect water quality, or be detrimental to vegetation or to public health and safety if not buried and/or treated.

Materials will be stored in a manner that will protect surface water and ground water by preventing erosion, the formation of polluted runoff and the infiltration of polluted water. Storage will be limited to the period until burial and/or treatment first become feasible, and so long as storage will not result in any risk of water pollution or other environmental damage.

Storage, burial or treatment practices will be consistent with other material handling and disposal provisions of R645 Rules.

During the period of operation of the Coal Hollow Mine, the observed pH of the water that has infrequently been discharged through the UPDES discharge points has consistently been alkaline in nature (UDOGM, 2015). No acid mine discharge has been observed at the Coal Hollow Mine. Measured concentrations of selenium and manganese in the mine discharge water have consistently been low (near the lower laboratory detection limits). Similarly, concentrations of total iron have also usually been low, although on a few occasions slightly elevated concentration of total iron (<1.61 mg/L) in the mine discharge water has been measured. These total iron concentrations are generally associated with suspended solids associated with storm water runoff or snowmelt events.

Based on the overall similarities in the geologic environments at the existing Coal Hollow Mine permit area and the proposed North Private lease area, it is considered likely that mine discharge waters that could potentially be discharged from the North Private Lease would have similar water quality characteristics (i.e. no acid mine drainage and no appreciable toxicity).

731.400. Transfer of Wells

Before final release of bond, exploratory or monitoring wells will be sealed in a safe and environmentally sound manner in accordance with R645-301-631, R645-301-738, and R645-301-765. With the prior approval of the Division, wells may be transferred to another party for further use. However, at a minimum, the conditions of such transfer will comply with Utah and local laws and the permittee will remain responsible for the proper management of the well until bond release in accordance with R645-301-529, R645-301-551, R645-301-631, R645-301-738, and R645-301-765.

731.530 State-appropriated water supply

A water supply well was constructed in the Sink Valley Alluvial groundwater system in October of 2010. The water well is being used as a water supply source for the mine and can also be used for water replacement if needed (also for use if needed as a replacement water source for mining in the 85.88-acre Dame Lease IBC).

731.600 Stream Buffer Zones

Any perennial or intermittent streams in the mine area will be protected by 100 foot stream buffer zones on either side of these streams. Coal mining and reclamation operations will not cause or contribute to the violation of applicable Utah or federal water standards and will not adversely affect the water quality and quantity or other environmental resources of the stream.

Temporary or permanent stream channel diversion will comply with R645-301-742-300. It should be noted that the Coal Hollow Mine plan calls for the temporary diversion of a reach of the Lower Robinson Creek stream channel approximately 2,000 feet in length in the southeast ¼ of Section 19, T39S, R5W. Details of the proposed diversion are given in Chapter 5, Section 527.220 of this MRP. If this action results in diminution of the meager discharge of surface water in the drainage below the planned diversion, where required a suitable mitigation for this potential impact will be designed and implemented in consultation with the Division of Oil, Gas and Mining.

The areas surrounding the streams that are not to be disturbed will be designated as buffer zones, and will be marked as specified in R645-301-521.260.

731.700 Cross sections and Maps

The locations of springs and seeps identified in the Coal Hollow Mine permit and adjacent area are shown in Drawing 7-1. The locations of springs and seeps in the North Private Lease area are shown in Appendix 7-16. The locations of baseline hydrologic monitoring locations (including those for the North Private Lease) are shown on Drawing 7-2. Monitoring well locations in the North Private Lease and adjacent areas are shown in Appendix 7-16 and Appendix 7-18. The locations of water rights in the Coal Hollow permit and adjacent area are provided on Drawing 7-3. Water rights in the North Private Lease area are shown on Drawing 7-3N. Cross-sections depicting the stratigraphy and hydrostratigraphy of the Coal Hollow Mine permit and adjacent area are presented in Chapter 6, Drawing 6-2 and in Appendix 7-16. Designs for impoundments in the Coal Hollow permit area are shown in Drawings 5-25 through 5-31 and impoundments in the North Private Lease area are shown in Drawings 5-65 through 5-67.

731.800 Water Rights and Replacement

Alton Coal Development, LLC commits to replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from the underground or surface source, where the water supply has been adversely impacted by contamination, diminution, or interruption proximately resulting from the surface mining activities. Baseline hydrologic information required in R645-301-624.100 through R645-301-624.200, R645-301-625, R645-301-626, R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be used to determine the extent of the impact of mining upon ground water and surface water.

Sorensen Spring (SP-40) is the current domestic water supply for the Sorensen Ranch (Personal communication, Darlynn Sorensen, 2008). There is currently no development at the spring that would convey water to the ranch house. Rather, water from the spring is obtained directly from the spring for use at the ranch. Monitoring of discharge rate and water quality is included in the proposed water monitoring plan for the Coal Hollow Mine. The operational and reclamation phase water monitoring protocols for this spring are listed in Tables 7-5 and 7-7A. Should the water source be interrupted, diminished, or contaminated, replacement water will be provided from the new water well that will be constructed prior to the beginning of overburden removal for pits 13, 14, and 15 (see description in section R645-301-727 above, and Drawing 5-8C) or other suitable water replacement source as approved by the Division.

There are no state-appropriated groundwater rights in the North Private Lease area.

As specified in R645-301-112, groundwater quantity will be protected by handling earth materials and runoff in a manner that will restore approximate premining recharge capacity of the reclaimed area as a whole, excluding coal mine waste disposal areas and fills, so as to allow the movement of water to the groundwater system.

732 Sediment Control Measures

Sediment control measures have been designed, constructed and maintained to prevent additional contributions of sediment to streamflow or to runoff outside the permit area.

732.100 Siltation Structures

Siltation structures within the permit area are described in Section 732.200

732.200 Sedimentation Ponds

Six diversion ditches along with five sediment impoundments are proposed for the Coal Hollow permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2.

Fifteen diversion ditches along with five sediment impoundments are proposed for the North Private Lease permit area. In addition, miscellaneous controls such as berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-47. Details associated with these structures can be viewed on Drawings 5-67 through 5-71 and Appendix 5-12. While approval of Areas 2 and 3 are dependent on the timely approval of permits from the U.S. Army Corps of Engineers, Area 1extended for pits 7, 8 and 9 will require the use of two temporary diversions and an impoundment. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-65A, 5-71A and 5-73. The watershed and structure sizing analysis can be viewed in Appendix 5-12A. Once approval to proceed into Areas 2 and 3 are acquired, these temporary features will no longer be necessary and will be mined through.

Sedimentation ponds have been designed in compliance with the requirements of R645-301-356.300, R645-301-356.400, R645-301-513.200, R645-301-742.200 through R645-301-742.240, and R645-301-763.

No sedimentation ponds or earthen structures that will remain open are planned.

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

732.300 Diversions

The runoff control plan is designed to isolate, to the maximum degree possible, runoff from disturbed areas from that of undisturbed areas. Where possible, this has been accomplished by allowing up-stream runoff to bypass the disturbed area, and routing any runoff from undisturbed areas that enter the disturbed area into a sediment control system.

Six diversion ditches along with five sediment impoundments are proposed for the Coal Hollow permit area. In addition, miscellaneous controls such as silt fence, berms and temporary diversion ditches are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2. A segment of Diversion Ditch 4 (DD4), due to premining contours, was not constructed until fill from the spoils pile attained an elevation that allowed positive flow. Prior to disturbances and until completion of DD4, a silt fence provided protection from offsite impacts. During reclamation, Pit 10 will be the final pit backfill requiring the remaining spoil stockpiled to be relocated, thus DD4 will be relocated with the Pit 10 borrow operations. All borrow activity will occur south of DD4 until elevations south of DD4 cause a positive flow directly to Sediment Pond 3. At this time DD4 can be realigned allowing final removal of Pit 10 borrow material. All temporary ditches will meet the design requirements of Diversion Ditch 4 (designed for the 100-year, 24 hour storm) and will be adjusted within the permitted active mining area in relation to the active pit, currant spoils pile configuration and reclamation.

Fifteen diversion ditches along with five sediment impoundments are proposed for the North Private Lease permit area. In addition, miscellaneous controls such as silt fences, berms and temporary diversion ditches are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-63. Details associated with these structures can be viewed on Drawings 5-67 through 5-71 and Appendix 5-12. While approval of Areas 2 and 3 are dependent on the timely approval of permits from the U.S. Army Corps of Engineers, Area 1 extended for pits 7, 8 and 9 will require the use of two temporary diversions and an impoundment. The detailed analysis for these structures and specific designs can be viewed on Drawings 5-65A, 5-71A and 5-73. The watershed and structure sizing analysis can be viewed in Appendix 5-12A. Once approval to proceed into Areas 2 and 3 are acquired, these temporary features will no longer be necessary and will be mined through.

732.400 Road Drainage

All roads will be constructed, maintained and reconstructed to comply with R645-301-742.400. Road drainage facilities include diversion ditches, culverts, containment berms, and/or water bars. Specific plans for road drainage, road construction, and road maintenance are presented in Chapter 5, Section 534 of this MRP.

A description of measures to be taken to obtain division approval for alteration or relocation of a natural drainage way will be presented to the Division when necessary.

A description of measures to be taken to protect the inlet end of a ditch relief culvert will be submitted to the Division when necessary.

All road drainage diversions will be maintained and repaired to operational condition following the occurrence of a large storm event. Culvert inlets and outlets will be kept clear of sediment and other debris.

733 IMPOUNDMENTS

733.100 General Plans

A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans for the Coal Hollow Mine have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1. The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2. The plans for the North Private Lease have been certified and a detailed geotechnical analysis has been provided in Appendix 5-11. The certifications, drawings and cross sections can be viewed in Drawings 5-67 through 5-71 and Appendices 5-12.

As requested by the Division, the design criteria of the mine site sediment ponds have been reevaluated in light of groundwater that is being encountered at the site (see Appendix 7-11). It was the determination of this reevaluation that the sediment ponds currently in place meet or exceed the minimum requirements of the Utah Coal Mining Rules and that the construction of additional ponds or the redesigning of existing ponds is not required at this time. Accordingly, the small ephemeral channel tributary to Lower Robinson Creek near the toe of the spoils pile mentioned in the Division Deficiency List (Task No. 3799) has been evaluated as a potential sediment pond site, but the construction of a sediment pond in that location is not required at the current time.

As indicated in Section 728.332, where appreciable alluvial groundwater inflows into the mine pit areas occur and where deemed necessary and possible, alluvial groundwater inflows into the mine pit areas will be diverted away from the mine pit areas through pipes, ditches, or other conveyance methods, minimizing the need for the pumping of mine discharge waters to the sediment ponds. Groundwater that interacts with the Tropic Shale and the Smirl coal seam in the mine pits is considered as mine water and accordingly it will be either routed to Pond #3 or Pond #4 in the Coal Hollow Permit and Pond #7 in the North Private Lease and subsequently discharged under the approved Coal Hollow Mine UPDES discharge permit, or it will be contained and managed within the pit areas and not discharged.

Depending on prevailing climatic conditions and on the nature and quantity of encountered mine waters, at times it may periodically be necessary to discharge water from the Coal Hollow Mine sediment ponds. The discharges from the ponds at the Coal Hollow Mine will occur in compliance with the approved Coal Hollow Mine UPDES permit (see Appendix 7-12).

Five impoundments are proposed to control storm water runoff and sediment from disturbed areas of the Coal Hollow Mine. Each impoundment is designed to contain the run off from a 100 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-26. The following table summarizes the final capacity results for each impoundment:

Coal Hollow Mine Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.2	123	0.6
2	1.7	2.3	135	0.6
3	6.3	12.6	200	6.3
4	2.1	5.5	261	3.4
1B	0.5	0.8	160	0.3

Structure 1 is a rectangular impoundment approximately 127 feet long by 82 feet wide and 9 feet in depth. This impoundment will control storm water run off from the facilities area. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 3 feet freeboard. This pond will control storm water from a watershed of approximately 27 acres. The cleanout and spillway elevation are 6911' and 6920', respectively. The top of the embankment is at elevation 6924'. Details for the design can be viewed on Drawing 5-28.

Structure 1B is a small rectangular impoundment that is approximately 40 feet long by 20 feet wide. This impoundment will control storm water run off from the facilities access road system. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 5 acres. The cleanout and spillway elevation are 6894’ and 6906’, respectively. The top of the embankment is at elevation 6908’. Details for the design can be viewed on Drawing 5-28B.

Structure 2 is a rectangular impoundment approximately 188 feet long by 36 feet wide and 9 feet in depth. This impoundment will control storm water runoff from the disturbed areas immediately south of Lower Robinson Creek. The impoundment will be constructed with a 24” drop pipe spillway. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum 3 feet freeboard. This pond will control storm water runoff from a watershed of approximately 74 acres. The cleanout and spillway elevation are 6891’ and 6900’, respectively. Top of the embankment is at elevation 6903’. Details for the design can be viewed on Drawing 5-29.

Structure 3 is a valley fill impoundment that will impound an area approximately 472 feet long by 229 feet wide and 9 feet deep. The fill for the impoundment will be constructed from an excavation 378 feet wide by 229 feet long and 8 feet deep. The embankment will be constructed in 2 foot lifts utilizing a dozer. The top of the embankment will be a minimum 12 feet wide. This pond will have a decant pipe install at the 6808’ elevation that allows for the pond level to be managed and to still be able to contain the 10 year 24 hour event. Also, this pond has a secondary open channel spillway that will have rip-rap min. 6” underlain with erosion control fabric. This pond will control storm water runoff from a watershed of approximately 388 acres post mining, it will also be capable of receiving ground water from the underground in the event it cannot be managed at the underground operation (not considered likely). The cleanout and spillway elevation are 6801’ and 6811’, respectively. Top of the embankment is at 6813’. Details for the design can be viewed on Drawing 5-30.

Structure 4 is a rectangular pond located at the south end of the permit area that is approximately 90 feet wide by 582 feet long and 12 feet deep. This impoundment will be incised into the existing ground. Part of the excavation will be used to construct a 12 foot wide embankment. The spillway will be an open channel that will have rip-rap min. 6”. This pond will control storm water runoff from a watershed of approximately 96 acres. The cleanout and spillway elevation are 6822’ and 6834’, respectively. Top of the embankment is at elevation 6838’. Details for the design can be viewed on Drawing 5-31.

Open channel spillway details for impoundments 3 and 4 are provided in Drawing 5-32. These spillways are designed for emergencies and are not expected to be used during normal operations.

Six impoundments (one temporary for Area 1 expanded) are proposed to control storm water runoff and sediment from disturbed areas of the North Private Lease. Each impoundment is designed to contain the run off from a 10 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-65. The following table summarizes the final capacity results for each impoundment:

North Private Lease Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
5	1.28	1.55	122	0.28
6	1.43	3.15	220	1.71
7	7.11	19.26	271	12.15
8	1.66	7.49	450	5.81
9	2.73	3.42	125	0.68
T1~~A~~	0.81	1.50	185	0.69

Structure 5 is a trapezoid impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18" primary spillway with an oil skimmer and an open channel secondary spillway that will have 6" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 18.8 acres. The cleanout and spillway elevation are 6840' and 6848' respectively. The top of the embankment is at elevation 6850'. Details for the design can be viewed on Drawing 5-67.

Structure 6 is a trapezoid impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18" primary spillway with an oil skimmer and an open channel secondary spillway that will have 6" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 24.0 acres. The cleanout and spillway elevation are 6858' and 6866' respectively. The top of the embankment is at elevation 6868'. Details for the design can be viewed on Drawing 5-68.

Structure 7 is a square impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with a 24" primary spillway with an oil skimmer and an open channel secondary spillway that will have 9" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 133.9

acres. The cleanout and spillway elevation are 6840’ and 6848’ respectively. The top of the embankment is at elevation 6850’. Details for the design can be viewed on Drawing 5-69.

Structure 8 is a triangle impoundment 10 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18” primary spillway with an oil skimmer and an open channel secondary spillway that will have 6” D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 28.4 acres. The cleanout and spillway elevation are 6884’ and 6894’ respectively. The top of the embankment is at elevation 6896’. Details for the design can be viewed on Drawing 5-70.

Structure 9 is a triangle impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18” primary spillway with an oil skimmer and an open channel secondary spillway that will have 6” D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 23.6 acres. The cleanout and spillway elevation are 6856’ and 6864’ respectively. The top of the embankment is at elevation 6866’. Details for the design can be viewed on Drawing 5-71.

Structure T1~~A~~ is a trapezoid impoundment 8 feet in depth. This temporary impoundment will control storm water runoff from Area 1 expanded for pits 7, 8, and 9. The impoundment is intended to be total containment, and therefore, will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 14.4 acres. The top of the embankment is at elevation 6874’. Details for the design can be viewed on Drawing 5-71A.

The outer slopes of the impoundments will be sloped to a maximum grade of 3h:1v. Inside slopes will be graded to a maximum 2h:1v. The slopes will be graded and revegetated for erosion control.

No underground mine workings exist near or under the impoundment structures; therefore subsidence surveys are not provided.

Geologic data for the area where impoundments will be located consists of mainly fine grained alluvium with high clay content. Seepage from the impoundments is expected to be minimal based on the high clay content of the existing materials. Characterization of the soils is contained in Chapter 2. Acid and Toxic analysis of the soils indicates that water seeping through the alluvium layer will not result in reducing water quality. The acid and toxic analysis for the alluvium can be viewed in Appendix 6-2.

Hydrologic data for the permit area is provided in Appendix 7-1. This data indicates that there will be some seepage through the subsurface that may travel to adjacent drainages. The quantities for this seepage are expected to be minimal and will have minimal impact to the overall hydrologic balance. Even though seepage may occur, analysis of the soils indicates that water quality will not be diminished.

The above information provides a summary of all the impoundment structures that are for the Coal Hollow Project and North Private Lease. Detailed designs and calculations are provided in this section, Drawings 5-26 through 5-32 and Appendix 5-2. No other impoundments are anticipated.

At some times it may be necessary to discharge water from the sediment ponds at the Coal Hollow Mine. The approved Coal Hollow UPDES permit (Appendix 7-12) allows for discharges.

733.200 Permanent and Temporary Impoundments

All impoundments have been designed and constructed using current, prudent engineering practices and have been designed to comply with the requirements of R645-301-512.240, R645-301-514.300, R645-301-515.200, R645-301-533.100 through R645-301-533.600, R645-301-733.220 through R645-301-733.226, R645-301-743.240, and R645-301-743.

No impoundments or sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) exist or are planned within the Mine Permit Area. Should impoundments and sedimentation ponds meeting the size or other qualifying criteria of MSHA, 30 CFR 77.216(a) become necessary, compliance with the requirements of MSHA, 30 CFR 77.216 will be met.

All eleven planned impoundments have been evaluated by a professional engineer to ensure stability of each structure. The stability analysis performed resulted in a static safety factor of at least 2.2 for each structure. The details for this analysis can be viewed in Appendix 5-1 for the Coal Hollow Mine and Appendix 5-12 & 5-12A for the North Private Lease.

No permanent impoundments are planned in the project area.

If any examination or inspection discloses that a potential hazard exists, the person who examined the impoundment will promptly inform the Division according R645-301-515.200.

734 Discharge Structures

Discharge structures will be constructed and maintained to comply with R645-301-744.

The proposed impoundments are designed to temporarily store water from storm events and snow melt. Long term standing water in the impoundments is anticipated to be seasonal and sediment will be removed as necessary to provide the required storage capacities. Emergency spillways have been included in the designs to provide a non-destructive discharge route should the capacities ever be exceeded. Surveys of these impoundments will be regularly conducted to ensure that the required design capacities are available.

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 6 hour duration, 100 year storm event even though they are not expected to be used. They will have rip-rap min 6" to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways. Also, impoundment 3 will have a decant installed at the 6808 elevation that will allow for the pond level to be managed and to still be able to contain the 100 year 24 hour event.

Impoundments 1, 1B, 2, 5, 6, 7, 8 and 9 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24" diameter pipes that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these three impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

Impoundment T1~~A~~ will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6.

Disposal of Excess Spoil

Areas designated for the disposal of excess spoil and excess spoil structures will be constructed and maintained to comply with R645-301-745.

Details of proposed excess spoil disposal plans are presented in Chapter 5, Section 535 of this MRP and are summarized below.

A geotechnical analysis has been completed for the proposed excess spoil structure. This analysis estimates the long-term safety factor to be 1.6 to 1.7 based on the proposed design. Following proper construction practices of building the structure in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structure will be stable under all conditions of construction. This construction will occur only in the designated excess spoil area as shown on Drawing 5-3 and 5-35. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. The geotechnical analysis for this structure can be viewed in Appendix 5-1.

The excess spoil is planned to be placed in an area where natural grades range from 0 to 5%. This is one of the most moderately sloping locations in the Permit Area. Stability of this structure is estimated to be 1.6 to 1.7 based on the Appendix 5-1.

Geotechnical borings were completed in the foundation of the proposed disposal area. Laboratory analysis of these borings has also been completed. Details of this analysis can be viewed in Appendix 5-1.

Permanent slopes for the proposed excess spoil will not exceed 3h:1v (33 percent), therefore no keyway cuts have been proposed in the design. Appendix 5-1 details the stability analysis for the proposed structure.

Excess spoil will not be disposed of in underground mine workings.

Horizontal lifts will not exceed four feet in thickness unless otherwise approved by the Division. The lifts will be concurrently compacted to meet 85% of the standard Procter. The geotechnical analysis (Appendix 5-1), provides information showing that these construction standards will provide mass stability and will prevent mass movement during and after construction. The excess spoil will be graded to provide drainage similar to original flow patterns. Topsoil and subsoil as designated in Chapter 2 will be removed and separated from other materials prior to placement of spoil.

A description of the character of the bedrock and any adverse geologic conditions in presented in Appendix 5-1.

Spring and seep survey information is provided on Drawing 7-1. There are no springs or seeps identified in the excess spoil area.

There are no historical underground mining operations in the proposed excess spoil area. There are future underground operations proposed.

There are no rock chimneys or drainage blankets proposed.

A stability analysis including strength parameters, pore pressures and long-term seepage conditions is presented together with all supporting data in Appendix 5-1.

Neither rock-toe buttresses nor key-way cuts are required under R645-301-535.112 or R645-301-535.113.

No valley fills or head-of-hollow fills are proposed.

No durable rock fills are proposed.

No disposal of waste on preexisting benches is planned

The excess spoil structure and fill above approximate original contour are the only alternative specifications proposed. A geotechnical analysis has been completed for this proposal and can be viewed in Appendix 5-1. All other mined areas will be restored to approximate original contour.

735 Coal Mine Waste

Areas designated for disposal of coal mine waste and coal mine waste structures will be constructed and maintained to comply with R645-301-746.

No structures for the disposal of coal mine waste are planned.

736 Noncoal Mine Waste

Noncoal mine waste will be stored and final disposal of noncoal mine waste will comply with R645-301-747

Noncoal mine waste, including but not limited to grease, lubricants, paints, flammable liquids, garbage, machinery, lumber and other combustible materials generated during coal mining and reclamation operations will be temporarily stored in a controlled manner.   Final disposal of noncoal mine wastes will consist of removal from the project area and transportation to a State-approved solid waste disposal area.

Only sizing of the coal is proposed. This process will not produce any waste.

At no time will any noncoal mine waste be deposited in a refuse pile or impounding structure, nor will any excavation for a noncoal mine waste disposal site be located within eight feet of any coal outcrop or coal storage area.

Notwithstanding any other provision to the R645 Rules, any noncoal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580, as amended) and 40 CFR Part 261 will be handled in accordance with the requirements of Subtitle C of RCRA and any implementing regulations.

Debris, acid-forming, toxic-forming materials and materials constituting a fire hazard will be identified and disposed of in accordance with R645-301-528.330, R645-301-537.200, R645-301-542.740, R645-301-553.100 through R645-301-553.600, R645-301-553.900, and R645-301-747. Appropriate measures will be implemented to preclude sustained combustion of such materials.

Plans do not include using dams, embankments or other impoundments for disposal of coal, overburden, excess spoil or coal mine waste.

738 Temporary Casing and Sealing of Wells

Wells constructed for monitoring groundwater conditions in the Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office.

Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

740 **DESIGN CRITERIA AND PLANS**

741 **GENERAL REQUIREMENTS**

742 **SEDIMENT CONTROL MEASURES**

742.100 General Requirements

742.110 Design

Appropriate sediment control measures will be designed, constructed and maintained using best technology currently available to prevent to the extent possible, contributions of sediment to stream flow or to runoff outside the permit area; meet the effluent limitations under R645-301-751; and minimize erosion to the extent possible.

Six diversion ditches along with five sediment impoundments are proposed for the Coal Hollow permit area. In addition, miscellaneous controls such as silt fence and berms are also proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-3. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2. These impoundments in combination with the ditches will be the primary method that will be used to control sediment resulting from disturbed areas. In addition to the drawings and Appendix 5-2 , the following is a description of the structures:

A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1. The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31 and Appendices 5-1 and 5-2.

Five impoundments are proposed to control storm water runoff and sediment from disturbed areas. Each impoundment is designed to contain the run off from a 100 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-26. The following table summarizes the final capacity results for each impoundment:

Coal Hollow Mine Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.2	123	0.6
2	1.7	2.3	135	0.6
3	6.3	12.6	200	6.3
4	2.1	5.5	261	3.4
1B	0.5	0.8	160	0.3

Structure 1 is a rectangular impoundment approximately 127 feet long by 82 feet wide and 9 feet in depth. This impoundment will control storm water run off from the facilities area. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 4 feet freeboard. This pond will control storm water from a watershed of approximately 27 acres. The cleanout and spillway elevation are 6911' and 6920', respectively. The top of the embankment is at elevation 6924'. Details for the design can be viewed on Drawing 5-28.

Structure 1B is a small rectangular impoundment that is approximately 40 feet long by 20 feet wide. This impoundment will control storm water run off from the facilities access road system. The impoundment will be constructed with a 24" drop pipe spillway in order to prevent any oil sheens that may occur from discharging. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 5 acres. The cleanout and spillway elevation are 6894' and 6906', respectively. The top of the embankment is at elevation 6908'. Details for the design can be viewed on Drawing 5-28B.

Structure 2 is a rectangular impoundment approximately 188 feet long by 36 feet wide and 9 feet in depth. This impoundment will control storm water runoff from the disturbed areas immediately south of Lower Robinson Creek. The impoundment will be constructed with a 24" drop pipe spillway. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum 3 feet freeboard. This pond will control storm water runoff from a watershed of approximately 74 acres. The cleanout and spillway elevation are 6891' and 6900', respectively. Top of the embankment is at elevation 6903'. Details for the design can be viewed on Drawing 5-29.

Structure 3 is a valley fill impoundment that will impound an area approximately 472 feet long by 229 feet wide and 9 feet deep. The fill for the impoundment will be constructed from an excavation 198 feet wide by 229 feet long and 8 feet deep. The embankment will be constructed in 2 foot lifts utilizing a dozer. The top of the embankment will be a minimum 12 feet wide. This pond will have a decant pipe install at the 6808' elevation that allows for the pond level to be managed and to still be able to contain the 10 year 24 hour event. Also, this pond has a secondary open channel spillway that will have rip-rap min. 6 underlain with erosion control fabric. This pond will control storm water runoff from a watershed of approximately 388 acres post mining, it will also be capable of receiving ground water from the underground in the event it cannot be managed at the underground operation (not considered likely). The cleanout and spillway elevation are 6801’ and 6810’, respectively. Top of the embankment is at 6814’. Details for the design can be viewed on Drawing 5-30.

Structure 4 is a rectangular pond located at the south end of the permit area that is approximately 90 feet wide by 582 feet long and 12 feet deep. This impoundment will be incised into the existing ground. Part of the excavation will be used to construct a 12 foot wide embankment. The spillway will be an open channel that will have rip-rap min. 6. This pond will control storm water runoff from a watershed of approximately 96 acres. The cleanout and spillway elevation are 6822’ and 6834’, respectively. Top of the embankment is at elevation 6838’. Details for the design can be viewed on Drawing 5-31.

Open channel spillway details for impoundments 3 and 4 are provided in Drawing 5-32. These spillways are designed for emergencies and are not expected to be used during normal operations.

Six impoundments (one temporary for Area 1 expanded) are proposed to control storm water runoff and sediment from disturbed areas of the North Private Lease.   Prior to removal of topsoil and construction of these impoundments, silt fences will be installed at the down gradient disturbance boundary for each impoundment. Once construction has been completed these silt fences can be replaced with excelsior logs for long term sediment control. Each impoundment is designed to contain at minimum the run off from a 10 year, 24 hour duration storm event. The locations of the impoundments and the associated watersheds can be viewed on Drawing 5-65 and 5-65A. Additionally, as depicted on drawings 5-47, 5-48, 5-48A and 5-65, a silt fence or berm will be constructed along the eastern boarder of Area 1.

The following table summarizes the final capacity results for each impoundment:

North Private Lease Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
5	1.28	1.55	122	0.28
6	1.43	3.15	220	1.71
7	7.11	19.26	271	12.15
8	1.66	7.49	450	5.81
9	2.73	3.42	125	0.68
T1~~A~~	0.81	1.85	139	0.69

Structure 5 is a trapezoid impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18" primary spillway with an oil skimmer and an open channel secondary spillway that will have 6" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 18.8 acres. The cleanout and spillway elevation are 6840' and 6848' respectively. The top of the embankment is at elevation 6850'. Details for the design can be viewed on Drawing 5-67.

Structure 6 is a trapezoid impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18" primary spillway with an oil skimmer and an open channel secondary spillway that will have 6" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 24.0 acres. The cleanout and spillway elevation are 6858' and 6866' respectively. The top of the embankment is at elevation 6868'. Details for the design can be viewed on Drawing 5-68.

Structure 7 is a square impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with a 24" primary spillway with an oil skimmer and an open channel secondary spillway that will have 9" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 133.9 acres. The cleanout and spillway elevation are 6840' and 6848' respectively. The top of the embankment is at elevation 6850'. Details for the design can be viewed on Drawing 5-69.

Structure 8 is a triangle impoundment 10 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18" primary spillway with an oil skimmer and an open channel secondary spillway that will have 6" D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 28.4 acres. The cleanout and spillway elevation are 6884' and 6894' respectively. The top of the embankment is at elevation 6896'. Details for the design can be viewed on Drawing 5-70.

Structure 9 is a triangle impoundment 8 feet in depth. This impoundment will control storm water runoff from the western side of the permit area were mining will begin. The impoundment will be constructed with an 18” primary spillway with an oil skimmer and an open channel secondary spillway that will have 6” D50 rip-rap. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 23.6 acres. The cleanout and spillway elevation are 6856’ and 6864’ respectively. The top of the embankment is at elevation 6866’. Details for the design can be viewed on Drawing 5-71.

Structure T1~~A~~ is a trapezoid impoundment 8 feet in depth. This temporary impoundment will control storm water runoff from Area 1 expanded for pits 7, 8, and 9. The impoundment will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. This impoundment will be incised into the existing ground. Part of the excavated material will be utilized to construct an embankment on the down grade side to provide a minimum of 2 feet freeboard. This pond will control storm water from a watershed of approximately 14.4 acres. The top of the embankment is at elevation 6874’. Details for the design can be viewed on Drawing 5-71A.

The outer slopes of the impoundments will be sloped to a maximum grade of 3h:1v. Inside slopes will be graded to a maximum 2h:1v. The slopes will be graded and revegetated for erosion control.

No underground mine workings exist near or under the impoundment structures; therefore, subsidence surveys are not provided.

Geologic data for the area where impoundments will be located consists of mainly fine grained alluvium with high clay content. Seepage from the impoundments is expected to be minimal based on the high clay content of the existing materials. Characterization of the soils is contained in Chapter 2. Acid and Toxic analysis of the soils indicates that water seeping through the alluvium layer will not result in reducing water quality. The acid and toxic analysis for the alluvium can be viewed in Appendix 6-2.

Hydrologic data for the permit area is provided in Appendix 7-1. This data indicates that there will be some seepage through the subsurface that may travel to adjacent drainages. The quantities for this seepage are expected to be minimal and will have minimal impact to the overall hydrologic balance. Even though seepage may occur, analysis of the soils indicates that water quality will not be diminished.

Sedimentation ponds have been designed in compliance with the requirements of R645-301-356.300, R645-301-356.400, R645-301-513.200, R645-301-742.200 through R645-301-742.240, and R645-301-763.

No sedimentation ponds or earthen structures that will remain open are planned.

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

The diversions ditches for the Coal Hollow Mine will be utilized to direct runoff from disturbed areas to the sediment impoundments. The channel sizing for the four diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on flows during a 100 year, 24 hour storm event:

Coal Hollow Mine Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3
3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3
B-1T-U	0.0	0.020	1.0	11.42	1.1	4.7	0.5
B-1T-L	0.0	0.020	4.8	**32.45	1.2	10.9	0.5

*All side slopes are 2h:1v
**Total flow from both watersheds

The diversions ditches for the North Private Lease will be utilized to direct runoff from disturbed areas to the sediment impoundments. The channel sizing for the fifteen diversion ditches, with two temporary diversion ditches that will be mined through in Area 1 once Area 2 is approved, has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 10 year, 6 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. The ditch locations, designs and cross sections can be viewed on Drawings 5-65, 5-65A, 5-72 and 5-73. Of special note, the evacuated material for UD-14 will be placed on the disturbed area side of the ditch to form a berm which will provide a distinct boundary between disturbed and undisturbed.

The following table summarizes the inputs and results for each diversion based on flows during a 10 year, 6 hour storm event:

North Private Lease Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
DD-5	0.0	0.025	5.21	0.60	0.29	3.50	0.71
DD-6	0.0	0.025	6.22	0.20	0.19	2.85	0.81
DD-7	0.0	0.025	4.84	0.28	0.22	2.82	0.78
DD-8	0.0	0.025	5.16	0.28	0.22	2.89	0.78
DD-9	0.0	0.025	8.42	0.80	0.30	4.51	0.70
DD-10	0.0	0.025	2.67	0.80	0.37	2.93	0.63
DD-11	0.0	0.025	6.07	0.51	0.27	3.56	0.83
DD-12	0.0	0.025	7.00	1.15	0.35	4.61	0.65
DD-13	0.0	0.025	2.04	3.32	0.66	3.78	0.84
UD-14	0.0	0.025	1.28	1.09	0.48	2.40	0.32
UD-15	0.0	0.025	7.35	0.10	0.14	2.55	0.86
DD-16	0.0	0.025	2.15	4.54	0.74	4.17	0.76
DD-17	0.0	0.025	2.12	1.28	0.46	3.02	0.34
UD-18	0.0	0.025	12.06	0.20	0.17	3.65	0.83
UD-19	0.0	0.025	1.99	0.59	0.35	2.43	0.65
DD-T1-01	0.0	0.025	4.00	0.17	0.19	2.32	0.69
DD-T1-02	0.0	0.025	2.86	0.35	0.27	2.45	0.77

*All side slopes are 2h:1v

The sedimentation plan has been designed to comply with the MSHA requirements given under R645-301-513.100 and R645-301-513.200.

These structures will retain sediment within the disturbed area. The diversion ditches are designed in manner that will minimize erosion of the channels and will divert runoff from disturbed areas to the impoundments. These sediment control measures are designed to meet the effluent limitations under R645-301-751.

742.126

Water encountered underground will be stored and treated as needed in underground sumps. It is anticipated most or all of such water would be utilized in the underground mining operation. Excess water would only be discharged after meeting applicable UPDES standards.

742.200 Siltation Structures

Siltation structures have been designed in compliance with the requirements of R645-301-742.

Miscellaneous controls such as silt fence and berms are proposed for specific areas. The proposed locations for these structures are shown on Drawing 5-26. Details associated with these structures can be viewed on Drawings 5-25 through 5-34 and Appendix 5-2 for the Coal Hollow Mine. The proposed locations for these structures are shown on Drawing 5-47. Details associated with these structures can be viewed in Appendix 5-13 for the North Private Lease.

742.210 General Requirements

Additional contributions of suspended solids and sediment to streamflow or runoff outside the permit area will be prevented to the extent possible using the best technology currently available. Siltation structures for an area will be constructed before beginning any coal mining and reclamation operations in that area and, upon construction, will be certified by a qualified registered professional engineer to be constructed as designed and as approved in the reclamation plan. Any siltation structures which impounds water will be designed, constructed and maintained in accordance with R645-301-512.240, R645-301-514.300, R645-301-515.200, R645-301-533.100 through R645-301-533.600, R645-301-733.220 through R645-301-733.224, and R645-301-743.

The primary controls for limiting suspended solids and sediment to stream flow and runoff outside the permit area is sediment impoundments and diversions ditches. The proposed system described in section 742.110 is designed to control storm water/runoff discharges from the disturbed areas. Discharges from this system are expected to be minimal and infrequent. Discharges that may occur will comply with R645-301-751.

The impoundment and ditch system will be inspected regularly and discharges will be sampled for water quality purposes.

742.212

Siltation structures including ponds and ditches will be the first features built when beginning a new area.

742.214

Water encountered underground will be stored and treated as needed in underground sumps. It is anticipated most or all of such water would be utilized in the underground mining operation. Excess water would only be discharged after meeting applicable UPDES standards.

742.220 Sedimentation Ponds.

742.221.1 The proposed sediment ponds are designed to be used individually

742.221.2 The locations for the sediment ponds were selected to be as near as possible to the disturbed areas and are not located in perennial streams

742.221.3 The ponds are designed and will be constructed and maintained to:

742.221.31 The ponds for the Coal Hollow Mine have been designed with excess capacity by at least 15% to allow for adequate sediment storage volume. The following table provides the design capacities in relation to a 24 hour duration, 100 year storm event:

Coal Hollow Mine Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
1	2.6	3.2	123	0.6
2	1.7	2.3	135	0.6
3	6.3	12.6	200	6.3
4	2.1	5.5	261	3.4
1B	0.5	0.8	160	0.3

The ponds for the North Private Lease have been designed with excess capacity to allow for 3 years of sediment storage volume. The following table provides the design capacities in relation to a 24 hour duration, 10 year storm event:

North Private Lease Sedimentation Impoundment Capacities				
Structure	Storage Required (ac/ft)	Design Storage* (ac/ft)	Percent of requirement	Additional Storage (ac/ft)
5	1.28	1.55	122	0.28
6	1.43	3.15	220	1.71
7	7.11	19.26	271	12.15
8	1.66	7.49	450	5.81
9	2.73	3.42	125	0.68
T1~~A~~	0.81	1.50	185	0.69

These sedimentation ponds will be surveyed at least annually to ensure that sufficient sediment storage is available in the impoundment. Sediment will be removed from the ponds as required based on results from the surveys. Calculations related to these design capacities can be viewed in Appendix 5-2 for the Coal Hollow Mine and in Appendix 5-12 &5-12A for the North Private Lease. Stage-Storage curves for each pond can be viewed on Drawings 5-28 through 5-31 and 5-67 through 5-71A.

742.221.32 The sedimentation ponds in the Coal Hollow Mine are designed to provide detention for a 100 year, 24 hour duration storm event. Calculations for this design can be viewed in Appendix 5-2. The sedimentation ponds in the North Private Lease are designed to provide detention for a 10 year, 24 hour duration storm event. Calculations for this design can be viewed in Appendix 5-12 & 5-

12A. This design standard is expected to keep discharges from the structure at a minimum and allow adequate settlement time to meet Utah and federal effluent limitations. In the event it becomes necessary to decant water to satisfy the required storage volumes, ACD will use a 4” gasoline driven pump to decant excess water. Temporary Pond T1~~A~~ has additional specifications for the pumping system; the pipeline will be 4” black polyethylene pipe approximately 1760’ in length, pump will be capable of moving a minimum of 0.5 cfs of water at a total head of 75’ and pipe will discharge onto existing rip-rap in Sediment Pond 6 as found in Appendix 5-12A. Water will be required to remain in the pond for a minimum of 24 hours prior to the beginning of decant operations and be discharged through the discharge point approved under UPEDES permit No. UTG25992 following all applicable monitoring protocol under this permit.

742.221.33 The sedimentation ponds at the Coal Hollow Mine are designed for a 100 year, 24 hour storm event which significantly exceeds a 10 year, 24 hour precipitation event. The 100 year, 24 hour event in the Alton area is 3.1 inches of precipitation. The sedimentation ponds at the North Private Lease are designed for a 10 year, 24 hour storm event. The 10 year, 24 hour precipitation event in this same location is approximately 2.0 inches of precipitation. The design standard used for the Coal Hollow project is 155% of the precipitation for the required “design event”.

742.221.34 Each pond will be constructed with an emergency spillway, should the capacities of the ponds ever be exceeded with the exception of temporary pond T1A which will be equipped with a pumping system (Appendix 5-12A). These spillways will provide a nondestructive route for storm water discharge, though the capacities of the ponds are not expected to be exceeded. The design capacities of the ponds are expected to contain each storm event and therefore will provide sufficient detention time to meet Utah and federal effluent limitations. The following is a description of each spillway:

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 24 hour duration, 100 year storm event even though they are not expected to be used during normal operations. They will have rip-rap min. 6” to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways.

Impoundments 1, 1B, and 2 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24” diameter pipes that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these two impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

Impoundments 5, 6, 7, 8 and 9 will be constructed with a drop pipe primary spillway and an open channel emergency spillways system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. The drop-pipe spillways are 18” diameter pipes for impoundments 5, 6, 8 and 9 and a 24” diameter pipe for impoundment 7 that are vertical in the impoundment. These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. The open channel emergency spillways are designed to discharge a 6 hour duration, 25 year storm event even though they are not expected to be used during normal operations. Impoundments 5, 6, 8 and 9 will have 6” rip-rap (D-50) and impoundment 7 will have 9” rip-rap (D-50) with erosion control fabric beneath to minimize erosion and spillway slopes will not exceed 3h:1v

Impoundment T1~~A~~ will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. Details can be found in Appendix 5-12A.

742.221.35 Regular inspections of the sediment pond system during construction and operations will identify any deficiencies that could cause short circuiting. Design standards for the system will ensure proper functioning during extreme storm events which makes it highly unlikely that issues related to short circuiting could occur during normal operations.

742.221.36 Surveys of the pond system will be conducted at least annually. These surveys will be compared against the required “design event” capacity for each pond. Sediment removal will occur as needed to maintain the required capacity.

742.221.37 Geologic conditions in the areas where sediment ponds will be constructed are suitable to the proposed use. Excessive settling of the ponds is not expected based on the high clay content of the soils. Embankments will be constructed in maximum two foot lifts to promote compaction during the construction process, reducing settling during operations. Supporting data for compaction can be viewed in Appendix 5-1.

742.221.38 Any sod, large roots, and/or frozen soil will be removed from sedimentation ponds. No coal processing will be conducted as part of the Coal Hollow Project; therefore wastes from this type of process will not be present.

742.221.39 Embankments will be constructed in maximum two foot lifts to promote compaction during the construction process, reducing settling during operations. Supporting data for this compaction method can be viewed in Appendix 5-1.

742.222 Sedimentation ponds for the Coal Hollow Mine or the North Private Lease do not meet the size or other qualifying standard for MSHA, 30 CFR 77.216(a).

742.223 Each sedimentation pond at the Coal Hollow Mine will be constructed with a spillway that will function as both the emergency and principle spillway. Each of these spillways will safely discharge a 25 year, 6 hour precipitation event. The following table summarizes the spillway discharge designs in relation to the 25 year, 6 hour precipitation event:

Sediment Impoundment – Spillway Flow Capacities		
Impoundment	Required Spillway Discharge (cfs)	Designed Spillway Discharge (cfs)
1	30.4	37.4
2	0.8	30.5
3	2.8	11.5
4	2.4	11.5
1B	6.06	23.9

The drop pipe spillways for impoundments 1, 1B, and 2 will be of nonerodible construction. The open channel spillways for impoundments 3 and 4 will be rip-rap min. 6” and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected.

742.224 Each sedimentation pond at the North Private Lease will be constructed with a principle spillway and an emergency spillway with the exception of T1~~A~~ which will have an pumping system (Appendix 5-12A). Each of these spillways will safely discharge a 25 year, 6 hour precipitation event. The following table summarizes the spillway discharge designs in relation to the 25 year, 6 hour precipitation event:

Sediment Impoundment – Primary Spillway Flow Capacities		
Impoundment	Required Spillway Discharge (cfs)	Designed Spillway Discharge (cfs)
5	2.23	9.66
6	2.85	9.66
7	10.11	20.80
8	3.42	9.66
9	3.60	9.66

The drop pipe spillways for all impoundments will be of nonerodible construction. The open channel spillways for impoundments 5, 6, 8 and 9 will be rip-rap (D50) 6" underlain with erosion fabric and are designed to carry sustained flows. The open channel spillways for impoundment 7 will be rip-rap (D50) 9" underlain with erosion fabric and is designed to carry sustained flows. Impoundment T1~~A~~ will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. Details can be found in Appendix 5-12A.

742.225 Either the requirements of 742.223.1 or 742.223.2 will be met for each sediment impoundment.

742.226 No exceptions to the sediment pond location guidance are requested

742.230 Other Treatment Facilities

If other treatment facilities become necessary, they will be designed to treat the 10-year, 24-hour precipitation event unless a lesser design event is approved by the Division based on terrain, climate, other site-specific conditions and a demonstration by the operator that the effluent limitations of R645-301-751 will be met.

No other treatment facilities are planned for the Coal Hollow Project.

742.240 Exemptions

Not Applicable

742.300 Diversions

742.310 General Requirements

742.311 There are no flows from mined areas that have been abandoned prior to May 3, 1978 at the Coal Hollow Project. Diversions at the Coal Hollow Project are planned to minimize water from disturbed areas from directly discharging into drainages without first being treated and to also prevent water from upland, adjacent areas from entering the project area. Four temporary diversion ditches are planned and one temporary diversion of Lower Robinson Creek. Two diversions will be primarily used to route water from upland, undisturbed areas away from the planned disturbed areas. Diversion ditch 2 has been split to minimize the amount of water from upland routed to Pond 2 (see drawing 5-34), 2B will route water from upland to Lower Robinson Creek and 2A will route water from disturbed area to Pond 2. Diversion ditch 4 is planned to direct water from disturbed areas into sediment impoundment Pond 4. The temporary diversion of Lower Robinson Creek is for maximum recovery of coal and will route flows around the mining area. Each temporary diversion has been designed to only carry runoff from areas that will or potentially could be affected by the mining operations, except Lower Robinson Creek diversion which will carry intermittent flows from the upstream watershed. Diversion locations were selected to generally carry runoff to the drainage paths that the precipitation would originally follow. These parameters were followed in the designs to minimize impacts to the overall hydrological balance within the permit and adjacent areas. Diversions will not be used to route water into underground mines. Specific design parameters are discussed in the following sections (R645-301-742.312.1 to 742.314). There are no flows from mined areas that have been abandoned prior to May 3, 1978 at the North Private Lease. Diversions at the North Private Lease are planned to minimize water from disturbed areas from directly discharging into drainages without first being treated and to also prevent water from upland, adjacent areas from entering the project area. Fifteen temporary diversion ditches are planned. Four diversions will be primarily used to route water from upland, undisturbed areas away from the planned disturbed areas. Each temporary diversion has been designed to only carry runoff from areas that will or potentially could be affected by the mining operations. Diversion locations were selected to generally carry runoff to the drainage paths that the precipitation would originally follow. These parameters were followed in the designs to minimize impacts to the overall hydrological balance within the permit and adjacent areas. Diversions will not be used to route water into underground mines. Specific design parameters are discussed in the following sections (R645-301-742.312.1 to 742.314).

742.312

The construction of and the operational activities at the proposed alluvial groundwater interceptor trench systems will be performed according to good engineering practices and in compliance with all applicable State and Federal rules. To ensure the safety of construction personnel during construction of the drain systems, work will be performed primarily by the equipment operators from within the operator compartments of the employed equipment. Equipment operators will be adequately trained on the hazards associated with the excavation work at the drain sites. Construction personnel will not be allowed to enter excavated trench areas during the drain construction operations other than as allowed by applicable State and Federal laws and regulations. Where necessary, work outside of equipment operator compartments will be performed in a prudent and safe manner. The excavated drain areas will be promptly backfilled after the drain construction materials have been emplaced.

A physical barrier will be constructed and maintained at alluvial groundwater interceptor drain discharge structures to prevent mine personnel from falling into the discharge structure.

742.312 Each diversion in the Coal Hollow Mine was designed to ensure stability and to minimize erosion. In order to accomplish this standard, the diversions were each designed for peak flows during a 100 year, 24 hour storm event. The following summarizes the steps used:

The channel sizing for the six proposed temporary diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on flows during a 100 year, 24 hour storm event:

Diversion Ditch Summary

Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3

3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3
B-1T-U	0.0	0.020	1.0	11.42	1.1	4.7	0.5
B-1T-L	0.0	0.020	4.8	**32.45	1.2	10.9	0.5

*All side slopes are 2h:1v
**Total flow from both watersheds.

The diversions ditches for the North Private Lease will be utilized to direct runoff from disturbed areas to the sediment impoundments. The channel sizing for the fifteen diversion ditches, with two temporary diversion ditches that will be mined through in Area 1 once Area 2 is approved, has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 10 year, 6 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. The ditch locations, designs and cross sections can be viewed on Drawings 5-65, 5-72 and 5-73. . Of special note, the evacuated material for UD-14 will be placed on the disturbed area side of the ditch to form a berm which will provide a distinct boundary between disturbed and undisturbed.

The following table summarizes the inputs and results for each diversion based on flows during a 10 year, 6 hour storm event:

North Private Lease Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
DD-5	0.0	0.025	5.21	0.60	0.29	3.50	0.71
DD-6	0.0	0.025	6.22	0.20	0.19	2.85	0.81
DD-7	0.0	0.025	4.84	0.28	0.22	2.82	0.78
DD-8	0.0	0.025	5.16	0.28	0.22	2.89	0.78
DD-9	0.0	0.025	8.42	0.80	0.30	4.51	0.70
DD-10	0.0	0.025	2.67	0.80	0.37	2.93	0.63
DD-11	0.0	0.025	6.07	0.51	0.27	3.56	0.83
DD-12	0.0	0.025	7.00	1.15	0.35	4.61	0.65
DD-13	0.0	0.025	2.04	3.32	0.66	3.78	0.84
UD-14	0.0	0.025	1.28	1.09	0.48	2.40	0.32
UD-15	0.0	0.025	7.35	0.10	0.14	2.55	0.86
DD-16	0.0	0.025	2.15	4.54	0.74	4.17	0.76
DD-17	0.0	0.025	2.12	1.28	0.46	3.02	0.34
UD-18	0.0	0.025	12.06	0.20	0.17	3.65	0.83
UD-19	0.0	0.025	1.99	0.59	.035	2.43	0.65
DD-T1-01	0.0	0.025	4.00	0.17	0.19	2.32	0.69

DD-T1-02	0.0	0.025	2.86	0.35	0.27	2.45	0.77

*All side slopes are 2h:1v

As shown in the above tables, flow depths will be shallow, flow velocity will be manageable for temporary flow conditions and sufficient freeboard will be present during a flood event. These conditions will provide diversion stability, protection against flooding and prevent to the extent possible additional contributions of suspended solids to streamflow outside the permit area. These diversions are designed to comply with all applicable local, Utah and federal laws and regulations. Further details related to the temporary diversion designs can be viewed in Appendix 5-2, Appendix 5-12 and Appendix 5-12A.

Based on the size of the watershed for Lower Robinson Creek, a different method of analysis was used than the method used for the other diversions. The HEC-1 program was used for this analysis and extra erosion protection has been included as part of the design. The channel was designed to safely handle the flows from a 100 year, 6 hour storm event. This diversion will be further discussed in section 742.320 Diversion of Perennial and Intermittent Streams.

742.313 The six temporary diversions at the Coal Hollow Mine will be reclaimed when they are no longer necessary. This will occur once final reclamation is determined to be sufficient within the project area and the sediment impoundments are no longer needed. This is anticipated to occur in the fourth year of operations.

The Lower Robinson Creek temporary diversion will be constructed in a responsible manner. This diversion will experience some erosion during flood events but erosion rates are expected to be generally less than those in the original channel above and below the diversion. The detailed design for this diversion can be viewed in Drawings 5-20 and 21. Calculations related to this diversion design can be viewed in Appendix 5-3.

The fifteen temporary diversions at the North Private Lease will be reclaimed when they are no longer necessary. This will occur once final reclamation is determined to be sufficient within the project area and the sediment impoundments are no longer needed. This is anticipated to occur in the sixth year of operations. Two temporary diversion ditches associated with Area 1 will be mined through when Area 2 is approved and pond 7 is established.

742.320 Diversion of Perennial and Intermittent Streams.

742.321 Temporary diversion of one intermittent stream is planned for the Coal Hollow Project. The planned diversion is in a length of the stream that appreciable flows only occur during storm events and snow melt periods. This diversion is necessary to recover coal located in the northwest corner of the project area. The diversion would provide mining in an area that is 22 acres and contains approximately 400,000 tons of recoverable coal. Without this diversion, most of this area could not be mined.

742.322 The original unmodified channel immediately upstream and downstream from the Lower Robinson Creek diversion has excessive erosion and is not in stable condition. The channel has incised deeply and has developed into a channel that has a capacity significantly greater than any anticipated storm events. Since these conditions are not desirable for the area, the diversion design instead has dimensions that are suitable to pass a 100 year, 6 hour storm event in compliance with R645-301-742.323.

742.323 The temporary Lower Robinson Creek diversion has been designed to safely pass a 100 year, 6 hour storm event. The watershed for this drainage is 3.64 square miles and has a peak flow of 83.5 cubic feet per second during a 100 year, 6 hour event. Minimum dimensions for carrying this flow was found to be a channel that has the following dimensions:

Bottom width: 2 feet
Side slopes: 3h:1v
Minimum slope height: 3 feet (1 foot freeboard added)

Details related to the design calculations are provided in Appendix 5-3. Rip-rap will be appropriately placed to minimize erosion of the channel.

Cross sections of the channel design are shown in Drawing 5-21. As shown in the drawing, all sections of the diversions exceed the minimum design standard. A plan view of the diversion design can be viewed in Drawing 5-20.

Design drawings for post-mining drainage channels in the North Private Lease area are shown on Drawing 5-79. Typical channel sections are shown on Drawings 5-72 and 5-73. Channel calculations are shown in Appendix 5-12. As shown on Drawing 5-79, engineered channels include minimum 6-inch D50 Rip-Rap placed over erosion control fabric in steep stream reaches that would be susceptible to erosion.

742.324 Design of the Lower Robinson Creek Diversion has been certified by a qualified registered professional engineer.

742.330 Diversion of Miscellaneous Flows.

742.323

As part of the reclamation process, Lower Robinson Creek will be reconstructed to its approximate original location. The design for this reconstruction is shown on Drawings 5-20A and 5-21A. This design includes considerable improvements to the channel compared to the channel's current condition. The current condition is such that less than 25% of the channel within the disturbed area has a flood plain present and most of the slopes are near the angle of repose with fair to poor vegetative cover. The reconstructed sides of the channel for the entire length reconstructed. Sharp corners in the original alignment have been rounded to sinuous curve shapes and rip-rap will be installed in the bottom section of the channel to minimize erosion. The flood plain will be seeded and covered with erosion matting to control erosion until natural vegetative condition can be attained.

742.331 Diversion of miscellaneous flows at the Coal Hollow Mine is planned using six diversion ditches. Two diversions will be primarily used to route runoff from upland, undisturbed areas away from the planned disturbed areas. Diversion ditch 2 has been split to minimize the amount of water from upland routed to Pond 2 (see drawing 5-34), 2B will route water from upland to Lower Robinson Creek and 2A will route water from disturbed area to Pond 2. Diversion ditch 4, B-1T-U and B-1T-L are planned to direct water from disturbed areas into sediment impoundment Pond 3. The locations of these diversions along with the associated watersheds can be viewed on Drawings 5-27, 5-33 and 5-34. Calculations related to the diversions can be viewed in Appendix 5-2.

Diversion of miscellaneous flows at the North Private Lease is planned using fifteen diversion ditches. Four diversions will be primarily used to route runoff from upland, undisturbed areas away from the planned disturbed areas. The locations of these diversions along with the associated watersheds can be viewed on Drawings 5-63, and 5-64. Calculations related to the diversions can be viewed in Appendix 5-12.

742.332 Each diversion at the Coal Hollow Mine was designed for stability and to minimize erosion. In order to accomplish this standard, the diversions were each designed for peak flows during a 100 year, 24 hour storm event. The following summarizes the steps used:

The channel sizing for the six proposed temporary diversion ditches has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 100 year, 24 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. Similar to the impoundment sizing, the Carlson Software Hydrology module was utilized to perform these calculations. The ditch locations, designs and cross sections can be viewed on Drawings 5-33 and 5-34.

The following table summarizes the inputs and results for each diversion based on peak flows during a 100 year, 24 hour storm event:

Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
1	3.0	0.020	2.8	14.8	0.5	6.8	0.3
2	2.5	0.020	3.5	6.9	0.4	6.0	0.3
3	4.5	0.020	2.4	16.7	0.5	6.3	0.3
4	5.0	0.020	1.8	19.8	0.6	5.4	0.3
B-1T-U	0.0	0.020	1.0	11.42	1.1	4.7	0.5
B-1T-L	0.0	0.020	4.8	**32.45	1.2	10.9	0.5

*All side slopes are 2h:1v
** Total flow from both watersheds

The diversions ditches for the North Private Lease will be utilized to direct runoff from disturbed areas to the sediment impoundments. The channel sizing for the fifteen diversion ditches, with two temporary diversion ditches that will be mined through in Area 1 once Area 2 is approved, has been evaluated using the TR-55 method to determine peak flows and the Manning's Equation (ME) to determine appropriate dimensions. The TR-55 method of analysis is the same method used to size impoundments and was utilized in this case to provide a peak flow for each diversion during a 10 year, 6 hour storm event. This peak flow was then input into the ME to determine an appropriate open channel design for minimizing the effects of erosion during peak flows. The ditch locations, designs and cross sections can be viewed on Drawings 5-65, 5-72 and 5-73. . Of special note, the evacuated material for UD-14 will be placed on the disturbed area side of the ditch to form a berm which will provide a distinct boundary between disturbed and undisturbed.

The following table summarizes the inputs and results for each diversion based on flows during a 10 year, 6 hour storm event:

North Private Lease Diversion Ditch Summary							
Ditch	*Base (ft)	Manning's n	Average Slope (%)	Peak Flow (cfs)	Flow Depth (ft)	Velocity (fps)	Freeboard (ft)
DD-5	0.0	0.025	5.21	4.77	0.64	5.89	0.36
DD-6	0.0	0.025	6.22	2.34	0.47	5.27	0.53
DD-7	0.0	0.025	4.84	5.34	0.67	5.89	0.83

DD-8	0.0	0.025	5.16	5.33	0.66	6.03	0.84
DD-9	0.0	0.025	8.42	0.70	0.28	4.36	0.72
DD-10	0.0	0.025	0.43	0.70	0.49	1.43	0.51
DD-11	0.0	0.025	6.07	5.22	0.64	6.38	0.86
DD-12	0.0	0.025	0.50	8.36	1.22	2.81	0.78
DD-13	0.0	0.025	2.04	22.80	1.36	6.13	0.64
UD-14	0.0	0.025	1.28	0.55	0.37	2.03	0.63
UD-15	0.0	0.025	7.35	0.10	0.14	2.55	0.86
DD-16	0.0	0.025	2.15	11.89	1.06	5.31	0.94
DD-17	0.0	0.025	2.12	11.38	1.04	5.22	0.96
UD-18	0.0	0.025	12.06	0.20	0.17	3.65	0.83
UD-19	0.0	0.025	1.99	0.59	.035	2.43	0.65
DD-T1-01	0.0	0.025	4.00	0.17	0.19	2.32	0.69
DD-T1-02	0.0	0.025	2.86	0.35	0.27	2.45	0.77

*All side slopes are 2h:1v

As shown in the above tables, flow depths will be shallow, flow velocity will be manageable for temporary flow conditions and sufficient freeboard will be present during a flood event. These conditions will provide diversion stability, protection against flooding and prevent to the extent possible additional contributions of suspended solids to stream flow outside the permit area. These diversions are designed to comply with all applicable local, Utah and federal laws and regulations. Further details related to the temporary diversion designs can be viewed in Appendix 5-2 for the Coal Hollow Mine and Appendix 5-12 & 5-12A for the North Private Lease.

742.333 All six miscellaneous flow diversions planned for the Coal Hollow Mine are temporary and will be reclaimed when no longer necessary for sediment and storm water control. Therefore, the channels must safely pass the peak runoff from a 2 year, 6 hour event. As previously described, these diversions have been designed to pass a 100 year, 24 hour storm event which significantly exceeds this required design standard. Precipitation from a 100 year, 24 hour storm event for this area is 3.1 inches while precipitation for the 2 year, 6 hour event is less than 1 inch.

All fifteen miscellaneous flow diversions planned for the North Private Lease are temporary and will be reclaimed when no longer necessary for sediment and storm water control. Two temporary diversion ditches associated with Area 1 expanded will be mined through when Area 2 is approved and pond 7 is established. Therefore, the channels must safely pass the peak runoff from a 2 year, 6 hour event. As previously described, these diversions have been designed to pass a 10 year, 24 hour storm event which significantly exceeds this required design standard. Precipitation from a 10 year, 24 hour storm event for this area is 2.39 inches while precipitation for the 2 year, 6 hour event is less than 1 inch.

742.400 Road Drainage

742.410 All Roads

742.411 To ensure environmental protection and safety appropriate for the planned duration and use, limits have been incorporated in the road designs for the Coal Hollow Project and the North Private Lease. These limits are applied to drainage control and culvert placement/sizing. These limits take into consideration the type and size of equipment planned for the operation. The following is a description of roads along with the design limits and standards that will be incorporated into construction:

Three primary Mine Haul roads at the Coal Hollow Mine are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to pits (pits shown on Drawing 5-10). This road will be approximately 1,400 feet in length and will be utilized mainly during the first two years of mining. There will be three culverts installed along this road all sized for a 100 year, 6 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower Robinson Creek watershed. This analysis can be viewed in Appendix 5-3. The third culvert is a crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

The second road extends from the first road and proceeds southwest to join and run along a 1,200' section of the rebuilt County Road 136. This section of road will be single lane travel only for all production equipment. The road then continues to the southwest to provide access to Pit B-1. This road is approximately 4,750 feet in total length. There are two culvert crossings along the County Road 136 portion of this road that are placed to match the original county specifications. These culverts will be 18 inch culverts sized to match the County Road 136 culverts originally in place.

The following specifications apply to these two Primary Mine Haul roads:

1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing, except for the section of the Pit B-1 access extending from County Road 136 to the pit. This section of road will utilize approximately 6" of crushed rock or gravel for road surfacing. This shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during a short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.
5) Cut and fill slopes of 1.5h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The underground mine portal access and haul road in Pit 10 will also be a primary road. This road is accessed from the main haul road from the coal unloading area. The underground access/haul road will be constructed to the same specifications for the haul roads above, except that the road may be narrowed to a 40 foot width.

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width.

The location and details for all these roads can be viewed on Drawings 5-3 and 5-22 through 5-24.

In addition to the two primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road system will have six culverts and selectively located berms to appropriately route water to the two sediment impoundments for the facilities area. The location of these culverts and berms is shown on Drawing 5-3. This road is referred to as "Facilities Roadway" and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

All roads will be maintained on an as needed basis using motor graders, water trucks for dust suppression, and other equipment as necessary. Crushed stone and/or gravel will be used as a surface course for primary roads outside the active mining area, and may be used as needed for ramps and travelways within the pit. Should the roads be damaged by a catastrophic event, such as an earthquake or a flood, repairs will be made as soon as possible after the damage has occurred or the road will be closed and reclaimed.

Cut and fill slopes along the primary roads will be minimal and are not expected to cause significant erosion. The water from roads in the project area will not directly discharge to drainages outside the project area without first being treated by flowing through a sediment impoundment. In locations where there are culvert crossings (i.e. Lower Robinson Creek), the fills slopes will be stabilized by utilizing standard methods such as grass matting or straw wattles.

Transportation facilities for the North Private Lease will consist of two primary road, and miscellaneous ancillary/temporary roads. Drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: A primary haul road will extend from the entrance to the permit area to the North end of Pit 6. This road is approximately 1755 feet in length. This road is referred as the "North Pits Haul Road". The second primary haul road "Kanab Creek Crossing" extends from an intersection with the North Pits Haul Road and cross to the East side of Kanab Creek. This road is approximately 700 feet in length. There is one culvert crossing along this road to cross Kanab Creek. This culvert will be a 172 inch culvert sized for maximum anticipated flows in Kanab Creek.

The following specifications apply to these Primary mine haul roads:
1) Roads will be approximately 80' in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18" of crushed rock or gravel for road surfacing
5) Cut and fill slopes of 1.5 h:1v
6) Berms placed as necessary along fills

The ancillary roads will have similar specifications except surfacing will occur only as needed and may be narrowed to a 40 foot road width. A typical cross section for the ancillary roads can be viewed on Drawing 5-24.

The location and details for the Primary Mine Haul road can be viewed on Drawings 5-58, through 5-64.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travel ways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

742.412 No roads will be located in the channel of an intermittent or perennial stream.

742.413 Primary roads constructed utilized during mining operations have been designed and located to route runoff from the roads to the sediment impoundment system. By routing the runoff to this system, sedimentation and flooding downstream resulting from the roads will be minimized. All other roads located within the active mining area will also follow this standard and runoff from the roads will not be directly discharged to drainages outside the permit area.

742.420 Primary Roads

742.421 To minimize erosion, primary roads will be constructed with a rock surface with minimal cut and fill slopes. These roads are located in the most practicable, stable areas within the permit boundary and mostly outside of the designed pits. These locations can be reviewed on Drawing 5-22 through 5-22G. Further descriptions of these roads can be viewed in Section 742.423.1 and 742.111.

742.422 There are no stream fords by primary roads at the Coal Hollow Project.

742.423 Drainage Control

- 742.423.1 Three primary Mine Haul roads are planned within the permit area. The first road extends from the coal unloading area to the first series of pits along the west side of the property. This road will be utilized for access to pits (pits shown on Drawing 5-10). This road will be approximately 1,400 feet in length and will be utilized throughout mining. There will be three culverts installed along this road all sized for a 100 year, 24 hour storm event. The first culvert will be across a tributary of Lower Robinson Creek and will be a 36 inch corrugated steel pipe. The second culvert is the main crossing over Lower Robinson Creek and is a 96 inch corrugated steel pipe. Both of these culverts have been sized based on analysis of the Lower Robinson Creek watershed. This analysis can be viewed in Appendix A5-3. The third culvert is crossing over a diversion ditch that will route water mainly from disturbed areas along the south side of Lower Robinson Creek to a sediment impoundment. This culvert will be a 24 inch corrugated steel pipe.

The second road extends from the first road and proceeds southwest to join and run along a 1,200’ section of the rebuilt County Road 136. This section of road will be single lane travel only for all production equipment. The road then continues to the southwest to provide access to Pit B-1. This road is approximately 4,750 feet in total. There are two culvert crossings along the County Road 136 portion of this road that are placed to match the original county. These culverts will be 18 inch culverts sized to match the County Road 136 culverts originally in.

The following specifications apply to these Primary mine haul roads:

1) Roads will be approximately 80’ in width
2) Approximately a 2% crown
3) Approximately one foot deep cut ditches along shoulders for controlling storm water
4) 18” of crushed rock or gravel for road surfacing, except for the Pit B-1 access extending from County Road 136 to the pit. This section of the road will utilize approximately 6” of crushed rock or gravel for road surfacing. This shallower depth of gravel will still provide the necessary benefits of dust control and sediment control for surface water runoff during the short usage life. For this section of road will be utilized for coal haulage for only around 2-3 months and the western half of it will be eventually mined out as part of the borrow area.
5) Cut and fill slopes of 1.5 h:1v
6) Minimum fill over each culvert will be 2 times diameter of culvert
7) Berms placed as necessary along fills

The location and details for Primary Mine Haul roads can be viewed on Drawings 5-3 and 5-22 and 5-23.

In addition to the two roads primary Mine Haul roads, the road located within the facilities area is also classified as a primary road. This road is planned to be 24 feet wide with 24 inches of compacted sub base and 8 inches of compacted 1 inch minus gravel as surfacing. This road system will have four culverts and selectively located berms appropriately placed to route water to the two sediment impoundments for the facilities area. The location of these culverts and berms is shown on Drawing 5-3. This road is referred to as “Facilities Roadway” and more details are described in 527.200 along with Drawings 5-22A and 5-22B.

In addition to the primary roads that will be present during active mining, four additional roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- Road to Water Well with details shown on Drawing 5-22D
- Road to east C. Burton Pugh property with details shown on Drawing 5-22C
- County Road 136 (K3900) with details on Drawing 5-22E, 5-22F and 5-22G. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-38 and is expected to be completed by the end of Year 4.
- Road to Swapp Ranch (same specification as the Water Well Road)

The location of these roads is shown on Drawings 5-37 along with the post mining topography. With the exception of the County Road, each road will be graded to complement the surrounding topography and drainages. Details for these roads are provided in the above referenced drawings.

County Road 136 will have a cut ditch on the up gradient side of the road as appropriate. The culvert located at the crossing of Lower Robinson Creek will remain. One culvert will be added at Station 21+66 as shown on Drawing 5-22E and two at Station 13+50 & 22+51 as shown on Drawing 5-22. For further details related to reestablishment of County Road 136, refer Drawings 5-22 through 5-22G and 5-35.

Transportation facilities for the North Private Lease will consist of two primary road, and miscellaneous ancillary/temporary roads. Drawings detail the designs and specifications for each one of the proposed facilities. The following is a description of each facility and a reference for the associated drawings:

- Roads: A primary haul road will extend from the entrance to the permit area to the North end of Pit 6. This road is approximately 1755 feet in length. This road is referred as the "North Pits Haul Road". The second primary haul road "Kanab Creek Crossing" extends from an intersection with the North Pits Haul Road and cross to the East side of Kanab Creek. This road is approximately 700 feet in length. There is one culvert crossing along this road to cross Kanab Creek. This culvert will be a 172 inch culvert sized for maximum anticipated flows in Kanab Creek.

  The following specifications apply to this Primary mine haul roads:

  1) Roads will be approximately 80' in width
  2) Approximately a 2% crown
  3) Approximately one foot deep cut ditches along shoulders for controlling storm water
  4) 18" of crushed rock or gravel for road surfacing
  5) Cut and fill slopes of 1.5 h: 1v
  6) Berms placed as necessary along fills

  The location and details for the Primary Mine Haul road can be viewed on Drawings 5-56 thru 5-58.

The ramps, benches and equipment travel paths within the active surface mining area are temporary in nature and will be relocated frequently as mining progresses. These temporary travelways are considered part of the pit due to their short term use, and are not individually designed nor engineered. They will be built and maintained to facilitate safe and efficient mine and reclamation operations.

In addition to the primary roads that will be present during active mining, two roads are planned to exist postmining and are also classified as primary roads for this reason.

Roads that will remain postmining are the following:

- County Road 136 (K3900) with details on Drawing 5-61. This County road will be reconstructed within the permit area by Kane County. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-76 and is expected to be completed by the end of Year 6.
- McDonalds Road (same specification as the County Road 136) with details on Drawing 5-62. This reconstruction will occur concurrently with the final stage of reclamation as scheduled on Drawing 5-76 and is expected to be completed by the end of Year 6.

The location of these roads is shown on Drawings 5-74 along with the post mining topography. With the exception of the County Road, each road will be graded to complement the surrounding topography and drainages. Details for these roads are provided in the above referenced drawings.

742.423.2 Drainage pipes and culverts will be constructed on a minimum 2% grade to avoid plugging. Minimum fill over culverts will be 2 times the diameter of the culvert itself to avoid collapsing. Grades going in and out of each culvert will be similar to the grade of the culvert itself to avoid erosion at the inlet and outlet.

742.423.3 Drainage ditches have been designed to pass a 100 year 24 hour storm event which will prevent uncontrolled drainage over the road surface and embankment. The watersheds associated with drainage in the project area are each relatively small (less than 400 acres) and are not expected to sustain flows that would carry significant debris through the project area. Therefore, trash racks and debris basins are not expected to be necessary at the Coal Hollow Project.

742.423.4 One natural intermittent stream channel is planned to be diverted. This channel is referred to as Lower Robinson Creek and this diversion will be temporary. A section of this stream runs across an area that is planned for mining.

The Lower Robinson Creek diversion has been designed to safely pass a 100 year, 6 hour storm event. The watershed for this drainage is

3.64 square miles and has a peak flow of 83.5 cubic feet per second during a 100 year, 6 hour event. Minimum dimensions for carrying this flow were found to be a channel that has the following dimensions:

Bottom width: 2 feet
Side slopes: 3h:1v
Minimum slope height: 3 feet (1 foot freeboard added)

Details related for the design calculations are provided in Appendix 5-3. Rip-rap will be appropriately placed to minimize erosion of the channel.

Cross sections of the channel design are shown in Drawing 5-21. As shown in the drawing, all sections of the diversions exceed the minimum design standard. A plan view of the diversion design can be viewed in Drawing 5-20. This diversion design is in accordance with R645-301-731.100 through R645-301-731.522, R645-301.600, R645-301-731.800, R645-301-742.300, and R645-301-751.

Design of the Lower Robinson Creek Diversion has been certified by a qualified registered professional engineer.

742.423.5 All stream crossings are planned to be culverts designed to pass the 100 year, 6 hour storm event. There are no plans to use fords as stream crossings. Calculations for culvert sizing can be found in Appendix 5-3 for the Coal Hollow Mine and in Appendix 5-12 for the North Private Lease.

743 **IMPOUNDMENTS**

743.100 General Requirements

Five temporary impoundments are planned at the Coal Hollow Project and six temporary impoundments for the North Private Lease. Design for these structures are shown in Drawings 5-28 through 5-32 and 5-67 thru 5-71A. These impoundments do not meet the criteria for Class B or C dams as specified in the U.S. Department of Agriculture, Natural Resources Conservation Service Technical Release 60.

743.110 None of the impoundments meet the criteria of MSHA, 30 CFR 77.216(a).

743.120 A professional engineer experienced in the design and construction of impoundments with assistance from a geotechnical expert has used current, prudent, engineering practices to design the proposed impoundments.

The plans have been certified and a detailed geotechnical analysis has been provided in Appendix 5-1 for the Coal Hollow Mine and Appendix 5-11 for the North Private Lease.

The certifications, drawings and cross sections can be viewed in Drawings 5-25 through 5-31for the Coal Hollow Mine and Drawings 5-67 through 5-71A and Appendices 5-1, 5-2, 5-11, 5-12 and 5-12A for each area.

Each impoundment is designed with a minimum freeboard of 2 feet. Based on the size of the impoundments and the relatively small size of the associated watersheds, this amount of freeboard will be sufficient to prevent overtopping from waves and/or storm events. These impoundments do not meet the criteria for Class B or C dams.

743.130

Each impoundment with the exception of T1~~A~~, will be constructed with a spillway that will function as both the emergency and principle spillway. Each of these spillways will safely discharge a 25 year, 6 hour precipitation event. The following table summarizes the spillway discharge designs in relation to the 25 year, 6 hour precipitation event:

Sediment Impoundment – Spillway Flow Capacities		
Impoundment	Required Spillway Discharge (cfs)	Designed Spillway Discharge (cfs)
1	30.4	37.4
2	0.8	30.5
3	2.8	11.5
4	2.4	11.5
1B	6.06	23.9
5	2.23	9.66
6	2.85	9.66
7	10.11	20.80
8	3.42	9.66
9	3.60	9.66

The drop pipe spillways for impoundments 1, 1B, 2, 5, 6 and 7 will be of nonerodable construction. The open channel spillways for impoundments 3 and 4 will be 6" minimum Rip Rap lined and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected. Impoundment T1A will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. Details can be found in Appendix 5-12A.

The impoundments at the Coal Hollow project do not meet the criteria for either Class B or C dams or MSHA CFR 77.216 (a).

743.140

A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments. Inspections will be made regularly during construction, upon completion of construction, and at least yearly until removal of the structure or release of the performance bond. The qualified registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. A copy of the report will be retained at or near the mine site.

The MRP does not contemplate construction of any impoundments meeting the NRCS Class B or C criteria for dams in TR-60, or the size or other criteria of 30 CFR Sec. 77.216.

743.200

No permanent impoundments are planned.

743.300

Design capacities for spillways exceed the 25 year, 6 hour event. The design capacities are provided in the table located in section R645-301-743.130.

744 DISCHARGE STRUCTURES

744.100

Each pond, with the exception of T1~~A~~, will be constructed with an emergency spillway, should the capacities of the ponds ever be exceeded. These spillways will provide a nondestructive route for storm water discharge, though the capacities of the ponds are not expected to be exceeded. The design capacities of the ponds are expected to contain each storm event and therefore will provide sufficient detention time to meet Utah and federal effluent limitations. The following is a description of each spillway:

Impoundments 3 and 4 will be constructed with open channel spillways. These spillways are designed to discharge a 24 hour duration, 100 year storm event even though they are not expected to be used during normal operations. They will have rip-rap min. 6" to minimize erosion and spillway slopes will not exceed 3h:1v. Drawing 5-32 provides the details for the open channel spillways.

Impoundments 1, 1B, 2, 5, 6, 7, 8 and 9 will be constructed with a drop pipe spillway system. Storm water and snow melt that occurs within the associated watersheds will be routed to these impoundments to contain sediment. These impoundments will have the drop-pipe spillways installed which will allow removal of any oil sheens that may result from parking lots, primary roads or maintenance activities by using absorbent materials to remove the sheen. The drop-pipe spillways are 24" diameter pipes for impoundments 1,1B, 2 & 7 and 18" for impoundments 5, 6, 8 and 9 that are vertical in the impoundment.

These pipes have a metal cover over the end. This cover is recessed over the pipe by at least an inch, with a gap between the cover and the pipe. This leaves a route for water to discharge once the impoundment is full but prevents debris or pollutants located on the water surface from discharging. This system was chosen for these two impoundments based on their locations in relation to the facilities and primary roads. This discharge system will be constructed for precautionary measures only since pollutants are not expected in the impoundments during normal operations.

The drop pipe spillways for impoundments 1, 1B, 2, 5, 6, 7, 8 and 9 will be of nonerodible construction. The open channel spillways for impoundments 3 and 4 will be rip-rap min. 6" and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected. The open channel spillways for impoundments 5, 6, 8 and 9 will be rip-rap (D50) 6", impoundment 7 will be rip-rap (D50) 9" and are designed to carry short-term, infrequent flows at non erosive velocities where sustained flows are not expected. These designs will minimize erosion and disturbance to the hydrologic balance.

Details related to these designs can be viewed in Drawings 5-28 through 5-32 for the Coal Hollow and Drawings 5-67 through 5-71 for the North Private Lease.

Impoundment T1~~A~~ will not be equipped with a spillway. Instead, the impoundment will be drained as necessary via an engineered pump and pipeline system, and discharged into existing structure 6. Details can be found in Appendix 5-12A.

744.200

Standard engineering design procedures have been used in the design of the discharge structures along with standard mining industry best management practices that are commonly used at surface mining operations.

745 Disposal of Excess Spoil

745.100 General Requirements

Excess spoil will be placed in designated disposal areas within the permit area, in a controlled manner to minimize the adverse effects of leachate and surface water runoff from the fill on surface and ground waters; ensure permanent impoundments are not located on the completed fill. Small depressions may be created if approved by the Division if they are needed to retain moisture or minimize erosion, create and enhance wildlife habitat or assist revegetation, and if they are not incompatible with the stability of the fill; and adequately cover or treat excess spoil that is acid- and toxic-forming with nonacid nontoxic material to control the impact on surface and ground water is accordance with R645-301-731.300 and to minimize adverse effects on plant growth and the approved postmining land use.

If the disposal area contains springs, natural or manmade water courses or wet weather seeps, the fill design will include diversions and underdrains as necessary to control erosion, prevent water infiltration into the fill and ensure stability.

Details of proposed excess spoil disposal plans are presented in Chapter 5, Section 535 of this MRP and are summarized below.

A geotechnical analysis has been completed for the proposed excess spoil structure. This analysis estimates the long-term safety factor to be 1.6 to 1.7 based on the proposed design. Following proper construction practices of building the structure in maximum four foot lifts and meeting 85% compaction based on the standard Procter will ensure that the structure will be stable under all conditions of construction. This construction will occur only in the designated excess spoil area as shown on Drawing 5-3 and 5-35. The fill will be placed with end dump haul trucks and lifts will be constructed using dozers. High precision GPS systems will be regularly utilized to check grades and appropriate lift thickness. The geotechnical analysis for this structure can be viewed in Appendix 5-1.

The excess spoil is planned to be placed in an area where natural grades range from 0 to 5%. This is one of the most moderately sloping locations in the Permit Area. Stability of this structure is estimated to be 1.6 to 1.7 based on the Appendix 5-1.

Geotechnical borings were completed in the foundation of the proposed disposal area. Laboratory analysis of these borings has also been completed. Details of this analysis can be viewed in Appendix 5-1 for the Coal Hollow Mine and in Appendix 5-11 for the North Private Lease.

Permanent slopes for the proposed excess spoil will not exceed 3h:1v (33 percent), therefore no keyway cuts have been proposed in the design. Appendix 5-1 details the stability analysis for the proposed structure.

Excess spoil will not be disposed of in underground mine workings.

Horizontal lifts will not exceed four feet in thickness unless otherwise approved by the Division. The lifts will be concurrently compacted to meet 85% of the standard Procter. The geotechnical analysis (Appendix 5-1), provides information showing that these construction standards will provide mass stability and will prevent mass movement during and after construction. The excess spoil will be graded to provide drainage similar to original flow patterns. Topsoil and subsoil as designated in Chapter 2 will be removed and separated from other materials prior to placement of spoil.

A description of the character of the bedrock and any adverse geologic conditions in presented in Appendix 5-1.

Spring and seep survey information is provided on Drawing 7-1. There are no springs or seeps identified in the excess spoil area.

There are no historical underground mining operations in the proposed excess spoil area. There are also no future underground operations proposed.

There are no rock chimneys or drainage blankets proposed.

A stability analysis including strength parameters, pore pressures and long-term seepage conditions is presented together with all supporting data in Appendix 5-1.

Neither rock-toe buttresses nor key-way cuts are required under R645-301-535.112 or R645-301-535.113.

No valley fills or head-of-hollow fills are proposed.

No durable rock fills are proposed.

No disposal of waste on preexisting benches is planned

The excess spoil structure and fill above approximate original contour are the only alternative specifications proposed. A geotechnical analysis has been completed for this proposal and can be viewed in Appendix 5-1. All other mined areas will be restored to approximate original contour.

745.200 Valley Fills and Head-of-Hollow Fills

Valley fills and head-of-hollow fills are not anticipated in the Coal Hollow Mine permit area.

745.300. Durable Rock Fills.

Durable rock fills are not anticipated in the Coal Hollow Mine permit area.

745.400. Preexisting Benches.

The disposal of excess spoil through placement on preexisting benches is not anticipated in the Coal Hollow Mine permit area.

746. COAL MINE WASTE

746.100. General Requirements.

No coal mine waste is anticipated.

746.200. Refuse Piles.

No refuse piles associated with coal mine waste are anticipated.

746.300. Impounding structures.

No impounding structures associated with coal mine waste are anticipated.

746.330. Drainage control.

No coal mine waste and associated drainage control is anticipated.

746.400. Return of Coal Processing Waste to Abandoned Underground Workings.

No coal mine processing waste is anticipated to be placed in underground workings.

747. **DISPOSAL OF NONCOAL WASTE**

747.100

Noncoal mine waste, including but not limited to grease, lubricants, paints, flammable liquids, garbage, machinery, lumber and other non combustible materials generated during coal mining and reclamation operations will be temporarily placed in covered dumpsters. This waste will be regularly removed from the project area and disposed of at a state approved solid waste disposal site outside the project area.

747.200

Noncoal mine waste will be stored in a metal, covered dumpster which will prevent storm precipitation or runoff from coming in contact with the waste.

747.300

No noncoal mine waste will be disposed of within the permit area with the exception perforated piping used in the construction of Alluvial Ground Water Drains . This will be left in place as mining advances. This perforated piping will be covered in place approximately 20’ to 30’ below the final reclaimed surface. All other waste materials (ie. metal culvert) associated with the Alluvial Ground Water Drains will be removed and disposed of in a State-approved solid waste disposal site. Also, concrete pads for the generator and fan utilized in the underground operation will remain and will be covered with approximately 120’ of overburden.

748. Casing and Sealing of Wells.

Wells constructed for monitoring groundwater conditions in the Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

750 **PERFORMANCE STANDARDS**

All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. Mining operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

751. Water Quality Standards and Effluent Limitations.

Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

Discharges from the Coal Hollow project are expected to be minimal based on the storm water and runoff controls that are described in R645-301-740. These structures are designed to contain large storm events without discharging runoff. Any runoff that does discharge will be treated through the sediment pond system.

Discharges from the proposed alluvial groundwater interceptor drain systems will be made in compliance with all applicable Utah and federal water quality laws and regulations. The proposed drain systems have been designed to intercept and discharge natural, un-contaminated up-gradient alluvial groundwater. The water from the alluvial groundwater intercept drain system will be collected in a gravel-packed underground drainage collection system and conveyed through pipes to a steel/concrete discharge structure from which the water will be discharged via pumping through a discharge hose to the discharge location. By managing the water in this matter, the potential for contamination of the water will be minimized. Prior to the initial discharge of water from newly constructed alluvial groundwater interceptor trench systems to receiving waters, the system will be adequately developed/pumped to remove residual fine-grained sediments that might be present in the system prior to discharge to receiving waters. Only suitable, uncontaminated groundwater will be discharged to the outfall location. The water quality and discharge rates from the alluvial groundwater intercept system will be monitored as per the requirements of the UPDES permit.

752. <u>Sediment Control Measures</u>

Sediment control measures will be located, maintained, constructed and reclaimed according to the plans and designs given under sections R645-301-732, R645-301-742 and R645-301-760. Plans and designs are described in these sections.

752.100
Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Plans and designs are described in these sections.

752.200. <u>Road Drainage</u>

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742.400 and R645-301-762 and to achieve the following:

Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices;

Control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area;

Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under R645-301-751;

Minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems; and

Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

All plans and designs to meet these standards are described in the above referenced sections and on Drawings 5-22 through 5-24.

753. Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed to comply with R645-301-733, R645-301-734, R645-301-743, R645-301-745 and R645-301-760. Plans and designs are described in these sections.

754. Disposal of Excess Spoil, Coal Mine Waste and Noncoal MineWaste.

Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with R645-301-735, R645-301-736, R645-301-745, R645-301-746, R645-301-747 and R645-301-760. Plans and designs are described in these sections.

755. Casing and Sealing of Wells

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738.

Wells constructed for monitoring groundwater conditions in the Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.
Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

760. RECLAMATION

761. GENERAL REQUIREMENTS

Before abandoning a permit area or seeking bond release, the mine will ensure that all temporary structures are removed and reclaimed, and that all permanent sedimentation ponds, diversions, impoundments and treatment facilities meet the requirements of R645-301 and R645-302 for permanent structures, have been maintained properly and meet the requirements of the approved reclamation plan for permanent structures and impoundments. The mine will renovate such structures if necessary to meet the requirements of R645-301 and R645-302 and to conform to the approved reclamation plan.

762. ROADS

A road not to be retained for use under an approved postmining land use will be reclaimed immediately after it is no longer needed for coal mining and reclamation operations, including restoring the natural drainage patterns, and reshaping all cut and fill slopes to be compatible with the postmining land use and to complement the drainage pattern of the surrounding terrain.

The post mining land configuration is shown on 5-37 for the Coal Hollow Mine and 5-74 along with postmining road locations. Cuts and fills for the reclaimed roads will be minimal which allows for minor construction to grade roads to the approximate landform that existed prior to disturbance.

763. SILTATION STRUCTURES

763.100.

Siltation structures will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. In no case will the structure be removed sooner than two years after the last augmented seeding.

All impoundments will be reclaimed at the end of operations. The estimated timeline for removal of these structures are shown on Drawing 5-38 for the Coal Hollow Mine and 5-76 for the North Private Lease. Expected removal is year seven for the Coal Hollow and year six at the North Private Lease, of the mining and reclamation process. In areas where soils are not stabilized following the removal of these sediment impoundments, silt fence will be appropriately installed and maintained to provide sediment control until stable conditions are met.

763.200.

When the siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan and R645-301-358, R645-301-356, and R645-301-357.

No permanent sedimentation impoundments are planned.

764. STRUCTURE REMOVAL

The application will include the timetable and plans to remove each structure, if appropriate.

All impoundments will be reclaimed at the end of operations. The estimated timeline for removal of these structures are shown on Drawing 5-38 for the Coal Hollow and Drawing 5-76 for the North Private Lease. In areas where soils are not stabilized following the removal of these sediment impoundments, silt fence will be appropriately installed and maintained to provide sediment control until stable conditions are met.

The facilities will be fully reclaimed at the end of mining operations with the exception of the water well shown on Drawing 5- 8B. The final contour for this area can be viewed on Drawing 5-37 for the Coal Hollow and Drawing 5-74 for the North Private Lease.

765. PERMANENT CASING AND SEALING OF WELLS

Wells constructed for monitoring groundwater conditions in the Coal Hollow Mine permit and adjacent area, including exploration holes and boreholes used for water wells or monitoring wells, will be designed to prevent contamination of groundwater and surface-water resources and to protect the hydrologic balance. A diagram depicting typical monitoring well construction methods is shown in Drawing 7-11. Monitoring wells will include a protective hydraulic seal immediately above the screened interval, an annular seal plugging the borehole above the hydraulic seal to near the ground surface, and a concrete surface seal extending from the top of the hydraulic seal to the ground surface which is sloped away from the well casing to prevent the entrance of surface flows into the borehole area. Well casings will protrude above the ground surface a sufficient height so as to minimize the potential for the entrance of surface water or other material into the well. A steel surface protector with a locking cover will be installed at monitoring wells to prevent access by unauthorized personnel. Where there is potential for damage to monitoring wells, the wells will be protected through the use of barricades, fences, or other protective devices. These protective devices will be periodically inspected and maintained in good operating conditions. Monitoring wells will be locked in a closed position between uses.

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well under R645-301-731.100 through R645-301-731.522 and R645-301-731.800, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division in accordance with R645-301-529.400, R645-301-631.100, and R645-301-748. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

Water wells less than thirty feet deep are not regulated by the Utah Division of Water Rights. The permanent closure and abandonment of water wells less than 30 feet deep will be accomplished by filling the well casing with neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other appropriate materials. The well casing will then be cut off below the ground surface and native materials placed over the abandoned well site.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

Permanent closure and abandonment of water wells greater than 30 feet in depth will be in accordance with the requirements of "Administrative Rules for Water Well Drillers", State of Utah, Division of Water Rights or other applicable state regulations. Abandonment of wells will be performed by a licensed water well driller. The wells to be abandoned will be completely filled using neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout, or other materials approved by the Utah State Engineer's office. Alternatively, the well may be abandoned using a different procedure upon approval from the Utah State Engineer's office.

Abandonment materials will be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. The casing will be severed a minimum of 2 feet below the ground surface. A minimum of 2 feet of compacted native material will be placed above the abandoned well upon completion.

Within 30 days of the completion of well abandonment procedures, a report will be submitted to the State Engineer by the responsible licensed driller giving data related to the abandonment of the well. This shall include the name of the licensed driller or other person(s) performing abandonment procedures, name of well owner at the time of abandonment, the address or location of the well by section, township, and range, abandonment materials and equipment used, water right or file number covering the well, the final disposition of the well, and the date of completion.

Exploration holes and boreholes will be backfilled, plugged, cased, capped, sealed, or otherwise managed to prevent acid or toxic contamination of water resources and to minimize disturbance to the prevailing hydrologic balance. Exploration holes and boreholes will be managed to ensure the safety of people, livestock, fish and wildlife, and machinery.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

If any exploration boreholes are to be used as monitoring wells or water wells, these will meet the provisions of R645-301-731

Boreholes will be backfilled to within 1 foot of the land surface with concrete or other materials approved by the Division as necessary to prevent contamination of groundwater or surface-water resources or to protect the prevailing hydrologic balance. The upper approximately 1 foot will be backfilled with native materials to facilitate reclamation (see Drawing 6-11). Exploration holes and boreholes that may be uncovered during mining and reclamation activities will be permanently closed unless approved for water monitoring or otherwise managed in a manner approved by the Division.

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Table 7-4 Hydrologic monitoring protocols.

Discharge and water level measurements

Protocol	Applies to	Parameter	Frequency
A	Streams	Discharge	Quarterly
B	Springs	Discharge	Quarterly
C	Monitoring wells, Springs	Water elevation	Quarterly
D	Springs	Discharge	Weekly measurements beginning one month prior to highwall mining and continuing until one month after highwall mining in the area, followed by monthly measurements for a period of six months
E	Monitoring wells	Water elevation	Weekly measurements beginning one month prior to highwall mining and continuing until one month after highwall mining in the area, followed by monthly measurements for a period of six months
F	Mine pit inflows of alluvial groundwater	Discharge	Quarterly discharge measurements if the alluvial flow into the pit exceeds 1.0 cfs. If there is no safe access to the pit location, discharge will be measured at nearest safe access location. If no safe access is possible, flow will be estimated.

Water quality

Protocol	Applies to	Parameters	Table	Frequency
1	Streams	Operational field and laboratory water quality measurements	7-6A*	Quarterly
2	Streams	Field water quality measurements only	7-6A*	Quarterly
3	Springs	Operational field and laboratory water quality measurements	7-7A*	Quarterly
4	Springs	Field water quality measurements only	7-7A*	Quarterly
5	Monitoring wells	Operational field and laboratory water quality measurements	7-7A*	Quarterly
6	Monitoring wells	Field water quality measurements only	7-7A*	Quarterly
7	Monitoring wells	Laboratory acidity measurements for a period of two years	---	Quarterly
8	Streams	Laboratory total and dissolved selenium measurements	---	Quarterly
9	Mine pit inflows of alluvial groundwater	Operational field and laboratory water quality measurements if the alluvial flow into the pit exceeds 1.0 cfs. If there is no safe access to the pit location, the flow will be sampled at nearest safe access location. If no safe access is possible, no sample will be collected for monitoring.	7-6A*	Quarterly

*Note: Every 5 years for the third or fourth quarter monitoring event, laboratory analysis will be performed according to the baseline parameter lists specified in Tables 7-6B and 7-7B for surface waters and groundwaters, respectively at sites for which operational laboratory water quality measurements are specified in Table 7-5. This will first be performed in the year 2015, continuing on a schedule of every five years thereafter.

Table 7-5 Hydrologic monitoring locations and protocols for operational and reclamation phase monitoring.

Site	Protocols	Comments
Streams		
BLM-1	A, 1, 8	Lower Robinson Creek adjacent to mined areas
RID-1	A, 2	Irrigation ditch in Lower Robinson Creek
SW-2	A, 1	Kanab Creek below Lower Robinson Creek
SW-3	A, 1	Kanab Creek above permit area
SW-4	A, 1	Lower Robinson Creek above permit area
SW-5	A, 1, 8	Lower Robinson Creek above Kanab Creek
SW-6	A, 1, 8	Sink Valley Wash at permit boundary
SW-8	A, 1	Swapp Hollow Creek above permit area
SW-9	A, 1, 8	Sink Valley Wash below permit area
SW-101	A, 2	Lower Robinson Creek in permit area
SW-1A	A, 2	Kanab Creek above North Private Lease permit area
SW-1	A, 1	Kanab Creek at upper North Private Lease permit boundary
SW-1M	A, 1	Kanab Creek within North Private Lease permit area
Kanab @ C.R	A, 1, 8	Kanab Creek at lower North Private Lease permit boundary
~~SW-3~~	~~A, 1~~	~~Kanab Creek below North Private Lease area (existing monitoring site)~~
RSD-1	A, 2	Ephemeral wash above North Private Lease permit area
SW-11	A, 1, 8	Intermittent drainage at lower North Private Lease permit boundary
April Creek	A, 1	E. Fork Simpson Hollow adjacent to North Private Lease permit boundary
Priscilla Creek	A, 2	Headwaters East Fork Simpson Hollow creek west of North Private Lease permit area
SW-15	A, 1, 8	Simpson Hollow below North Private Lease mining area at Kanab Creek confluence
EW-1	A, 2	Ephemeral tributary to Kanab Creek
Springs		
Sorensen Spring (SP-40)	B,4, D	Developed alluvial spring in Sink Valley at Sorensen ranch
SP-3	B, 4	Spring in upland pediment alluvium south of permit area (developed and piped down canyon in Sink Valley Wash – now monitored at transfer box at mouth of canyon)
SP-4	B, 3	Developed spring in Sink Valley Wash 1 mile below permit area
SP-6	B, 3	Seep in Sink Valley below permit area, seeps directly into excavated pond
SP-8	B, 3, D	Developed alluvial spring in Sink Valley at Dames ranch
SP-14	B, 3, D	Alluvial spring in Sink Valley
SP-16	B, 4	Alluvial spring in Sink Valley

Site	Protocols	Comments
SP-20	B, ~~3~~4, D	Alluvial spring in Sink Valley
SP-22	B, 4, D	Alluvial spring in Sink Valley, seeps directly into small excavated pool.
SP-23	B, 4	Alluvial spring in Sink Valley
SP-33	B, 3	Developed spring in lower Sink Valley alluvium
Pond Spring	B, 3	Spring below Alton Town, flows to adjacent pond
Hill Spring	B, 4	Spring below Alton Town
Coyote Seep	B, C, 3	Alluvial seep in North Private Lease area
Alkali Seep	B, 4	Dakota Formation seep below North Lease permit area
Dakota Seep	B, 4	Dakota Formation seep below permit area (usually dry)
Seep Z	B, 4	Dakota Formation seep adjacent to North Lease area
Wells		
Y-36	C	Coal well in Sink Valley above permit area
~~Y-38*~~	~~C~~	~~Coal well in Sink Valley in permit area~~
Y-45	C	Coal seam well in Swapp Hollow above permit area
Y-61	C, 5, E	Water well in Sink Valley artesian alluvial groundwater system above permit area
Y-63	C	Monitoring well in lower Sink Valley Alluvium below mining areas
Y-98	C	Alluvial well in Robinson Creek above permit area
Y-102	C	Alluvial well in upper Sink Valley in permit area
~~C0-18*~~	~~C~~	~~Alluvial monitoring well in Lower Robinson Creek drainage~~
~~C0-54*~~	~~C~~	~~Monitoring well in Lower Robinson Creek drainage near coal seam~~
C1-24	C	Alluvial monitoring well in Lower Robinson Creek drainage
C2-15	C, E	Monitoring well in Sink Valley alluvium
C2-28	C, E	Monitoring well in Sink Valley alluvium
C2-40	C, E	Monitoring well in Sink Valley alluvium
C3-15	C, E	Monitoring well in Sink Valley alluvium
C3-30	C, E	Monitoring well in Sink Valley alluvium
C3-40	C, E	Monitoring well in Sink Valley alluvium
C4-15	C, E	Monitoring well in Sink Valley alluvium
C4-30	C, E	Monitoring well in Sink Valley alluvium
C4-50	C, E	Monitoring well in Sink Valley alluvium
C5-130	C, E	Monitoring well in Sink Valley artesian alluvial groundwater system above permit area
~~C7-20*~~	~~C~~	~~Monitoring well in Sink Valley alluvium~~
~~C9-15*~~	~~C~~	~~Monitoring well in Sink Valley alluvium~~
~~C9-25*~~	~~C~~	~~Monitoring well in Sink Valley alluvium~~
~~C9-40*~~	~~C~~	~~Monitoring well in Sink Valley alluvium~~
LR-45	C, 5	Monitoring well in Lower Robinson Creek alluvium below mine area
LS-28	C, 5	Monitoring well in Sink Valley Alluvium below mining areas

Site	Protocols	Comments
LS-60	C	Monitoring well in Sink Valley Alluvium below mining areas
LS-85	C, 5	Monitoring well in artesian Sink Valley Alluvium below mining areas
SS-15	C	Monitoring well in Sink Valley Alluvium below mining areas
SS-30	C, 5	Monitoring well in Sink Valley Alluvium below mining areas
SS-75	C	Monitoring well in burned coal area material
UR-70	C, ~~5~~6	Monitoring well in Lower Robinson Creek alluvium above mine area
Y-100	C	Monitoring well in alluvium above underground mining area
Y-101	C	Monitoring well in alluvium above underground mining area
Y-103	C, 5	Alluvial well in North Private Lease area
Y-53	C	Smirl coal seam well southeast of North Private Lease
Y-55	C	Smirl coal seam well west of North Private Lease area
Y-69	C	Smirl coal seam well west of North Private Lease area
Y-70[+]	C	Smirl coal seam well in North Private Lease area
NLP-1[+]	C	Alluvial monitoring well in North Private Lease area
NLP-2[+]	C	Alluvial monitoring well in North Private Lease area
NLP-3[+]	C	Alluvial monitoring well in North Private Lease area
NLP-4	C, 5	Alluvial monitoring well in North Private Lease area
NLP-5	C, 5	Alluvial monitoring well in North Private Lease area
NLP-6	C	Alluvial monitoring well above North Private Lease area
NLP-7	C	Alluvial monitoring well above North Private Lease area
NLP-8	C	Alluvial monitoring well above North Private Lease area
NLP-9	C	Alluvial monitoring well above North Private Lease area
NLP-10[+]	C	Alluvial monitoring well in North Private Lease area
NLP-11	C	Alluvial monitoring well in North Private Lease area
~~NLP-12[+]~~	~~C, 5~~	~~Alluvial monitoring well below mining area~~
NLP-13	C, 5	Dakota Formation/alluvial well below mining area
CN0-60	C, 5	North Private Lease alluvial groundwater monitoring well
CN1-43	C	North Private Lease alluvial groundwater monitoring well
CN1-58	C, 5	North Private Lease alluvial groundwater monitoring well
CN2-70	C, 5	North Private Lease alluvial groundwater monitoring well
CN3-69[+]	C	North Private Lease alluvial groundwater monitoring well
CN3-80	C	North Private Lease alluvial groundwater monitoring well
CN3-81	C	North Private Lease alluvial groundwater monitoring well
CN3-93	C	North Private Lease alluvial groundwater monitoring well
CN3-98	C, 5	North Private Lease alluvial groundwater monitoring well
CN4-49	C, 5	North Private Lease alluvial groundwater monitoring well
CN5-52	C	North Private Lease alluvial groundwater monitoring well
CN5-58	C	North Private Lease alluvial groundwater monitoring well
CN7-70	C, 5	North Private Lease alluvial groundwater monitoring well
Clem-1	C	Alluvial monitoring well near Kanab Creek below NPL
Clem-2	C	Alluvial monitoring well near Kanab Creek below NPL
Clem-3	C	Alluvial monitoring well near Kanab Creek below NPL
Clem-4	C	Alluvial monitoring well near Kanab Creek below NPL
BW-1	C	Well to be completed if possible in pit backfill area after mining complete and area backfilled – monitoring will commence quarterly after well is successfully completed. Proposed well location is in North Private Lease Pit 12.

Site	Protocols	Comments
Mine Pit Inflows	F,9	Alluvial groundwater inflows to mine pits (>1.0 cfs)

* Wells in mine pit areas that have been mined through and are no longer operative.
[+] Wells in proposed mine pit areas that will be mined through in the future

Table 7-6A Surface water operational and reclamation phase water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductance	µS/cm @ 25°C
Dissolved Oxygen	mg/L
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L
Bicarbonate	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Oil and grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7-6B Surface water baseline water quality monitoring

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductance	µS/cm @ 25°C
Dissolved Oxygen	mg/L
Temperature	°C

LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L
Total Alkalinity	mg/L
Total Hardness ($CaCO_3$)	mg/L
Acidity	mg/L
Aluminum (dissolved)	mg/L
Arsenic (dissolved)	mg/L
Bicarbonate	mg/L
Boron (dissolved)	mg/L
Cadmium (dissolved)	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Copper (dissolved)	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Lead (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Molybdenum (dissolved)	mg/L
Ammonia	mg/L
Nitrate+Nitrite	mg/L
Phosphorous (total)	mg/L
Potassium (dissolved)	mg/L
Selenium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Zinc (dissolved)	mg/L
Oil and grease	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

Table 7-7A Groundwater operational and reclamation phase water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductance	µS/cm @ 25°C
Temperature	°C

LABORATORY MEASUREMENTS

Total Dissolved Solids	mg/L
Carbonate	mg/L
Bicarbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Potassium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Cations	meq/L
Anions	meq/L
Cation/Anion Balance	%

Table 7-7B Groundwater baseline water quality monitoring.

FIELD MEASUREMENTS	REPORTED AS
pH	pH units
Specific Conductance	µS/cm @ 25°C
Temperature	°C
LABORATORY MEASUREMENTS	
Total Dissolved Solids	mg/L
Total Alkalinity	mg/L
Total Hardness ($CaCO_3$)	mg/L
Acidity	mg/L
Aluminum (dissolved)	mg/L
Arsenic (dissolved)	mg/L
Bicarbonate	mg/L
Boron (dissolved)	mg/L
Cadmium (dissolved)	mg/L
Carbonate	mg/L
Calcium (dissolved)	mg/L
Chloride	mg/L
Copper (dissolved)	mg/L
Iron (total)	mg/L
Iron (dissolved)	mg/L
Lead (dissolved)	mg/L
Magnesium (dissolved)	mg/L
Manganese (total)	mg/L
Manganese (dissolved)	mg/L
Molybdenum (dissolved)	mg/L
Ammonia	mg/L
Nitrate+Nitrite	mg/L
Phosphorous (total)	mg/L
Potassium (dissolved)	mg/L
Selenium (dissolved)	mg/L
Sodium (dissolved)	mg/L
Sulfate	mg/L
Zinc (dissolved)	mg/L
Cations	meq/l
Anions	meq/l
Cation/Anion Balance	%

APPENDIX 7-3N

EXHIBIT 7-1N

Stream Reaches

(North Lease)

STREAM REACHES

REF#	WR#	OWNER	SOURCE
1	85-153	Ray J. Palmer	Kanab Creek
2	85-548	Lloyd W. & Ross E. & Gail P. & Vard H. Heaton	Kanab Creek
3	85-154	Ray J. Palmer	Kanab Creek
4	85-135	C. Leonard & Edna R. Heaton	Kanab Creek
5	85-399	Orval Palmer	Kanab Creek
6	85-136	C. Leonard & Edna R. Heaton	Kanab Creek
7	85-155	Ray J. & Melba Palmer	Kanab Creek
8	85-156	Ray J. and Melba Palmer	Kanab Creek
9	85-456	Kanab District USA Bureau of Land Management	Kanab Creek
10	85-161	Twin Eagles Ranch, LLC	Kanab Creek
11	85-457	Kanab District USA Bureau of Land Management	Kanab Creek
12	85-162	Twin Eagles Ranch, LLC	Kanab Creek
13	85-159	Twin Eagles Ranch, LLC	Kanab Creek
14	85-455	Kanab District USA Bureau of Land Management	Simpson Hollow Creek
15	85-160	Twin Eagles Ranch, LLC	Simpson Hollow Stream
16	85-551	Lloyd W. & Ross E. & Gail P. & Vard H. Heaton	East Fork Simpson Hollow Creek

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-153

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/08/2014 Page 1

WATER RIGHT: 85-153 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================
OWNERSHIP*************************************************************************************************
==========================================================================================================

NAME: Ray J. Palmer
ADDR: Alton UT 84710

==========================================================================================================
DATES, ETC.***********************************************************************************************
==========================================================================================================

LAND OWNED BY APPLICANT?                     COUNTY TAX ID#:
FILED:     07/22/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/22/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:

==========================================================================================================
LOCATION OF WATER RIGHT***********************************************************************************
==========================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from S4 corner, Sec 06, T39S, R5W, SLBM,
                               to a point at N 660 ft. E 660 ft. from S4 corner, Sec 06, T39S, R5W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================
SUPPLEMENTAL GROUP NO. 612235.  Water Rights Appurtenant to the following use(s):
85-152(DIL),153(DIL),154(DIL)
..........................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 150.00                 PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================
PLACE OF USE for STOCKWATERING****************************************************************************
==========================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 06 T 39S R  5W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  :  : X:  *
**********************************************************************************************************
**************************************************E N D   O F   D A T A***********************************
**********************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-548

```
                              (WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/28/2014    Page 1

WATER RIGHT: 85-548     APPLICATION/CLAIM NO.:              CERT. NO.:

==================================================================================================================================
OWNERSHIP*************************************************************************************************************************
==================================================================================================================================

NAME: Lloyd W. & Ross E. & Gail P. & Vard H. Heaton
ADDR: Alton UT 84710

==================================================================================================================================
DATES, ETC.***********************************************************************************************************************
==================================================================================================================================

LAND OWNED BY APPLICANT?                     COUNTY TAX ID#:
FILED:     04/14/1970|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:         |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  04/14/1970|LAP, ETC:           |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim              Source of Info: Proposed Determination        Status:

==================================================================================================================================
LOCATION OF WATER RIGHT***********************************************************************************************************
==================================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. W 660 ft. from E4 corner, Sec 06, T39S, R5W, SLBM,
                             to a point at S 660 ft. E 660 ft. from N4 corner, Sec 07, T39S, R5W, SLBM.
                        COMMENT: Administratively updated by State Engineer.

==================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==================================================================================================================================
SUPPLEMENTAL GROUP NO. 612515.  Water Rights Appurtenant to the following use(s):
85-412(DIL),413(DIL),414(DIL),415(DIL),543(DIL),544(DIL),545(DIL),546(DIL),547(DIL),548(DIL),549(DIL),550(DIL),551(DIL),552(DIL)
553(DIL),554(DIL),555(DIL),556(DIL),557(DIL),558(DIL),559(DIL),608(DIL),631(DIL),632(DIL),713(DIL),731(DIL),733(DIL)
..................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 1600.0                          PERIOD OF USE: 04/01 TO 12/31

==================================================================================================================================
PLACE OF USE for STOCKWATERING*****************************************************************************************************
==================================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 06 T 39S R  5W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  : X:  :  *
Sec 07 T 39S R  5W SLBM      *  :  :  :  *     * X:  :  :  *     *  :  :  :  *     *  :  :  :  *
**********************************************************************************************************************************
*****************************************************E N D   O F   D A T A*******************************************************
**********************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-154

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/28/2014 Page 1

WATER RIGHT: 85-154 APPLICATION/CLAIM NO.: CERT. NO.:

```
====================================================================================================================================
OWNERSHIP***************************************************************************************************************************
====================================================================================================================================

NAME: Ray J. Palmer
ADDR: Alton UT 84710

====================================================================================================================================
DATES, ETC.*************************************************************************************************************************
====================================================================================================================================

LAND OWNED BY APPLICANT?                  COUNTY TAX ID#:
FILED:     07/22/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:           |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/22/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination       Status:

====================================================================================================================================
LOCATION OF WATER RIGHT*************************************************************************************************************
====================================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. W 660 ft. from N4 corner, Sec 07, T39S, R5W, SLBM,
                              to a point at S 660 ft. W 660 ft. from N4 corner, Sec 07, T39S, R5W, SLBM.
                         COMMENT: Administratively updated by State Engineer.

====================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
====================================================================================================================================
SUPPLEMENTAL GROUP NO. 612235.  Water Rights Appurtenant to the following use(s):
85-152(DIL),153(DIL),154(DIL)
....................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 150.00                            PERIOD OF USE: 04/01 TO 12/31

====================================================================================================================================
PLACE OF USE for STOCKWATERING******************************************************************************************************
====================================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 07 T 39S R  5W SLBM      *  : X:  :  *     *  :  :  :  *     *  :  :  :  *     *  :  :  :  *
************************************************************************************************************************************
****************************************************E N D   O F   D A T A***********************************************************
************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-135


```
WATER RIGHT: 85-135    APPLICATION/CLAIM NO.:              CERT. NO.:

====================================================================================================================================
OWNERSHIP***************************************************************************************************************************
====================================================================================================================================

NAME: C. Leonard & Edna R. Heaton
ADDR: Moccasin AZ 86002

====================================================================================================================================
DATES, ETC.*************************************************************************************************************************
====================================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     07/21/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/21/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d           ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination       Status:

====================================================================================================================================
LOCATION OF WATER RIGHT*************************************************************************************************************
====================================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 1980 ft. from W4 corner, Sec 07, T39S, R5W, SLBM,
                               to a point at N 660 ft. E 1980 ft. from W4 corner, Sec 07, T39S, R5W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

====================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
====================================================================================================================================
SUPPLEMENTAL GROUP NO. 612229.  Water Rights Appurtenant to the following use(s):
85-135(DIL),136(DIL)
....................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 20.000                          PERIOD OF USE: 04/01 TO 12/31

====================================================================================================================================
PLACE OF USE for STOCKWATERING******************************************************************************************************
====================================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 07 T 39S R  5W SLBM       *  :  :  : X*     *  :  :  :  *     *  :  :  :  *     *  :  :  :  *
************************************************************************************************************************************
*****************************************************E N D   O F   D A T A**********************************************************
************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-399

WATER RIGHT: 85-399 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================================
OWNERSHIP*****************************************************************************************************************
==========================================================================================================================

NAME: Orval Palmer
ADDR: Alton UT 84710

==========================================================================================================================
DATES, ETC.***************************************************************************************************************
==========================================================================================================================

LAND OWNED BY APPLICANT?                   COUNTY TAX ID#:
FILED:     03/12/1970|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  03/12/1970|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:

==========================================================================================================================
LOCATION OF WATER RIGHT***************************************************************************************************
==========================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 1980 ft. from W4 corner, Sec 07, T39S, R5W, SLBM,
                              to a point at N 660 ft. E 1980 ft. from W4 corner, Sec 07, T39S, R5W, SLBM.
                         COMMENT: Administratively updated by State Engineer.

==========================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================
SUPPLEMENTAL GROUP NO. 612390.
..........................................................................................................................
  STOCKWATER: 54.0000 Stock Units                                                              PERIOD OF USE: 01/01 TO 12/31

==========================================================================================================================
PLACE OF USE for STOCKWATERING********************************************************************************************
==========================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 07 T 39S R  5W SLBM      *  :  :  : X*     *  :  :  :  *     *  :  :  :  *     *  :  :  :  *
**************************************************************************************************************************
*****************************************************E N D   O F   D A T A***********************************************
**************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-136

WATER RIGHT: 85-136 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: C. Leonard & Edna R. Heaton
ADDR: Moccasin AZ 86022
INTEREST: 100%

DATES, ETC.

```
LAND OWNED BY APPLICANT?                  COUNTY TAX ID#:
FILED:     07/21/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [       ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/21/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:
```

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
(1)Stockwatering directly on stream from a point at S 660 ft. E 1980 ft. from W4 corner, Sec 07, T39S, R5W, SLBM,
to a point at S 660 ft. E 660 ft. from W4 corner, Sec 07, T39S, R5W, SLBM.
COMMENT: Administratively updated by State Engineer.

USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
(The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)

SUPPLEMENTAL GROUP NO. 612229. Water Rights Appurtenant to the following use(s):
85-135(DIL),136(DIL)

STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs Group Total: 20.000 PERIOD OF USE: 04/01 TO 12/31

PLACE OF USE for STOCKWATERING

```
                              NORTH-WEST≈      NORTH-EAST≈      SOUTH-WEST≈      SOUTH-EAST≈
                              NW NE SW SE      NW NE SW SE      NW NE SW SE      NW NE SW SE
Sec 07 T 39S R  5W SLBM      *  :  :  :  *    *  :  :  :  *    * X: X:  :  *    *  :  :  :  *
```

E N D O F D A T A

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-155

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/04/2014 Page 1

WATER RIGHT: 85-155 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================================
OWNERSHIP*****************************************************************************************************************
==========================================================================================================================

NAME: Ray J. & Melba Palmer
ADDR: Alton UT 84710
INTEREST: 100%

==========================================================================================================================
DATES, ETC.***************************************************************************************************************
==========================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     07/22/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:           |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/22/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [            ]

PD BOOK: [  85-1    ]|MAP:  [2d           ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:

==========================================================================================================================
LOCATION OF WATER RIGHT***************************************************************************************************
==========================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from SW corner, Sec 07, T39S, R5W, SLBM,
                              to a point at S 660 ft. E 660 ft. from NW corner, Sec 18, T39S, R5W, SLBM.
                         COMMENT: Administratively updated by State Engineer.

==========================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================
SUPPLEMENTAL GROUP NO. 612236.  Water Rights Appurtenant to the following use(s):
85-155(DIL),156(DIL)
..........................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 150.00                    PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================================
PLACE OF USE for STOCKWATERING********************************************************************************************
==========================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 07 T 39S R  5W SLBM       *  :  :  :  *     *  :  :  :  *     *  :  : X:  *     *  :  :  :  *
Sec 18 T 39S R  5W SLBM       * X:  :  :  *     *  :  :  :  *     *  :  :  :  *     *  :  :  :  *
**************************************************************************************************************************
***************************************************E N D   O F   D A T A**************************************************
**************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-156

```
                         (WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/08/2014    Page 1

WATER RIGHT: 85-156    APPLICATION/CLAIM NO.:             CERT. NO.:

====================================================================================================================================
OWNERSHIP***************************************************************************************************************************
====================================================================================================================================

NAME: Ray J. and Melba Palmer
ADDR: Alton UT 84710

====================================================================================================================================
DATES, ETC.*************************************************************************************************************************
====================================================================================================================================

LAND OWNED BY APPLICANT?                   COUNTY TAX ID#:
FILED:     07/22/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  07/22/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination       Status:

====================================================================================================================================
LOCATION OF WATER RIGHT*************************************************************************************************************
====================================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. E 660 ft. from W4 corner, Sec 18, T39S, R5W, SLBM,
                              to a point at S 660 ft. E 660 ft. from W4 corner, Sec 18, T39S, R5W, SLBM.
                         COMMENT: Administratively updated by State Engineer.

====================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
====================================================================================================================================
SUPPLEMENTAL GROUP NO. 612236.  Water Rights Appurtenant to the following use(s):
85-155(DIL),156(DIL)
....................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 150.00                          PERIOD OF USE: 04/01 TO 12/31

====================================================================================================================================
PLACE OF USE for STOCKWATERING*******************************************************************************************************
====================================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 18 T 39S R  5W SLBM      *  :  :  :  *     *  :  :  :  *     * X:  :  :  *     *  :  :  :  *
************************************************************************************************************************************
****************************************************E N D   O F   D A T A**********************************************************
************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-456

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/05/2014 Page 1

WATER RIGHT: 85-456 APPLICATION/CLAIM NO.: CERT. NO.:

==
OWNERSHIP**
==

NAME: Kanab District USA Bureau of Land Management
ADDR: 669 S. Highway 89 A
Kanab Utah 84741

==
DATES, ETC.**
==

```
LAND OWNED BY APPLICANT?                 COUNTY TAX ID#:
FILED:              |PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:         |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:          |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:           |LAP, ETC:             |LAPS LETTER:
RUSH LETTR:         |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a           ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:
```

==
LOCATION OF WATER RIGHT**
==

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
(1)Stockwatering directly on stream from a point at S 660 ft. W 660 ft. from E4 corner, Sec 13, T39S, R6W, SLBM,
to a point at N 660 ft. W 660 ft. from SE corner, Sec 13, T39S, R6W, SLBM.
COMMENT: Administratively updated by State Engineer.

==
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
(The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==
SUPPLEMENTAL GROUP NO. 612416. Water Rights Appurtenant to the following use(s):
85-455(DIL),456(DIL),457(DIL)
....
STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs Group Total: 5.0000 PERIOD OF USE: 01/01 TO 12/31
Garn Swapp Allotment No. 40.

==
PLACE OF USE for STOCKWATERING***
==

```
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 13 T 39S R  6W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  : X:  : X*
```

****
E N D   O F   D A T A*******************************
****

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-161

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/08/2014 Page 1

WATER RIGHT: 85-161 APPLICATION/CLAIM NO.: CERT. NO.:

CHANGES: a38554 Approved

```
==========================================================================================================================
OWNERSHIP*****************************************************************************************************************
==========================================================================================================================

NAME: Twin Eagles Ranch, LLC
ADDR: 1375 West 3150 South
      Hurricane UT 84737
INTEREST: 100%

==========================================================================================================================
DATES, ETC.***************************************************************************************************************
==========================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     08/01/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  08/01/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [              ]

PD BOOK: [  85-1    ]|MAP:  [4a          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:

==========================================================================================================================
LOCATION OF WATER RIGHT***************************************************************************************************
==========================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane          COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. W 660 ft. from NE corner, Sec 24, T39S, R6W, SLBM,
                               to a point at S 660 ft. W 660 ft. from NE corner, Sec 24, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================
SUPPLEMENTAL GROUP NO. 612239.  Water Rights Appurtenant to the following use(s):
85-159(DIL),160(DIL),161(DIL),162(DIL),163(DIL)
..........................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 400.00                       PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================================
PLACE OF USE for STOCKWATERING*********************************************************************************************
==========================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 24 T 39S R  6W SLBM      *  :  :  :  *     *  : X:  :  *     *  :  :  :  *     *  :  :  :  *
**************************************************************************************************************************
*****************************************************E N D   O F   D A T A************************************************
**************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-457

WATER RIGHT: 85-457 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================
OWNERSHIP*************************************************************************************************
==========================================================================================================

NAME: Kanab District USA Bureau of Land Management
ADDR: 669 S. Highway 89 A
      Kanab Utah 84741

==========================================================================================================
DATES, ETC.***********************************************************************************************
==========================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:              |PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:         |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:         |PROOF DUE:
EXTENSION:          |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:            |LAP, ETC:           |LAPS LETTER:
RUSH LETTR:         |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a          ]|PUB DATE:

Type of Right: Diligence Claim              Source of Info: Proposed Determination        Status:

==========================================================================================================
LOCATION OF WATER RIGHT***********************************************************************************
==========================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. E 660 ft. from N4 corner, Sec 24, T39S, R6W, SLBM,
                             to a point at S 660 ft. E 660 ft. from N4 corner, Sec 24, T39S, R6W, SLBM.
                        COMMENT: Administratively updated by State Engineer.

==========================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                 (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================
SUPPLEMENTAL GROUP NO. 612416.  Water Rights Appurtenant to the following use(s):
85-455(DIL),456(DIL),457(DIL)
..........................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 5.0000              PERIOD OF USE: 01/01 TO 12/31
Garn Swapp Allotment No. 40.

==========================================================================================================
PLACE OF USE for STOCKWATERING****************************************************************************
==========================================================================================================
                             NORTH-WEST≈      NORTH-EAST≈      SOUTH-WEST≈      SOUTH-EAST≈
                             NW NE SW SE      NW NE SW SE      NW NE SW SE      NW NE SW SE
Sec 24 T 39S R  6W SLBM     *  :  :  :  *    * X:  :  :  *    *  :  :  :  *    *  :  :  :  *
**********************************************************************************************************
*********************************************E N D   O F   D A T A***************************************
**********************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-162

WATER RIGHT: 85-162 APPLICATION/CLAIM NO.: CERT. NO.:

CHANGES: a38554 Approved

```
==========================================================================================================================================
OWNERSHIP*********************************************************************************************************************************
==========================================================================================================================================

NAME: Twin Eagles Ranch, LLC
ADDR: 1375 West 3150 South
      Hurricane UT 84737

==========================================================================================================================================
DATES, ETC.*******************************************************************************************************************************
==========================================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     08/01/1969|PRIORITY:    /  /1864|PUB BEGAN:           |PUB ENDED:           |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:          |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:          |CERT/WUC:  08/01/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:           |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a           ]|PUB DATE:

Type of Right: Diligence Claim                Source of Info: Proposed Determination        Status:

==========================================================================================================================================
LOCATION OF WATER RIGHT*******************************************************************************************************************
==========================================================================================================================================

FLOW:

SOURCE: Kanab Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 1980 ft. E 660 ft. from N4 corner, Sec 24, T39S, R6W, SLBM,
                               to a point at S 660 ft. W 1980 ft. from E4 corner, Sec 24, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================================
SUPPLEMENTAL GROUP NO. 612239.  Water Rights Appurtenant to the following use(s):
85-159(DIL),160(DIL),161(DIL),162(DIL),163(DIL)
..........................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 400.00                          PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================================================
PLACE OF USE for STOCKWATERING*************************************************************************************************************
==========================================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 24 T 39S R  6W SLBM       *  :  :  :  *     *  :  : X:  *     *  :  :  :  *     * X:  :  :  *
******************************************************************************************************************************************
*****************************************************E N D   O F   D A T A****************************************************************
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```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-159


```
WATER RIGHT: 85-159     APPLICATION/CLAIM NO.:              CERT. NO.:

CHANGES:    a38554 Approved

=====================================================================================================================================
OWNERSHIP****************************************************************************************************************************
=====================================================================================================================================

NAME: Twin Eagles Ranch, LLC
ADDR: 1375 West 3150 South
      Hurricane UT 84737

=====================================================================================================================================
DATES, ETC.**************************************************************************************************************************
=====================================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     08/01/1969|PRIORITY:    /  /1864|PUB BEGAN:           |PUB ENDED:            |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:          |SE ACTION: [        ]|ActionDate:           |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:          |CERT/WUC:  08/01/1969|LAP, ETC:             |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:           |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim                Source of Info: Proposed Determination        Status:

=====================================================================================================================================
LOCATION OF WATER RIGHT**************************************************************************************************************
=====================================================================================================================================

FLOW:

SOURCE: West Fork Simpson Hollow Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from S4 corner, Sec 11, T39S, R6W, SLBM,
                               to a point at N 660 ft. W 660 ft. from SE corner, Sec 11, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

=====================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
=====================================================================================================================================
SUPPLEMENTAL GROUP NO. 612239.  Water Rights Appurtenant to the following use(s):
85-159(DIL),160(DIL),161(DIL),162(DIL),163(DIL)
.....................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 400.00                          PERIOD OF USE: 04/01 TO 12/31

=====================================================================================================================================
PLACE OF USE for STOCKWATERING*******************************************************************************************************
=====================================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 11 T 39S R  6W SLBM       *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  :  : X: X*
*************************************************************************************************************************************
******************************************************E N D   O F   D A T A*********************************************************
*************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-455

WATER RIGHT: 85-455 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================================
OWNERSHIP*****************************************************************************************************************
==========================================================================================================================

NAME: Kanab District USA Bureau of Land Management
ADDR: 669 S. Highway 89 A
      Kanab Utah 84741

==========================================================================================================================
DATES, ETC.***************************************************************************************************************
==========================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:              |PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:         |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [       ]|ActionDate:          |PROOF DUE:
EXTENSION:          |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:           |LAP, ETC:            |LAPS LETTER:
RUSH LETTR:         |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a          ]|PUB DATE:

Type of Right: Diligence Claim              Source of Info: Proposed Determination        Status:

==========================================================================================================================
LOCATION OF WATER RIGHT***************************************************************************************************
==========================================================================================================================

FLOW:

SOURCE: Simpson Hollow Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 660 ft. E 1980 ft. from W4 corner, Sec 13, T39S, R6W, SLBM,
                              to a point at S 660 ft. E 660 ft. from N4 corner, Sec 13, T39S, R6W, SLBM.
                         COMMENT: Administratively updated by State Engineer.

==========================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================
SUPPLEMENTAL GROUP NO. 612416.  Water Rights Appurtenant to the following use(s):
85-455(DIL),456(DIL),457(DIL)
..........................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 5.0000                    PERIOD OF USE: 01/01 TO 12/31
Garn Swapp Allotment No. 40.

==========================================================================================================================
PLACE OF USE for STOCKWATERING********************************************************************************************
==========================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 13 T 39S R  6W SLBM      *  :  :  :  *     * X:  :  :  *     *  : X:  :  *     *  :  :  :  *
**************************************************************************************************************************
*****************************************************E N D   O F   D A T A***********************************************
**************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-160

WATER RIGHT: 85-160 APPLICATION/CLAIM NO.: CERT. NO.:

CHANGES: a38554 Approved

```
==========================================================================================================================================
OWNERSHIP*********************************************************************************************************************************
==========================================================================================================================================

NAME: Twin Eagles Ranch, LLC
ADDR: 1375 West 3150 South
      Hurricane UT 84737

==========================================================================================================================================
DATES, ETC.*******************************************************************************************************************************
==========================================================================================================================================

LAND OWNED BY APPLICANT?                    COUNTY TAX ID#:
FILED:     08/01/1969|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [       ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  08/01/1969|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [4a          ]|PUB DATE:

Type of Right: Diligence Claim              Source of Info: Proposed Determination       Status:

==========================================================================================================================================
LOCATION OF WATER RIGHT*******************************************************************************************************************
==========================================================================================================================================

FLOW:

SOURCE: Simpson Hollow Stream

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at S 1980 ft. E 660 ft. from N4 corner, Sec 24, T39S, R6W, SLBM,
                               to a point at S 1980 ft. E 660 ft. from N4 corner, Sec 24, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================================
SUPPLEMENTAL GROUP NO. 612239.  Water Rights Appurtenant to the following use(s):
85-159(DIL),160(DIL),161(DIL),162(DIL),163(DIL)
..........................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 400.00                              PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================================================
PLACE OF USE for STOCKWATERING************************************************************************************************************
==========================================================================================================================================
                               NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                               NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 24 T 39S R  6W SLBM       *  :  :  :  *     *  :  : X:  *     *  :  :  :  *     *  :  :  :  *
******************************************************************************************************************************************
******************************************************E N D   O F   D A T A***************************************************************
******************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-551

WATER RIGHT: 85-551 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================================
OWNERSHIP*****************************************************************************************************************
==========================================================================================================================

NAME: Lloyd W. & Ross E. & Gail P. & Vard H. Heaton
ADDR: Alton UT 84710

==========================================================================================================================
DATES, ETC.***************************************************************************************************************
==========================================================================================================================

LAND OWNED BY APPLICANT?                   COUNTY TAX ID#:
FILED:     04/14/1970|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  04/14/1970|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination        Status:

==========================================================================================================================
LOCATION OF WATER RIGHT***************************************************************************************************
==========================================================================================================================

FLOW:

SOURCE: East Fork Simpson Hollow Creek

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
( 1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from S4 corner, Sec 12, T39S, R6W, SLBM,
                               to a point at N 660 ft. E 1980 ft. from W4 corner, Sec 13, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================================
SUPPLEMENTAL GROUP NO. 612515.  Water Rights Appurtenant to the following use(s):
85-412(DIL),413(DIL),414(DIL),415(DIL),543(DIL),544(DIL),545(DIL),546(DIL),547(DIL),548(DIL),549(DIL),550(DIL),551(DIL),552(DIL)
553(DIL),554(DIL),555(DIL),556(DIL),557(DIL),558(DIL),559(DIL),608(DIL),631(DIL),632(DIL),713(DIL),731(DIL),733(DIL)
..........................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 1600.0                      PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================================
PLACE OF USE for STOCKWATERING********************************************************************************************
==========================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 12 T 39S R  6W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  :  : X:  *
Sec 13 T 39S R  6W SLBM      *  :  :  : X*     *  :  :  :  *     *  :  :  :  *     *  :  :  :  *
**************************************************************************************************************************
*************************************************E N D   O F   D A T A***************************************************
**************************************************************************************************************************
```

APPENDIX 7-3N

EXHIBIT 7-2N

Surface Diversions

(North Lease)

SURFACE DIVERSIONS

REF#	WR#	OWNER	SOURCE
1	85-71	Sharon C. and Lorene C. Lamb	Kanab Creek
2	85-305	Clark & Florene S. Lamb	Kanab Creek

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-71(D17)

WATER RIGHT: 85-71 APPLICATION/CLAIM NO.: D17 CERT. NO.:

OWNERSHIP

NAME: Sharon C. and Lorene C. Lamb
ADDR: Orderville UT 84758

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: 08/08/1950|PRIORITY: / /1892|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF: |CERT/WUC: 09/03/1969|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]

PD BOOK: [85-1]|MAP: [4a]|PUB DATE:

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: 2.55 cfs

SOURCE: Kanab Creek

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 1630 ft W 1625 ft from NE cor, Sec 24, T 39S, R 6W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
(The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)

SUPPLEMENTAL GROUP NO. 612500.

IRRIGATION: 51.5 acres PERIOD OF USE: 04/01 TO 10/31

###PLACE OF USE:	NORTH WEST QUARTER				NORTH EAST QUARTER				SOUTH WEST QUARTER				SOUTH EAST QUARTER				Section
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	Totals
Sec 24 T 39S R 6W SLBM												0.7000			13.8000		14.5000
Sec 25 T 39S R 6W SLBM		20.0000		10.0000	7.0000												37.0000
																GROUP ACREAGE TOTAL:	51.5000

END OF DATA

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-305

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/08/2014 Page 1

WATER RIGHT: 85-305 APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Clark & Florene S. Lamb
ADDR: Mt. Carmel UT 84758
INTEREST: 66.7%

NAME: Sharon C. and Lorene C. Lamb
ADDR: Orderville UT
INTEREST: 33.3%
REMARKS: husband & wife

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:
FILED: 08/28/1969 |PRIORITY: / /1864 |PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No] |HEARNG HLD: |SE ACTION: [ ] |ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ] |ELEC/PROOF: |CERT/WUC: 08/28/1969 |LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]

PD BOOK: [85-1] |MAP: [4a] |PUB DATE:

Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT

FLOW: 2.55 cfs

SOURCE: Kanab Creek

COUNTY: Kane COMMON DESCRIPTION:

POINT OF DIVERSION -- SURFACE:
(1) S 1630 ft W 1625 ft from NE cor, Sec 24, T 39S, R 6W, SLBM
Diverting Works: Source:

Stream Alt Required?: No

USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
(The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)

SUPPLEMENTAL GROUP NO. 612337.

IRRIGATION: 41.5 acres PERIOD OF USE: 04/01 TO 10/31

###PLACE OF USE:	NORTH WEST QUARTER NW	NE	SW	SE	NORTH EAST QUARTER NW	NE	SW	SE	SOUTH WEST QUARTER NW	NE	SW	SE	SOUTH EAST QUARTER NW	NE	SW	SE	Section Totals
Sec 25 T 39S R 6W SLBM			0.6000						10.8000		19.3000						30.7000
Sec 26 T 39S R 6W SLBM																7.4000	7.4000
Sec 35 T 39S R 6W SLBM						3.4000											3.4000
																GROUP ACREAGE TOTAL:	41.5000

E N D O F D A T A

APPENDIX 7-3N

EXHIBIT 7-3N

Springs

(North Lease)

SPRINGS

REF#	WR#	OWNER	SOURCE
1	85-631	Lloyd W. & Ross E. & Gail P. & Vard H. Heaton	Shed Spring
2	85-632	lloyd W. & Ross E. & Gail P. & Vard H. Heaton	Slope Spring Area

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-631

```
                              (WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 12/05/2014    Page 1

WATER RIGHT: 85-631    APPLICATION/CLAIM NO.:             CERT. NO.:

====================================================================================================================================
OWNERSHIP***************************************************************************************************************************
====================================================================================================================================

NAME: Lloyd W. & Ross E. & Gail P. & Vard H. Heaton
ADDR: Alton UT 84710

====================================================================================================================================
DATES, ETC.*************************************************************************************************************************
====================================================================================================================================

LAND OWNED BY APPLICANT?                  COUNTY TAX ID#:
FILED:     04/14/1970|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:           |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  04/14/1970|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d           ]|PUB DATE:

Type of Right: Diligence Claim               Source of Info: Proposed Determination       Status:

====================================================================================================================================
LOCATION OF WATER RIGHT*************************************************************************************************************
====================================================================================================================================

FLOW: 0.111 cfs

SOURCE: Shed Spring

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION:
( 1)Stockwatering directly on spring located at N 660 ft. E 660 ft. from SW corner, Sec 12, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

====================================================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
====================================================================================================================================
SUPPLEMENTAL GROUP NO. 612515.  Water Rights Appurtenant to the following use(s):
85-412(DIL),413(DIL),414(DIL),415(DIL),543(DIL),544(DIL),545(DIL),546(DIL),547(DIL),548(DIL),549(DIL),550(DIL),551(DIL),552(DIL)
553(DIL),554(DIL),555(DIL),556(DIL),557(DIL),558(DIL),559(DIL),608(DIL),631(DIL),632(DIL),713(DIL),731(DIL),733(DIL)
....................................................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 1600.0                              PERIOD OF USE: 04/01 TO 12/31

====================================================================================================================================
PLACE OF USE for STOCKWATERING******************************************************************************************************
====================================================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 12 T 39S R  6W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  : X:  *     *  :  :  :  *
************************************************************************************************************************************
***************************************************E N D   O F   D A T A************************************************************
************************************************************************************************************************************
```

STATE OF UTAH -- DIVISION OF WATER RIGHTS -- DATA PRINT OUT for 85-632

WATER RIGHT: 85-632 APPLICATION/CLAIM NO.: CERT. NO.:

```
==========================================================================================================
OWNERSHIP*************************************************************************************************
==========================================================================================================

NAME: Lloyd W. & Ross E. & Gail P. & Vard H. Heaton
ADDR: Alton UT 84710

==========================================================================================================
DATES, ETC.***********************************************************************************************
==========================================================================================================

LAND OWNED BY APPLICANT?                  COUNTY TAX ID#:
FILED:     04/14/1970|PRIORITY:    /  /1864|PUB BEGAN:          |PUB ENDED:          |NEWSPAPER:
ProtestEnd:          |PROTESTED: [No      ]|HEARNG HLD:         |SE ACTION: [        ]|ActionDate:          |PROOF DUE:
EXTENSION:           |ELEC/PROOF:[        ]|ELEC/PROOF:         |CERT/WUC:  04/14/1970|LAP, ETC:            |LAPS LETTER:
RUSH LETTR:          |RENOVATE:            |RECON REQ:          |TYPE: [             ]

PD BOOK: [  85-1    ]|MAP:  [2d          ]|PUB DATE:

Type of Right: Diligence Claim             Source of Info: Proposed Determination       Status:

==========================================================================================================
LOCATION OF WATER RIGHT***********************************************************************************
==========================================================================================================

FLOW: 0.045 cfs

SOURCE: Slope Spring Area

COUNTY: Kane         COMMON DESCRIPTION:

POINT OF DIVERSION:
( 1)Stockwatering directly on spring located at N 660 ft. W 660 ft. from SE corner, Sec 11, T39S, R6W, SLBM.
                          COMMENT: Administratively updated by State Engineer.

==========================================================================================================
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family
                  (The Beneficial Use Amount is the quantity of Use that this Water Right contributes to the Group Total.)
==========================================================================================================
SUPPLEMENTAL GROUP NO. 612515.  Water Rights Appurtenant to the following use(s):
85-412(DIL),413(DIL),414(DIL),415(DIL),543(DIL),544(DIL),545(DIL),546(DIL),547(DIL),548(DIL),549(DIL),550(DIL),551(DIL),552(DIL)
553(DIL),554(DIL),555(DIL),556(DIL),557(DIL),558(DIL),559(DIL),608(DIL),631(DIL),632(DIL),713(DIL),731(DIL),733(DIL)
..........................................................................................................
  STOCKWATER: Beneficial Use Amt: UNEVALUATED ELUs      Group Total: 1600.0                 PERIOD OF USE: 04/01 TO 12/31

==========================================================================================================
PLACE OF USE for STOCKWATERING****************************************************************************
==========================================================================================================
                              NORTH-WEST≈       NORTH-EAST≈       SOUTH-WEST≈       SOUTH-EAST≈
                              NW NE SW SE       NW NE SW SE       NW NE SW SE       NW NE SW SE
Sec 11 T 39S R  6W SLBM      *  :  :  :  *     *  :  :  :  *     *  :  :  :  *     *  :  :  : X*
**********************************************************************************************************
****************************************************E N D   O F   D A T A*********************************
**********************************************************************************************************
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APPENDIX 7-18

Alluvial Groundwater Systems

(North Private Lease Area)

Characterization of Alluvial Groundwater Systems in the North Private Lease area at the Alton Coal Development, LLC Coal Hollow Mine

20 July 2016

Alton Coal Development, LLC
Cedar City, Utah

PH
Petersen Hydrologic, LLC
Consultants in Hydrogeology

Characterization of Alluvial Groundwater Systems in the North Private Lease area at the Alton Coal Development, LLC Coal Hollow Mine

20 July 2016

Alton Coal Development, LLC
Cedar City, Utah

Prepared by:

Erik C. Petersen, P.G.
Principal Hydrogeologist
Utah P.G. No. 5373615-2250

LICENSED PROFESSIONAL GEOLOGIST
ERIK CARL PETERSEN
No. 5373615-2250
STATE OF UTAH

PH
Petersen Hydrologic, LLC
Consultants in Hydrogeology

2695 N. 600 E.
Lehi, Utah 84043
(801) 766-4006

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1.0 INTRODUCTION

The Alton Coal Development, LLC (ACD) Coal Hollow Mine is located approximately 3 miles south of the town of Alton, Utah (Figure 1). A permit to operate the Coal Hollow Mine was issued on 10 November 2010. The first coal was mined in early February 2011.

Alton Coal Development, LLC recently obtained a permit from the Utah Division of Oil, Gas and Ming to extend the mining operations at the existing Coal Hollow Mine into Area 1 at the North Private Lease area. In conjunction with mine permitting for Areas 2 and 3 at the North Private Lease, Alton Coal Development, LLC commissioned Petersen Hydrologic, LLC has performed an investigation of alluvial sediments and alluvial groundwaters in the North Private Lease area. The purpose of this document is to present the findings of this investigation to the Utah Division of Oil, Gas and Mining in consideration of permitting of mine Areas 2 and 3 at the North Private Lease.

The reader is referred to the mining and reclamation plan for the Coal Hollow Mine (C0250005) and specifically to Appendix 7-16 (Petersen Hydrologic, 2015) of the Coal Hollow Mine MRP which provides an analysis of groundwater and surface-water systems in the region for supporting information for this document. The reader is also referred to the report of an alluvial valley floor field investigation that was previously conducted in the North Private Lease area by Petersen Hydrologic, LLC, Mt. Nebo Scientific, Inc, and Long Resource Consultants, Inc (Petersen Hydrologic, et al, 2012). That document provides additional geologic, hydrologic, and hydrogeologic information from the North Private Lease area and is available as Appendix 7-17 in Chapter 7 of the Coal Hollow Mine MRP.

2.0 METHODS OF STUDY

The methods of study utilized in this hydrogeologic investigation, including data collection methods and investigative techniques, are described below.

- Information from previous drilling activities in the North Private Lease area were obtained and reviewed. These include the following:

    - Drilling information from two wells drilled by Utah International, Inc. in 1985 and 1986 as part of a previous mine permitting action with the Utah Division of Oil, Gas and Mining. Information from these wells was obtained in hard-copy format from the Utah Division of Oil, Gas and Mining.

    - Drilling, potentiometric, and water quality information obtained during the drilling and construction of the 13 monitoring wells installed in the North Private Lease and adjacent area during 2012 and 2013.

  - Geologic information (geologic logs and laboratory physical and chemical testing of sediments) from a series of 8 boreholes drilled in the North Private Lease area during 2012 as part of coal exploration activities in the lease.

- As part of this investigation, thirteen 2-inch monitoring wells were installed in the alluvial sediments in the North Private Lease area during March of 2016. These wells were drilled by Grimshaw Drilling, LLC of Cedar City, Utah using mud rotary drilling techniques. An additional 4-inch well (CN3-81) was installed in the gravel-bearing alluvium for use in aquifer pump testing.

- Also as part of this investigation, four 1-inch direct-push piezometers were installed along the banks of Kanab Creek immediately down-gradient (south) of the North Private Lease area. These wells were installed by Clement Drilling and Geophysical of Cedar Hills, Utah.

- Monitoring well ground coordinates and collar elevations were determined by ACD personnel using survey-grade GPS. Elevations of the water surface along Kanab Creek were also surveyed by ACD personnel.

- Samples for water quality analysis were collected from selected monitoring wells for laboratory water quality analysis. Laboratory water quality measurements were performed by Chemtech-Ford Laboratories of Murray, Utah, which is a Utah state-certified analytical laboratory. Information on laboratory analytical methods is provided on the Chemtech-Ford laboratory reporting sheets in Attachment E.

- An aquifer pump test was performed in the alluvial groundwater systems in the North Private Lease area during the period from 27 April 2016 to 1 May 2016. The 4-inch well (CN3-81) was utilized for the pumping well, with a pumping period of 56 hours. Twenty-two surrounding wells were monitored as observation wells during the test. Antecedent and recovery data were also collected during the test. The well was continuously pumped during the 56 hour period at an average rate of approximately 28.8 gpm using a Grundfos RediFlow 3 submersible pump and gasoline powered electrical generator.

- Potentiometric levels in wells were monitored during the test using a Waterline Envirotech, Ltd. Model 150 tape, a Waterline Envirotech, Ltd. Model 500 coaxial water-level indicator, or a Geotech Environmental water level meter. Potentiometric data were also monitored at selected wells using pressure transducer/data logger units. Personnel from Alton Coal Development (Kirk Nichols) assisted with water level measurements during the early period of the pumping test.

- Discharge rates were measured periodically during the test using a stop-watch and a calibrated container. Discharge temperature, specific conductance, and pH of the water pumped from CN3-81 and also the water in Kanab Creek adjacent to the pumping test area were also measured periodically during the test. Temperature measurements were performed using a Taylor brand electronic digital thermometer. Specific conductance measurements were performed using a Hanna Instruments brand, model HI 98311conductivity meter with automatic temperature compensation. The instrument was calibrated using traceable ASTM conductivity standard solutions. The pH measurements were performed using a Hanna Instruments brand, model HI 98128 pH meter, which incorporates a double junction pH electrode and automatic temperature compensation. The instrument was calibrated using traceable ASTM pH standard solutions.

- The pump test data were analyzed using the most current version of the program Aqtesolv (2007; version 4.50.002) from HydroSOLVE, Inc.

- Modeling of the alluvial groundwater system in the North Private Lease was performed using the program THWELLS (1996) and the aquifer parameters determined from the 2016 aquifer pump test. THWELLS is an analytical model from the International Ground Water Modeling Center that models flow in a confined, leaky confined, or unconfined aquifer. The program calculates the drawdown or buildup of piezometric head in an aquifer due to the combined effect of discharge or recharge of up to 100 wells. The calculations of total drawdowns in the North Private Lease were accomplished using the Hantush-Jacob equation for isotropic, homogeneous aquifer of infinite extent in a semi-confined (leaky) aquifer.

3.0 PRESENTATION OF DATA

The location of the North Private Lease area is shown on Figure 1. A geologic map of the North Private Lease area is presented in Figure 2. Also shown on Figure 2 are locations of monitoring wells and geologic borings in the North Private Lease area. Spatial drawdown information (maximum pumping drawdown) from the alluvial groundwater pumping test is also plotted on Figure 2. Construction details and locations for monitoring wells completed during the 2016 alluvial drilling program are provided in Table 1. A summary of the results of the 2016 aquifer pump test is provided in Table 2. Relationships between groundwater elevations in monitoring wells adjacent to Kanab Creek and surface waters in the creek are provided in Table 3. Discharge rate and water quality data from pumping well CN3-81 and Kanab Creek adjacent to the pump test area are provided in Table 3. Geologic logs for boreholes drilled during the 2016 alluvial drilling program are provided in Attachment A. Aquifer pump test information, including time-drawdown plots and tabulations of water level readings for the pumping and observation wells are provided in Attachment B. Details of the Aqtesolv pumping test analysis are provided in Attachment C. Photographs from the North Private Lease area are provided in the Photographs Section in Attachment D. Field and laboratory water quality measurements from selected 2016 monitoring wells in the North Private Lease area are provided in Attachment E.

4.0 Pump Test Results

The pump test information, including antecedent water level trend data, water level observation data collected during the pumping and recovery periods, and pumping rate data were compiled and graphed for analysis (see Attachments B and C). Pertinent data were then analyzed using Aqtesolv software. During the Aqtesolv analysis, the water level time drawdown data were graphed using a log-log plot. The character of the drawdown and recovery curves were compared to typical diagnostic plots for groundwater systems existing under differing aquifer regimes. During the Aqtesolv analysis, it was apparent that the data best fit the type curves for a “leaky” or semi-confined groundwater system. This observation is consistent with the field observations of conditions in the groundwater system (i.e. a sequence of partially saturated, lower-permeability interbedded clays, silts, and sands overlying the generally coarser gravel-bearing system. Using the parameters and assumptions shown in Attachment C, aquifer parameters were determined as shown on Table 2. It is noteworthy that the value of hydraulic conductivity determined in this test (5.88×10^{-3} cm/sec) is of similar magnitude to the value previously obtained by Utah International during testing at nearby well Y-103 (8.99×10^{-3} cm/sec).

An additional purpose of the pump test was to determine whether there is hydraulic communication between the various portions of the gravel-bearing zone in the North Private Lease area. It was noteworthy that a rapid response to the pumping at well CN3-81 was identified at well CN4-49 (more than 1.4 feet of drawdown), which is located 508 feet east of CN3-81 on the opposite side of Kanab Creek. It was also notable that a small but apparently related response to the pumping at CN3-81 was observed at well CN1-58, which is located 1,150 feet north of pumping well CN3-81. The muted response at this well apparently commenced after only a few minutes of pumping. It should be noted that at some of the more distant observation wells there were minor observable changes in water levels over time during the pump test, but the changes did not appear to be related to pumping at CN3-81. Rather, these changes appeared to more likely be associated with natural variability in water levels that occurred independent of the pumping (see Attachment B).

The hydraulic gradient measured in the vicinity of the pumping well prior to the start of the pump test was relatively flat (0.004) with a flow direction toward the east south-east.

It should be noted that the field water quality parameters (temperature, pH, and specific conductance) were monitored in the pumped groundwater periodically during the pump test. Pumping rates at CN3-81 were also monitored during the test (Table 4). These parameters did not change appreciably during the test. Field water quality parameters were also measured in Kanab Creek during the pump test (Table 4). The field water quality parameters measured in these two locations (alluvial groundwater at CN3-81 and Kanab Creek) are substantially different from each other. No trends in field water quality parameters were identified in groundwater from CN3-81 that would suggest a changing source of water over time during the test.

5.0 Groundwater Modeling

Groundwater modeling in the North Private Lease area was performed as part of this investigation to evaluate the relationship between groundwater withdrawals (and potentially groundwater injection) and changes to the hydraulic head in the alluvial groundwater system in and adjacent to proposed mining areas.

The data used in the groundwater modeling activities include information on the aquifer properties (water levels and subsurface stratigraphy) gained during the 2016 drilling and monitoring well installation program and also from several previous drilling activities in the North Private Lease area, and information regarding the aquifer characteristics (transmissivity, storage coefficient, etc.) determined from the 2016 aquifer pump test.

The THWELLS (1996) analytical groundwater modeling program, which supports the analysis of groundwater systems existing under semi-confined (leaky) groundwater conditions using the Hantush-Jacob equation, was selected for use in this groundwater modeling investigation.

The areas of focus for the groundwater modeling activities presented in this report include regions where proposed surface mining pits will be created in proximity to Kanab Creek and its associated alluvial groundwater systems. Generally, the sediments encountered in regions of the North Private Lease area that are more distant from Kanab Creek have been found to consist primarily of lower permeability clays, silts, and sands. Large groundwater flows are not anticipated to occur where these types of sediments dominate in mining areas. It should be noted that the THWELLS model used in this investigation can be utilized in the future to evaluate groundwater systems and proposed mining-related activities in other portions of the mine area as necessary.

Modeling of potential stream depletion was not performed as part of this investigation because the results of the 2016 pump testing did not indicate a strong hydraulic connection between the gravel-bearing alluvial groundwater system and the Kanab Creek surface water system in the proximity of the aquifer testing location.

In order to evaluate the relationship between potential groundwater withdrawals in the vicinity of the easternmost mine pit areas west of Kanab Creek (CN3-81 area), a series of three modeling simulations was performed. The results of modeling of these groundwater extraction scenarios are shown graphically on Figures 3, 4, and 5 and summarized in Attachment F. In each scenario, groundwater is extracted from the alluvial groundwater system using a series of eleven hypothetical production wells oriented in a north-south orientation and spaced 100 feet apart. The groundwater extraction simulated in these modeling scenarios could represent a north-south trending surface mining pit 1,000 feet in length into which groundwater flows, or a north-south oriented 1,000-foot array of wells from which groundwater is pumped from the alluvial aquifer at the specified rate.

In the first modeled scenario, groundwater is produced at a constant rate of 30 gpm from each of the 11 wells for a combined extraction rate of 330 gpm (0.74 cfs). For the second simulation, the extraction rate for each well was increased to 50 gpm, for a combined extraction rate of 550 gpm (1.26 cfs). For the third simulation, the extraction rate for each well was increased to 75 gpm, for a combined extraction rate of 825 gpm (1.84 cfs). In each scenario, the pumping time was set at 10 days. However, it was apparent during the modeling sensitivity studies performed as part of this study that the water level drawdowns reached approximate stabilization in less than 1 day.

From these scenarios it is apparent that appreciable drawdown of the alluvial aquifer can likely occur under even moderate pumping rates. Under scenario 1, pumping the eleven wells at a rate of 30 gpm each produced a rapid drawdown of more than 20 feet in a zone that is up to approximately 450 feet wide along the 1,000-foot long, north-south trending line of wells. Also under scenario 1, a zone of drawdown greater than 30 feet is present that is about 75 feet wide (Figure 3). Under the second scenario, a zone of groundwater drawdown greater than 30 feet is present that is up to about 500 feet wide, with a zone of drawdown greater than 40 feet that is about 200 feet wide (Figure 4). Under scenario 3, a zone of drawdown of more than 50 feet is projected in an area that is up to more than 400 feet wide (Figure 5).

It should be noted that per the Utah R645 mining rules and the proposed mining plan for the North Private Lease, backfilling of mine pit areas will be constantly occurring as mining progresses. For these reasons, the typical maximum expected length of open highwall along the eastern margin of the pit would be on the order of two pits, or around 450-600 feet, which is on the order of half the length of the simulated groundwater extraction areas modeled in the three scenarios discussed above.

These simulations demonstrate that extraction of groundwater from the gravel-bearing alluvial groundwater systems near Kanab Creek can produce appreciable drawdowns in the aquifer (such extractions could be associated with mine dewatering and/or gravity inflow of groundwater into the mine pits in the North Private Lease area).

Gravity groundwater drainage to mine pit areas

The general magnitude of gravity groundwater drainage into the mine pit area can be projected using Darcy's Law which is given as:

$$Q=KIA$$

Where "Q" is the discharge, "K" is the hydraulic conductivity, and "I" is the hydraulic gradient. Based on this equation, the projected discharge into the mine pit areas from the gravel-bearing alluvial zone (per 100 linear feet of exposed highwall with a 40 foot saturated thickness) may be calculated using values for these parameters as determined during the 2016 drilling, monitoring well installation, and pump testing programs as follows:

- K = 16.67 ft/day (Measured in the gravel-bearing zone near well CN3-81 during 2016 aquifer testing).
- I = 0.10 (It is noted that the hydraulic gradient in the undisturbed system measured in May 2016 was much (25 times) lower at 0.004, but the local gradient near the proposed mine highwall areas is expected to increase appreciably with a corresponding initial surge of groundwater when the gravel-bearing zone is first exposed in the mine pit highwalls. Therefore, the conservative value of 0.10 has been utilized in this evaluation. Over the longer term, the hydraulic gradients in more distant portions of the alluvial aquifer away from the proposed mine pit areas [that would be the source of potential ongoing groundwater inflow to the mine pits over longer periods of time] – would likely be lower, likely resulting in lower groundwater inflow rates over time).
- A = 400 ft^2 (100 linear feet of highwall length multiplied by thickness of the gravel-bearing zone in easternmost highwall area [CN3-81 area] of about 40 feet).

Thus, using these assumptions, a discharge (Q) of 6667 ft^3/day or 35 gpm per 100 linear feet of exposed highwall is projected. Note that if a lower hydraulic gradient was present, the calculated discharge into the pits would be proportionally lower (i.e. a gradient of 0.01 would yield a flow of one-tenth that predicted for a gradient of 0.10). It is anticipated that in areas outside the gravel-bearing alluvial zone, where lower permeability sediments dominate, inflows to the mine pits will likely be less than the amount in areas where the gravel-bearing zone is exposed.

It is important to note that Darcy's Law is directly applicable where there is constant flow in a confined, homogeneous aquifer of uniform thickness. In the North Private Lease area, the gravel-bearing alluvial zone is known to be variable in thickness, lithologic character, and spatial extent. For these reasons, the magnitude of the groundwater inflow projected above should be considered approximate – as based on the best information available at the time of this investigation.

If water were allowed to flow into the mine pits at large flow rates for a prolonged time, it is likely that the amount of groundwater extracted could become large relative to the amount of groundwater locally held in storage in the groundwater system, resulting in decreased hydraulic heads and possibly saturated thicknesses in the vicinity of the mine. However, the mine plan for the North Private Lease does not anticipate individual pits being left open for long periods of time and thus, this occurrence is not anticipated.

6.0 Observations

During drilling activities in the North Private Lease area, two principle hydrostratigraphic zones were identified in the alluvial system. The upper stratigraphy commonly exists primarily of interbedded clays, silts, and sands with caliche being present in some locations in the shallow subsurface. In areas where it is present, a gravel-bearing zone of fluvial origin was identified beneath the finer-grained overlying sediments. The gravel-bearing zone was identified previously during drilling activities by Utah International (1987) during the drilling of monitoring well Y-101. The approximate extent of this gravel-bearing zone as identified in available borehole data is shown on Figure 2. It is apparent that the gravel-bearing zone is generally situated near the present location of Kanab Creek and pinches out to the west (and likely also to the east). It should be noted that based on the drilling technique utilized (mud rotary), it is sometimes difficult to discriminate between a relatively clean gravel deposit and one in which the gravel is supported in a matrix of finer grained deposits (i.e. sands, silts, and clays). This is because the cuttings from the finer-grained deposits are commonly mixed in with the circulating drilling mud during drilling, which can make these fractions difficult to identify and quantify in the drill cutting returns. Additionally, larger clasts of gravel or boulders are commonly ground up during the rotary drilling operations making the identification of the presence of these larger rocks in the subsurface difficult. Accordingly, the gravel-bearing zone should be considered a zone in which a substantial portion of the material present is comprised of gravel – with varying (but not quantified) proportions of intermixed finer-grained deposits. It is noted that attempts were made to drill through the alluvial deposits at the North Private Lease using only air, or only water with little drilling mud, but these attempts were unsuccessful.

As noted in Table 2, the hydraulic conductivity of the gravel-bearing hydrostratigraphic unit as determined from the 2016 pumping test (16.67 ft/day or 5.88×10^{-3} cm/sec) is in the range of a typical clean sand or the upper range of silty sand (Freeze and Cherry, 1979). This finding would suggest that the gravels present in the gravel-bearing zone are likely supported in a matrix of finer grained deposits (sands or silty sands). This conclusion is consistent with field observations of the gravel deposits present in the stream banks adjacent to Kanab Creek in the pump test area (see Photographs Section Attachment D). It is notable that where observable in these locations the gravel and boulder clasts are generally supported in a matrix of finer-grained silts, sands, and clays.

It is noted that a marked and rapid response in water levels measured in well CN4-49 occurred during the pumping test in response to pumping at CN3-81, with drawdowns of up to 1.41 feet (Attachment B). No similar characteristic response to the pumping was identified in monitoring well NLP-4, which is screened in the stream gravels immediately adjacent to Kanab Creek. This observation is supportive of the conclusion that the groundwater in the deeper alluvial gravel-bearing zone exists under semi-confined conditions and that the gravel-bearing zone is not in strong, immediate hydraulic communication with surface waters in Kanab Creek. If this were the case, it would be anticipated that appreciable groundwater drawdowns would not be noted on the other side of the creek because surface waters would recharge the zone and prevent appreciable drawdowns on the other side of the creek from occurring (i.e. a constant head boundary).

Observations of water levels in monitoring wells NLP-4, NLP-5, and NLP-11 relative to surface water levels in Kanab Creek at adjacent locations are also supportive of the conclusion that Kanab Creek is not in strong, immediate hydraulic communication with the deeper gravel-bearing horizon in those locations. As noted in Table 5, water levels in those monitoring wells are lower at each location than the local elevation of the Kanab Creek water surface (with differences ranging from 1.48 to 3.08 feet). Notably at well locations NLP-4 and NLP-5 Kanab Creek is situated less than about 30 feet from the wells. This information suggests that Kanab Creek is at least somewhat perched above the alluvial groundwater system in which the monitoring wells are completed. The perched condition is likely attributable to the presence of interbedded low-permeability silty or clayey strata between the bottom of the creek bed and the underlying alluvial groundwater system. Visual observations also suggest the common presence of an apparent low-permeability skin on the Kanab Creek stream channel substrate. While rocks and boulders are commonly present in the stream channel, surrounding deposits of clays and silts are usually present in the channel bed and bank (see Photographs Section Attachment D), which may decrease the hydraulic connection with underlying groundwater alluvial sediments.

7.0 REFERENCES CITED

Aqtesolve for Windows, 2007, Version 4.50.002, Computer software for aquifer analysis, Glenn M. Duffield, Hydrosolve, Inc.

Freeze, R.A., and Cherry, J.C., 1979, Groundwater, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 604 p.

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Petersen Hydrologic, 2015, Probable Hydrologic Consequences of Mining in the North Private Lease area at the Alton Coal Development, LLC Coal Hollow Mine, Unpublished consulting report for Alton Coal Development, LLC, Cedar City, Utah.

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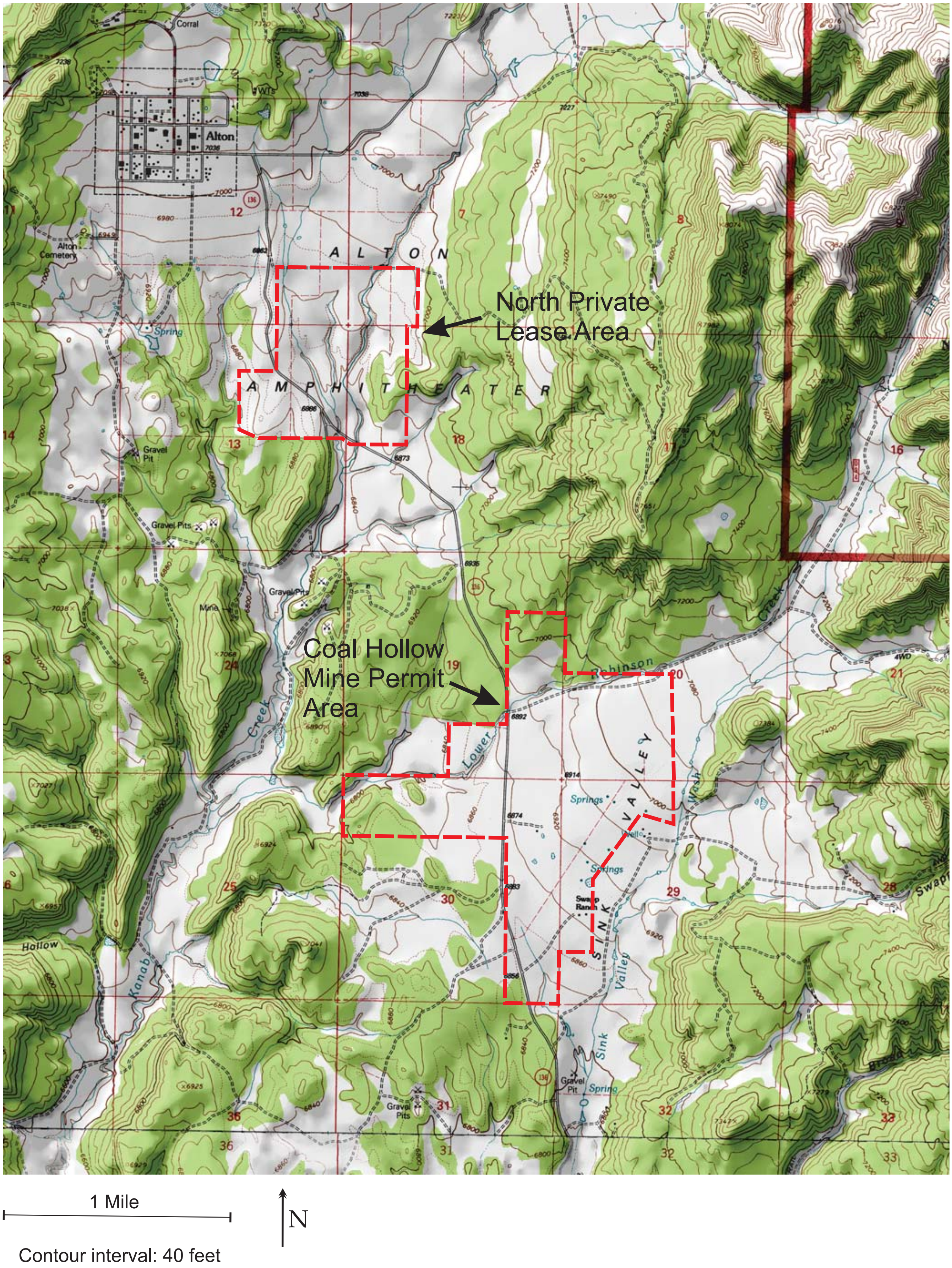
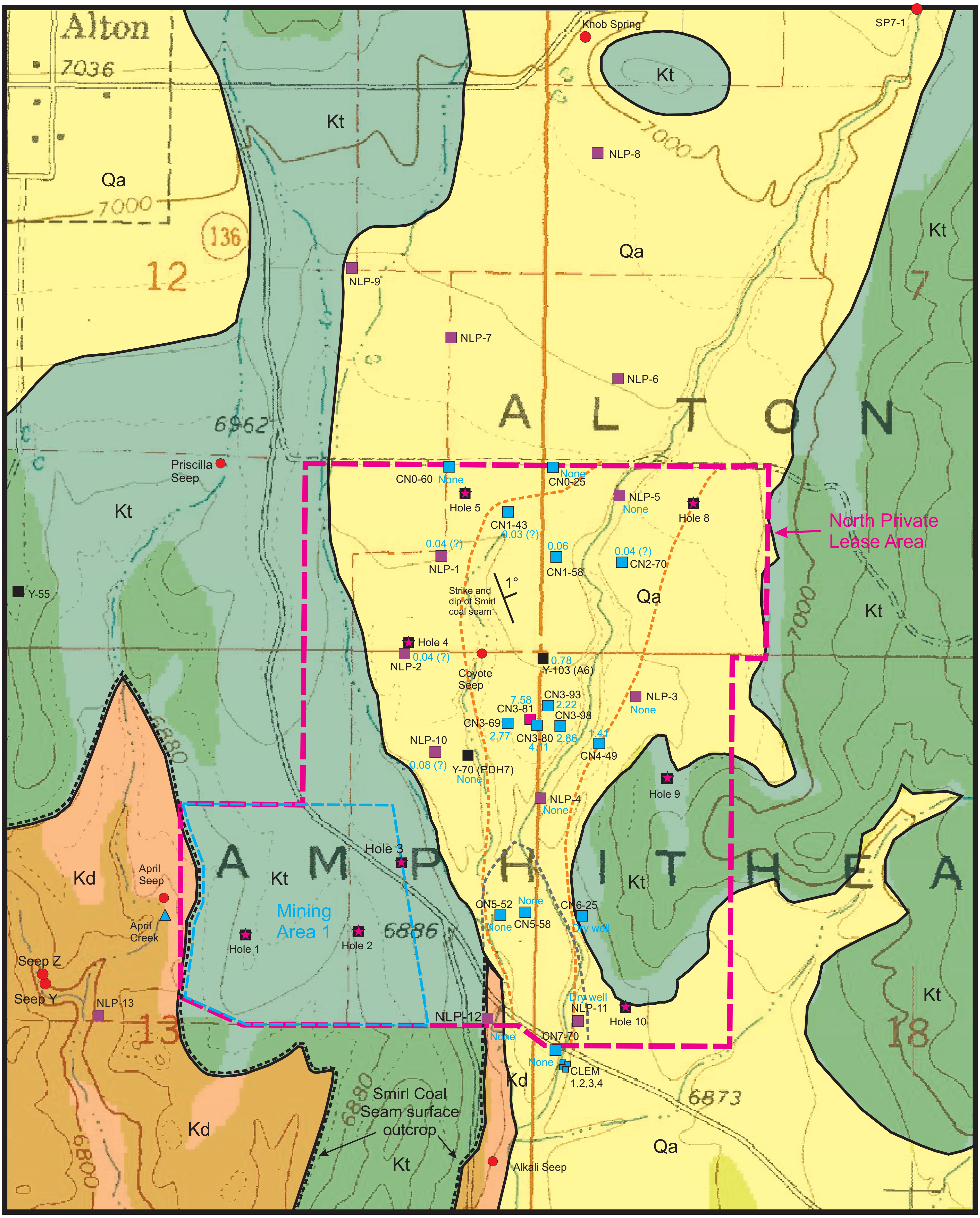


Figure 1 Location of the North Private Lease area at the Coal Hollow Mine.



Information sources: Tilton (2001)
Erik Petersen P.G.
Petersen Hydrologic, LLC

North

0 500 1,000
feet

Contour interval: 40 feet

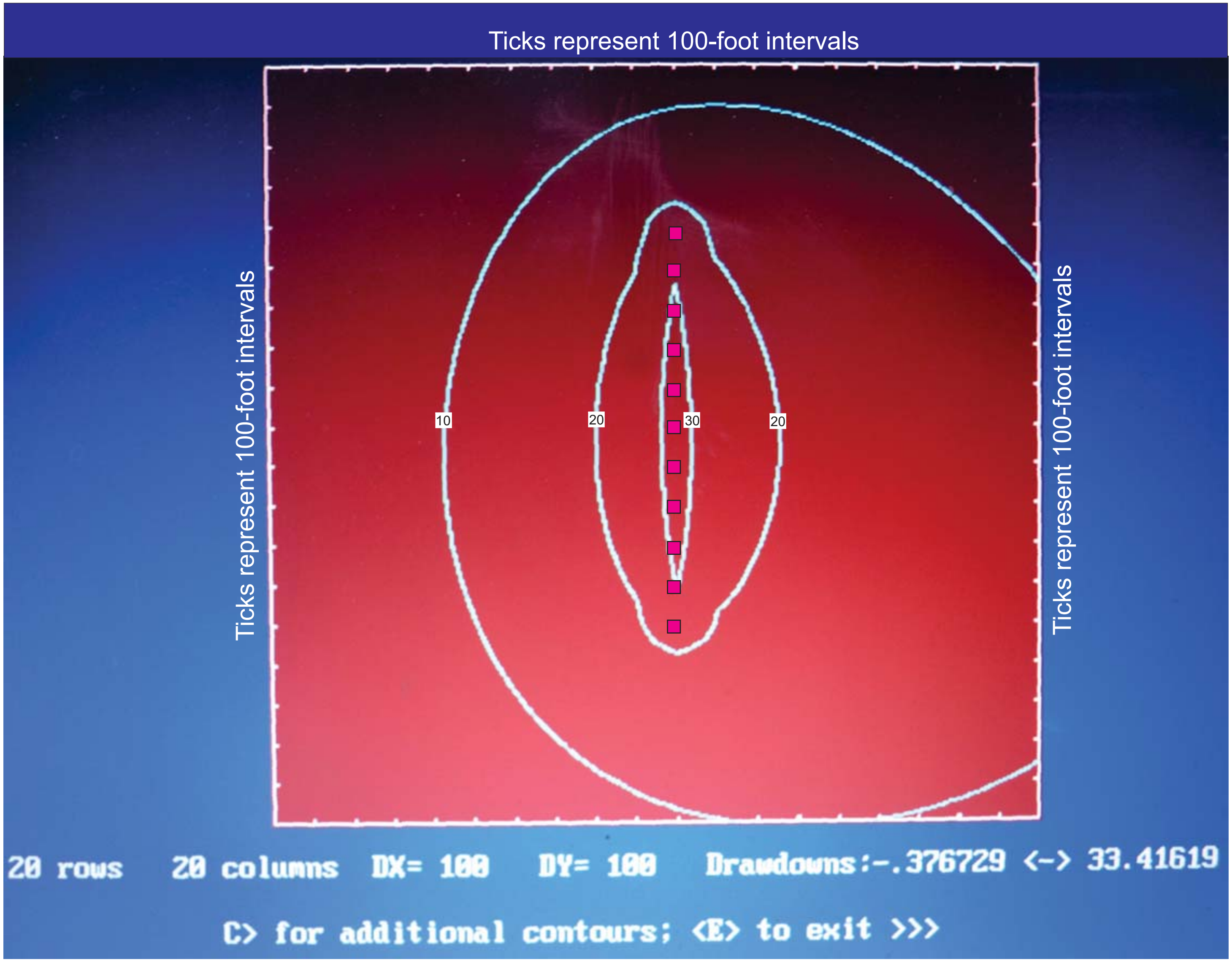
Quaternary alluvium
Tropic Shale (Cretaceous)
Dakota Formation (Cretaceous)

Smirl Coal Seam surface outcrop
Smirl Coal Seam projected subsurface
Approximate extent of fluvial gravel zone within lease area

2016 monitoring well
2016 4-inch pumping well
Direct push well
UII monitoring well
2012 Exploration boring

0.78 Maximum well drawdown - 29 April 2016 test

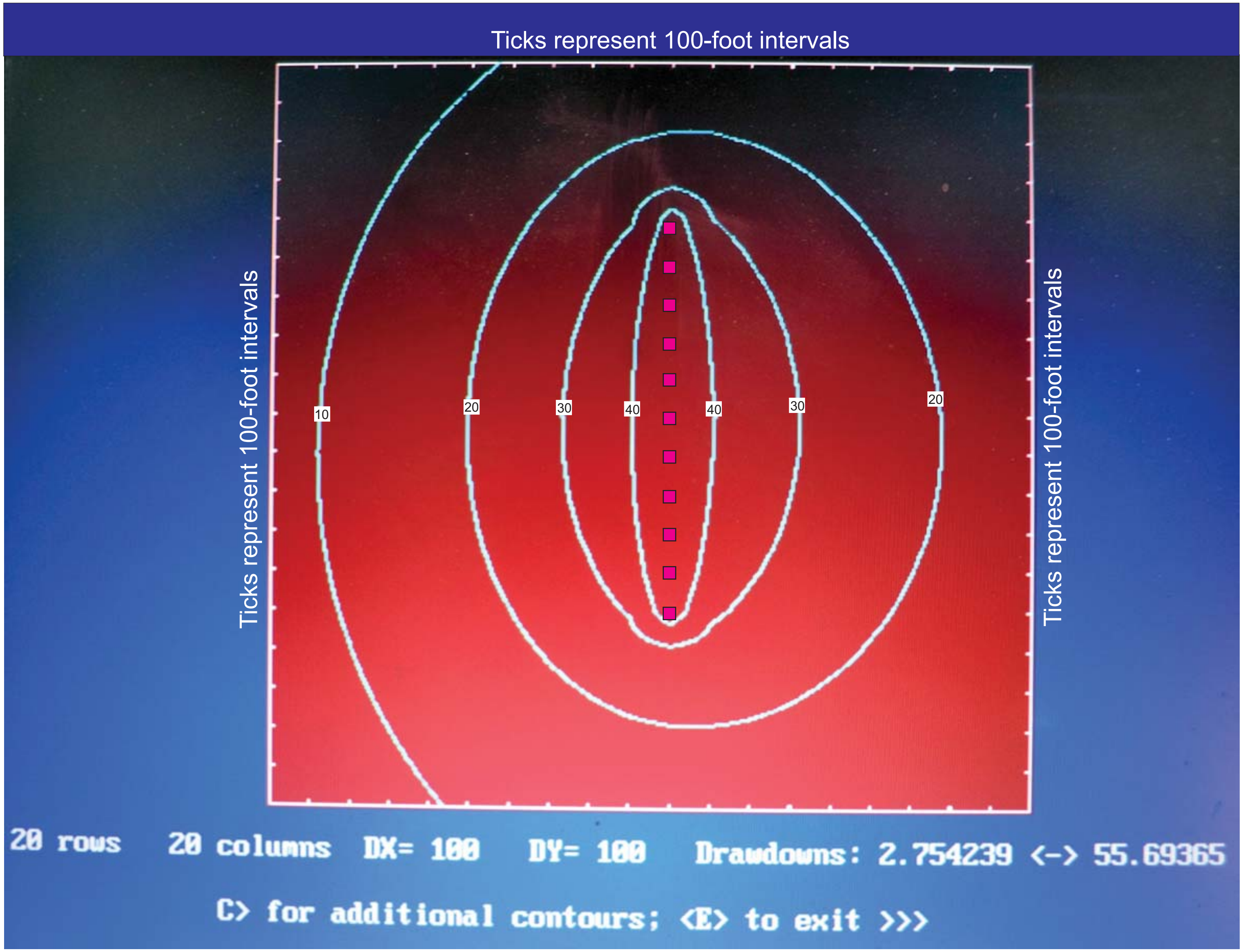
Figure 2 Geologic map of North Private Lease area with monitoring well and geologic boring locations. Also shown are maximum drawdowns from 2016 alluvial groundwater pump test.



PUMPING SCENARIO 1:
Number of pumping wells: 11
Pumping well spacing: 100 feet
Pumping rate: 30 gpm (per well)

Pumping well
Drawdown (feet)

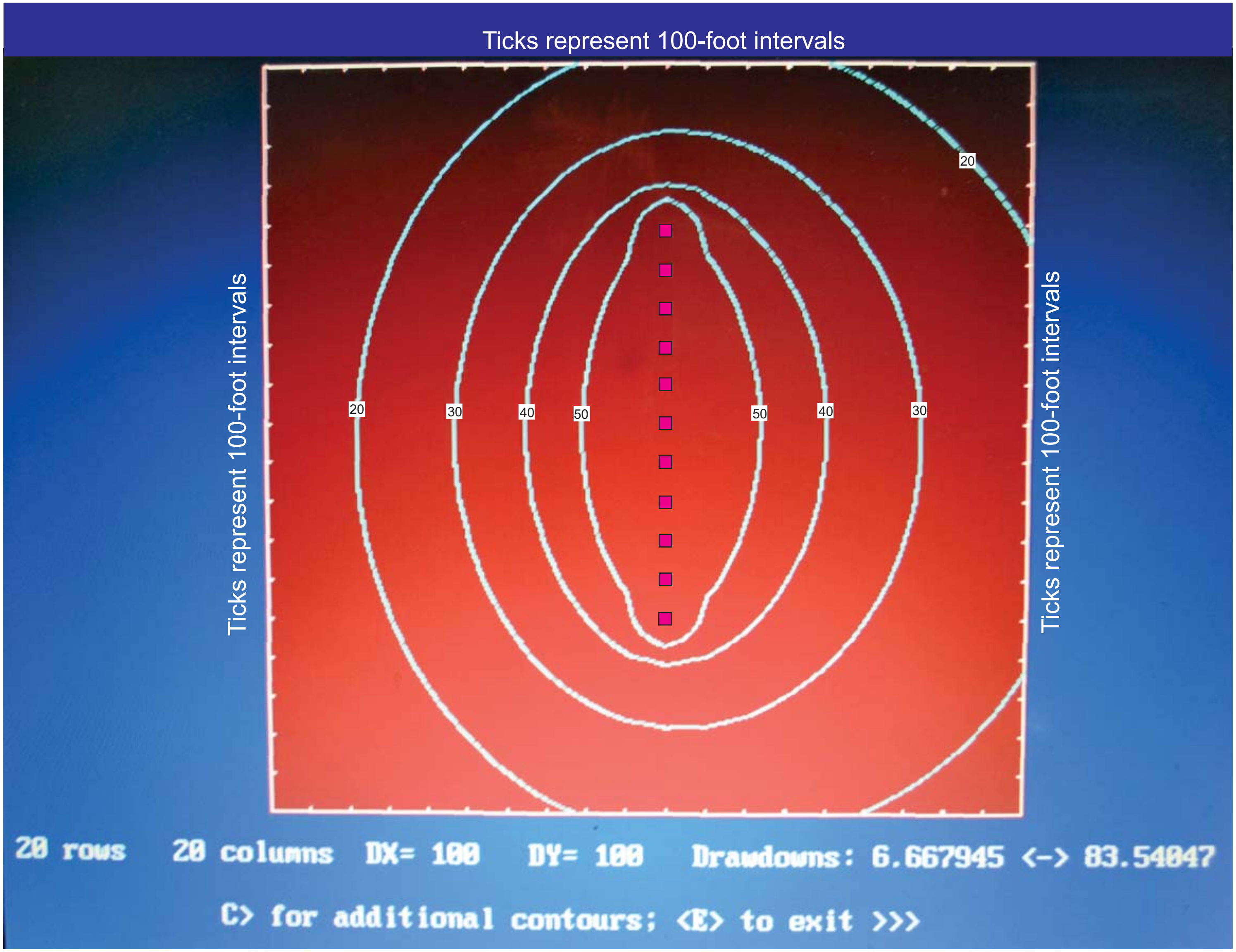
Figure 3 Modeled alluvial aquifer drawdown under pumping scenario 1.



PUMPING SCENARIO 2:
Number of pumping wells: 11
Pumping well spacing: 100 feet
Pumping rate: 50 gpm (each well)

Pumping well
10 Drawdown (feet)

Figure 4 Modeled alluvial aquifer drawdown under pumping scenario 2.



PUMPING SCENARIO 3:
Number of pumping wells: 11
Pumping well spacing: 100 feet
Pumping rate: 75 gpm (each well)

Pumping well
10 Drawdown (feet)

Figure 5 Modeled alluvial aquifer drawdown under pumping scenario 3.

Table 1 Construction details for for 2016 monitoring wells in the North Private Lease area.

Well ID	Alt. ID	Location UTM NAD 27 (Hand held GPS)		Date drilled	Borehole diameter	Drilling type	Total borehole depth (ft.)	Casing type	Bottom blank length (ft.)	Screen type	Screen length (ft.)	Screen diameter	Screen bottom (ft.)	Screen top (ft.)	Gravel type	Gravel bottom (ft.)	Gravel top (ft.)	Plug bottom (ft.)	Plug top (ft.)
CN0-60	CN0-1	370185	4143447	15-Mar-16	6.125-inch	mud rotary	86	2-inch sch 80	26	Hand slotted, 1/8 - inch slot	30	2-inch	60	30	pea gravel 3/8 -	86	30	30	0
CN0-25	CN0-2	369968	4143451	14-Mar-16	6.25-inch	mud rotary	56	2-inch sch 80	13	Hand slotted, 1/8 - inch slot	20	2-inch	25	15	pea gravel 3/8 -	56	15	15	0
CN1-58	CN1-1	370191	4143257	7-Mar-16	6.25-inch	mud rotary	68	2-inch sch 80	10	Hand slotted, 1/8 - inch slot	20	2-inch	58	38	pea gravel 3/8 -	68	34	34	0
CN1-43	CN1-2	370090	4143355	14-Mar-16	6.25-inch	mud rotary	56	2-inch sch 80	13	Hand slotted, 1/8 - inch slot	20	2-inch	43	23	pea gravel 3/8 -	43	22	22	0
CN2-70	CN2-1	370335	4143248	18-Mar-16	6.25-inch	mud rotary	115	2-inch sch 80	30	Hand slotted, 1/8 - inch slot	40	2-inch	70	30	pea gravel 3/8 -	100	29	20	0
CN3-98	CN3-1	370200	4142900	3-Mar-16	6.25-inch	mud rotary	108	2-inch sch 80	10	Hand slotted, 1/8 - inch slot	30	2-inch	98	68	pea gravel 3/8 -	98	42	42	0
CN3-69	CN3-2	370088	4142905	8-Mar-16	6.25-inch	mud rotary	83	2-inch sch 80	10	Hand slotted, 1/8 - inch slot	30	2-inch	69	39	pea gravel 3/8 -	79	38	38	0
CN3-80	CN3-3	370151	4142903	9-Mar-16	6.25-inch	mud rotary	83	2-inch sch 80	0	Hand slotted, 1/8 - inch slot	40	2-inch	80	40	pea gravel 3/8 -	80	39	39	0
CN3-93	CN3-4	370175	4142942	10-Mar-16	6.25-inch	mud rotary	108	2-inch sch 80	10	Hand slotted, 1/8 - inch slot	40	2-inch	93	53	pea gravel 3/8 -	93	52	52	0
CN3-81	CN3-5	370134	4142913	24-Mar-16	7.875-inch	mud rotary	84	4-inch sch 40	0	Hand slotted, 1/8 - inch slot	40	4-inch	81	41	pea gravel 3/8 -	81	40	40	0
CN4-49	CN4-1	370285	4142864	21-Mar-16	6.25-inch	mud rotary	59	2-inch sch 80	5	Hand slotted, 1/8 - inch slot	20	2-inch	49	29	pea gravel 3/8 -	59	25	25	0
CN5-58	CN5-1	370122	4142503	1-Mar-16	6.125-inch	mud rotary	63	2-inch sch 80	0	20 slot machine	30	2-inch	58	28	Pea gravel 3/8 -	58	28	28	0
CN5-52	CN5-2	370069	4142496	2-Mar-16	5.875-inch	mud rotary	63	2-inch sch 80	0	Hand slotted, 1/8 - inch slot	20	2-inch	52	32	Pea gravel 3/8 -	52	31	31	0
CN6-25	CN6-1	370250	4142495	22-Mar-16	6.25-inch	mud rotary	28	2-inch sch 80	3	Hand slotted, 1/8 - inch slot	15	2-inch	25	10	pea gravel 3/8 -	28	10	10	0
CN7-70	CN7-1	370184	4142207	16-Mar-16	6.25-inch	mud rotary	76	2-inch sch 80	0	Hand slotted, 1/8 - inch slot	30	2-inch	70	40	pea gravel 3/8 -	70	39	39	0
Clem 1	Hole 1	370214	4142181	14-Mar-16	6.25-inch	Direct push	32	1-inch pvc	0	Size 10 slot pvc	20	1-inch	28	8	10-20 Silica sand	28	6	6	0
Clem 2	Hole 2	370208	4142171	15-Mar-16	6.25-inch	Direct push	28	1-inch pvc	0	Size 10 slot pvc	20	1-inch	28	8	10-20 Silica sand	28	5	5	0
Clem 3	Hole 3	370200	4142177	15-Mar-16	6.25-inch	Direct push	28	1-inch pvc	0	Size 10 slot pvc	20	1-inch	27	7	10-20 Silica sand	27	5	5	0
Clem 4	Hole 4	370202	4142185	15-Mar-16	6.25-inch	Direct push	28	1-inch pvc	0	Size 10 slot pvc	20	1-inch	27.5	7.5	10-20 Silica sand	27.5	5	5	0

Table 2 Aquifer parameters determined in the 2016 pump test in the North Private Lease area.

(see Attachments A, B, and C for additional testing details)

Primary gravel-bearing zone (CN3-81 area)

Aquifer model: Leaky aquifer (semi-confined)
(pumping well with two observation wells)

Solution method: Hantush-Jacob

$T = 667\ ft^2/day$
$b = 40$ feet
$S = 1.599 \times 10^{-4}$ (unitless parameter)
$K = 16.67$ ft/day
   $= 5.881 \times 10^{-3}$ cm/sec

Tropic Shale
Not sufficiently transmissive for testing (produced no water)
K = very low

Table 3 Kanab Creek surface water - alluvial groundwater relationships in North Private Lease area.

	Data collected on 31 May 2016			
	Stream water surface elevation adjacent to well (feet)	Groundwater elevation in monitoring well (feet)	Ground elevation at well location (feet)	Water elevation separation (feet)
NLP-4 area	6869.44	6867.96	6871	-1.48
NLP-5 area	6917.47	6914.39	6921	-3.08
NLP-11 area	6836.25	6833.39	6862	-2.86

Table 4 Discharge rate and water quality data from water pumped from CN3-81 and sampled from Kanab Creek during pumping test.

Date	Time	Q (gpm)	T (°C)	pH (S.U.)	Sp. conductance (µS/cm)
CN3-81 (pumping well)					
29-Mar-16	10:30	29.5	---	---	---
29-Mar-16	10:38	28.1	---	---	---
29-Mar-16	12:02	26.7	---	7.15	2,156
29-Mar-16	12:34	28.3	---	---	---
29-Mar-16	11:56	28.5	---	---	---
29-Mar-16	13:09	28.8	---	---	---
29-Mar-16	13:45	---	---	6.97	2,161
29-Mar-16	15:35	29.0	11.2	7.04	2,157
29-Mar-16	18:30	29.0	11.2	7.00	2,145
29-Mar-16	20:45	28.8	11.2	7.01	2,148
30-Apr-16	0:36	29.4	11.2	7.00	2,172
30-Apr-16	7:30	28.9	11.1	6.93	2,170
30-Apr-16	9:51	29.5	---	---	---
30-Apr-16	16:00	28.8	11.2	7.02	2,175
30-Apr-16	16:20	29.0	---	---	---
30-Apr-16	22:00	29.7	11.2	7.02	2,161
1-May-16	9:20	28.9	11.2	7.04	2,194
1-May-16	13:21	28.7	11.2	7.07	2,174
1-May-16	18:15	29.2	11.2	7.06	2,175
Kanab Creek at SW-4					
30-Apr-16	8:56	---	6.2	8.56	895
1-May-16	11:30	---	9	8.68	905

Attachment A

Geologic logs for 2016 boreholes

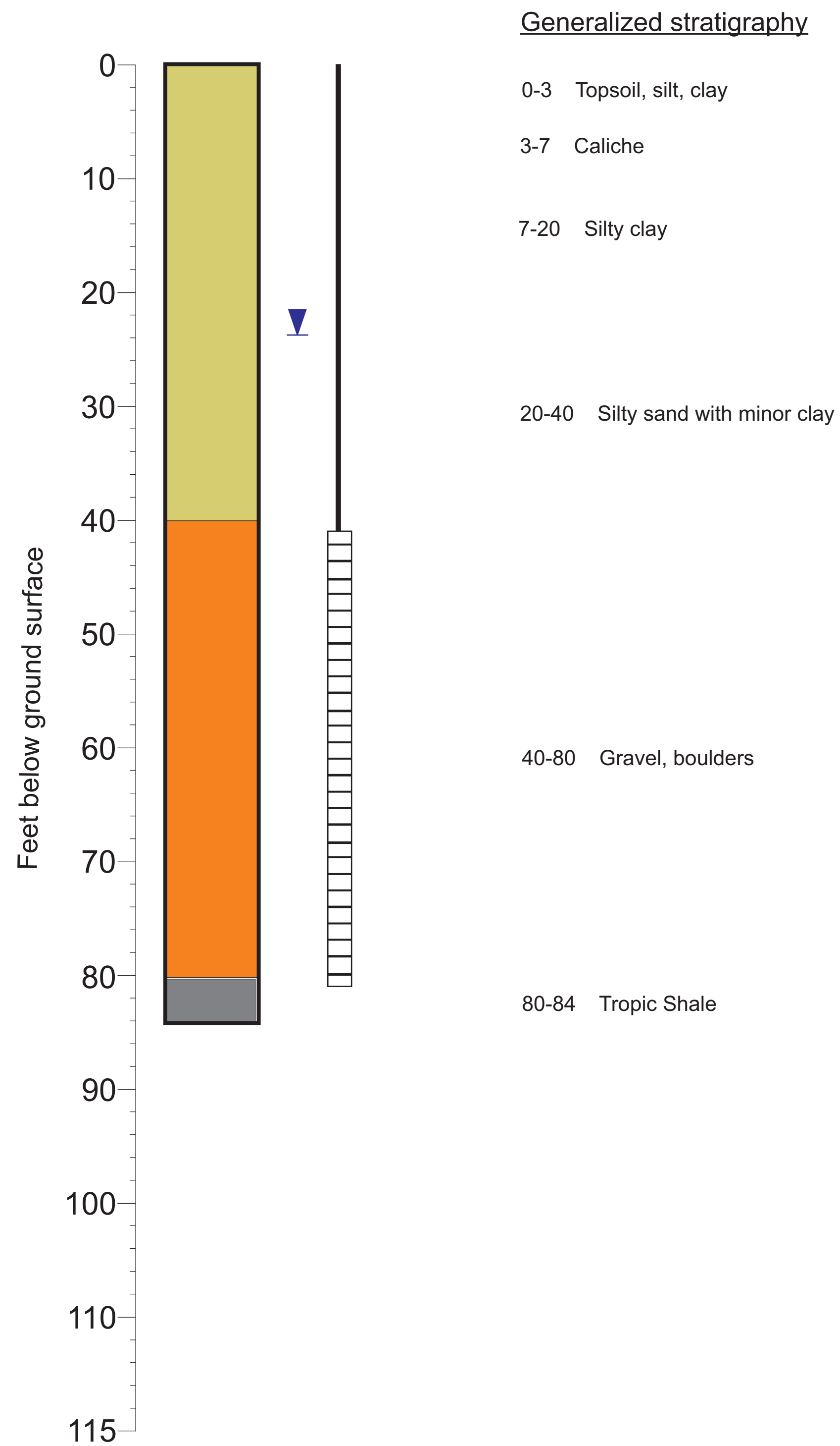
In the North Private Lease area

(and UII well Y-103)

(Listed in order of increasing distance from pumping well CN3-81)

Listing of 2016 Geologic Logs

Well ID
CN3-81
CN3-80
CN3-93
CN3-69
CN3-98
Y-103
CN4-49
CN1-58
CN2-70
CN5-58
CN5-52
CN1-43
CN0-25
CN0-60
CN7-70



Well ID: CN3-81 (CN3-5)

Location: 1764206, 364102 ft.
Collar elevation: 6910.80 ft.
Date constructed: 24 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 41-81 ft.
Well casing diameter: 4-inch
Borehole diameter: 7.875-inch
Casing stick-up: 1.67 ft.

Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

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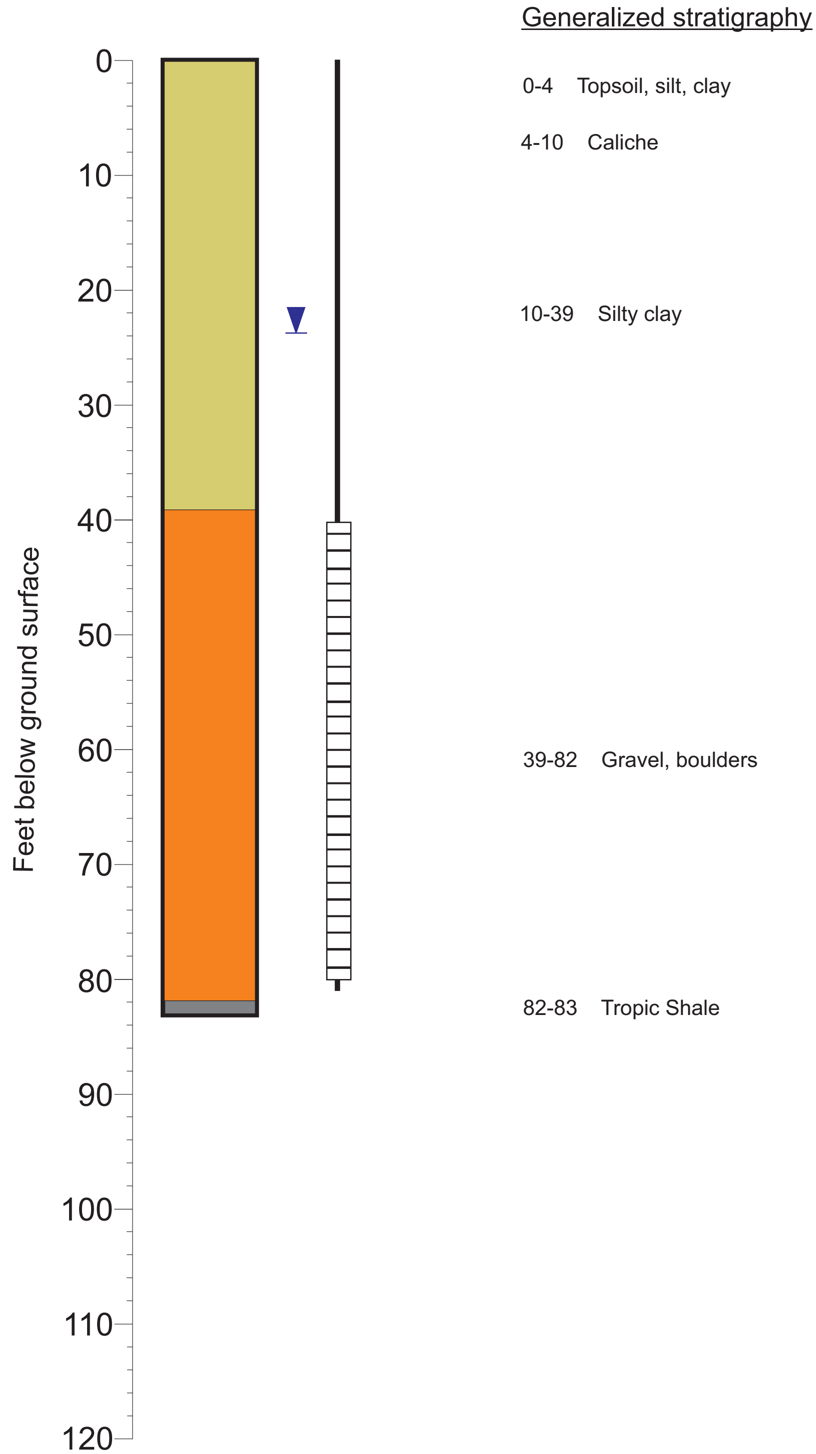
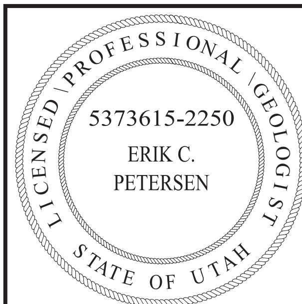
Alton Coal Development, LLC
Coal Hollow Mine





Well ID: CN3-80 (CN3-3)

Location: 1764246, 364066 ft.
Collar elevation: 6910.29 ft.
Date constructed: 9 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 40-80 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.67 ft.

Screened interval

Hydrostratigraphic unit
Clay/silt/sand
Gravel (mixed matrix)
Tropic Shale
Water level (March 2016)

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Consultants in Hydrogeology

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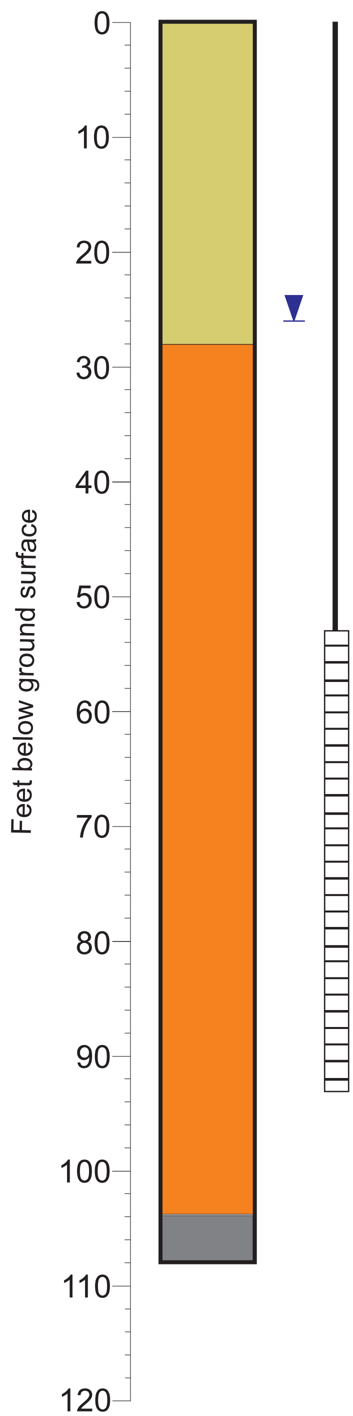

Generalized stratigraphy

0-3 Soil, clayey silt

3-7 Caliche

7-28 Clay, silty clay

28-74 Gravel

74-75 Clay

75-104 Gravel

104-108 Tropic Shale
(top of coal at 108)

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Well ID: CN3-93 (CN3-4)

Location: 1764325, 364201 ft.
Collar elevation: 6912.34 ft.
Date constructed: 10 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 53-93 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.42 ft.

Screened interval

Hydrostratigraphic unit

Clay/silt/sand
Gravel (mixed matrix)
Tropic Shale
Water level (March 2016)

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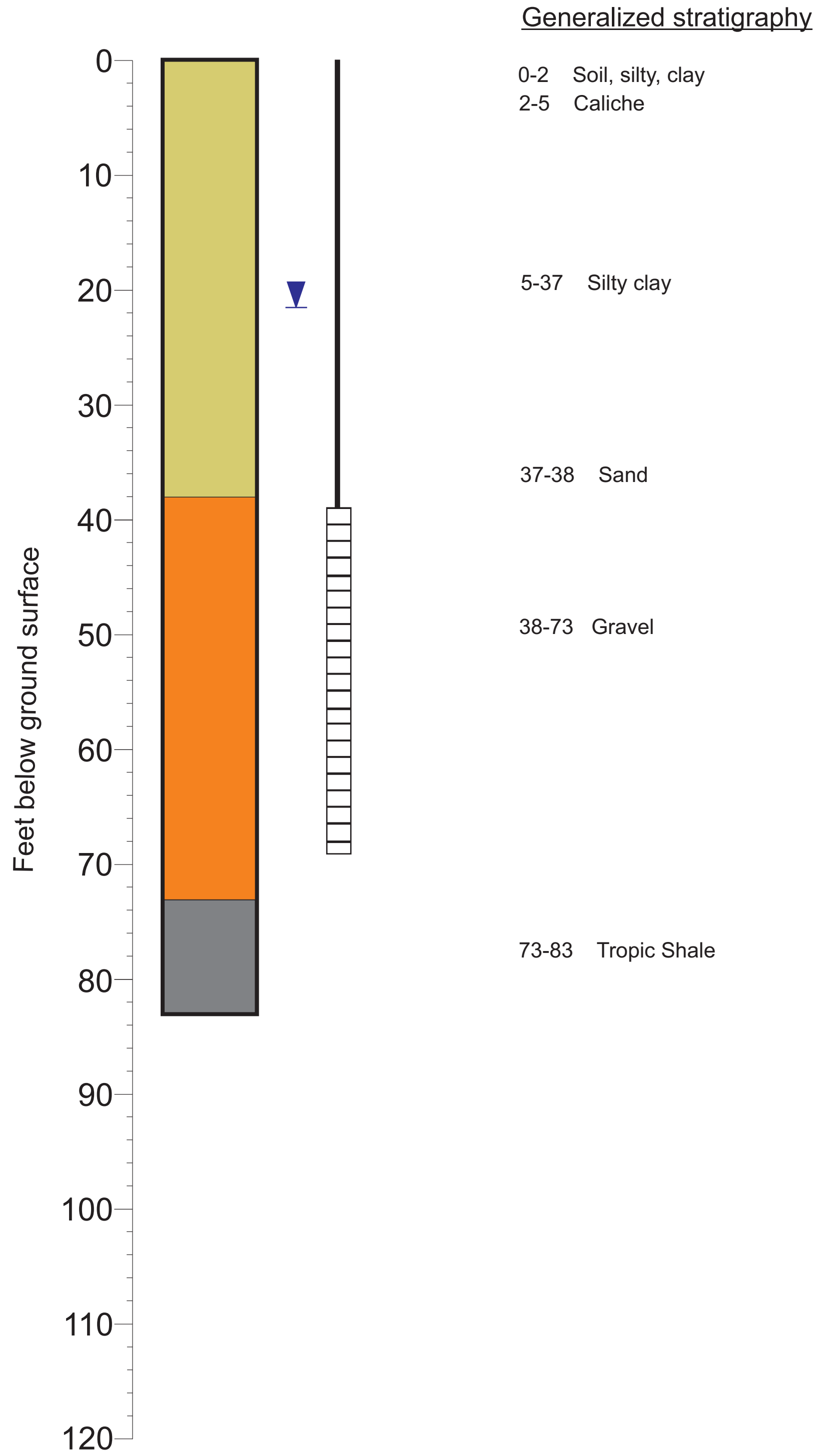
Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



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STATE OF UTAH

Well ID: CN3-69 (CN3-2)

Location: 1764043, 364077 ft.
Collar elevation: 6907.54 ft.
Date constructed: 8 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 39-69 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 0.38 ft.

Screened interval

Hydrostratigraphic unit
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

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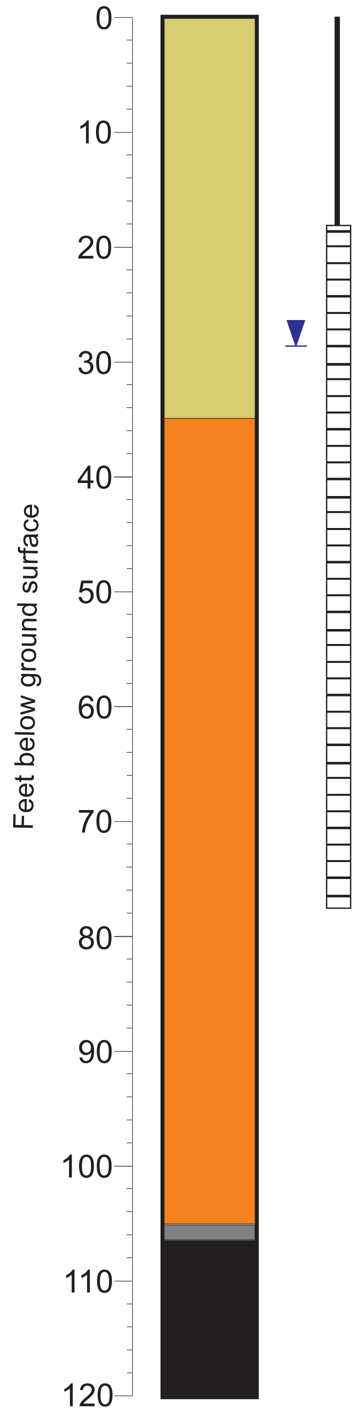
Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



Generalized stratigraphy

0-10 Silt, clayey

10-15 Silty clay

15-35 Silty sand, clay

35-55 Gravel, sandy

55-75 Gravel

75-90 Sandy gravel

90-105 Gravel

105-106.5 Tropic Shale

106.5-120 Coal

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STATE OF UTAH

Well ID: Y-103 (A6)

Location:
Collar elevation: 6919.8 ft.
Date constructed: 7 Nov 1986
Drilled by: Jack
Logged by: J. Kiefer

Drilling method: Mud rotary
Well screened interval: 17.9-77.8 ft.
Well casing diameter: 2-inch
Borehole diameter: 8.875-inch
Casing stick-up: 2.9 ft.

Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
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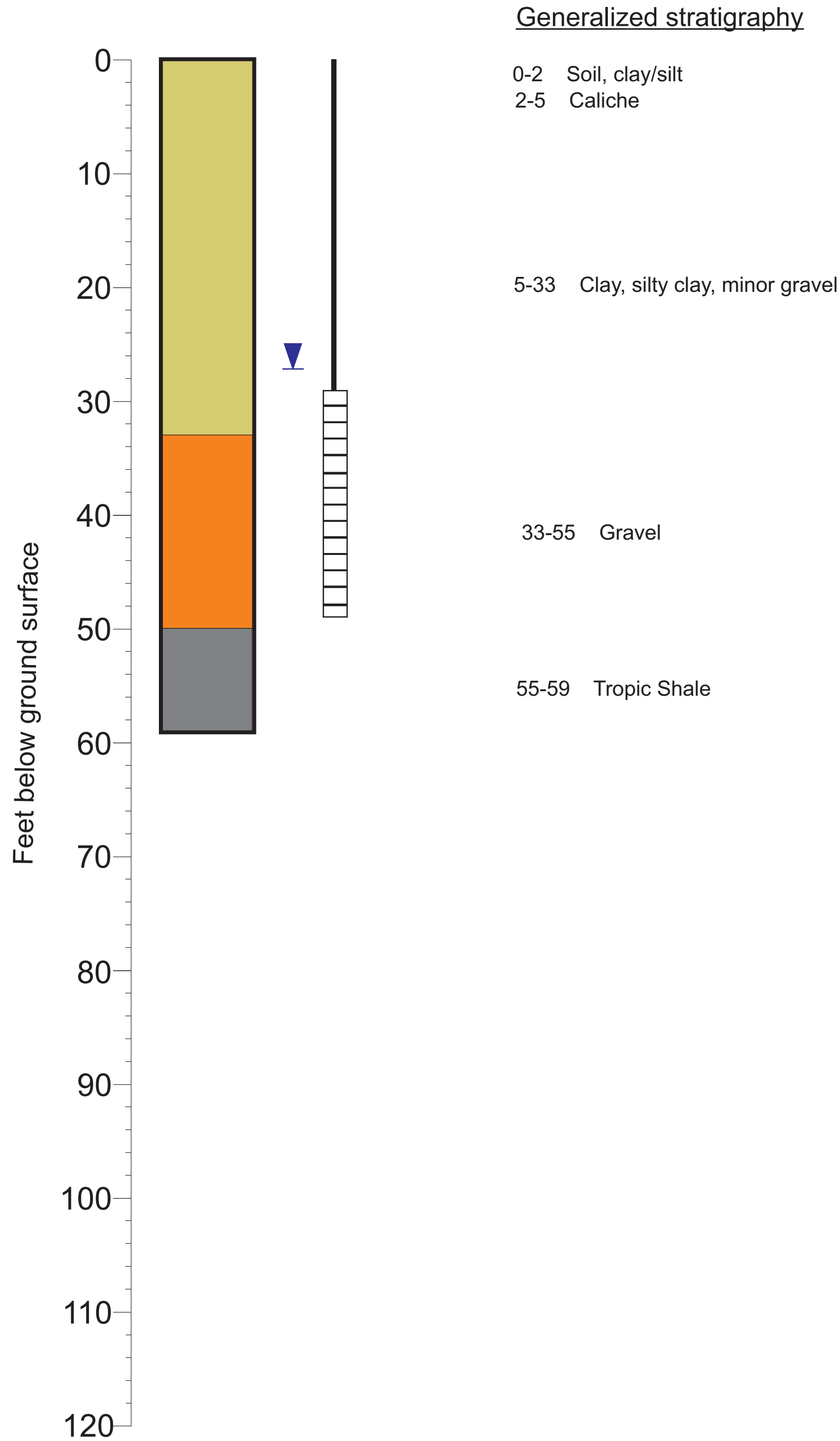
Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



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ERIK C. PETERSEN
STATE OF UTAH

Well ID: CN4-49 (CN4-1)

Location: 1764687, 363938 ft.
Collar elevation: 6912.09 ft.
Date constructed: 21 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 29-49 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.54 ft.

Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

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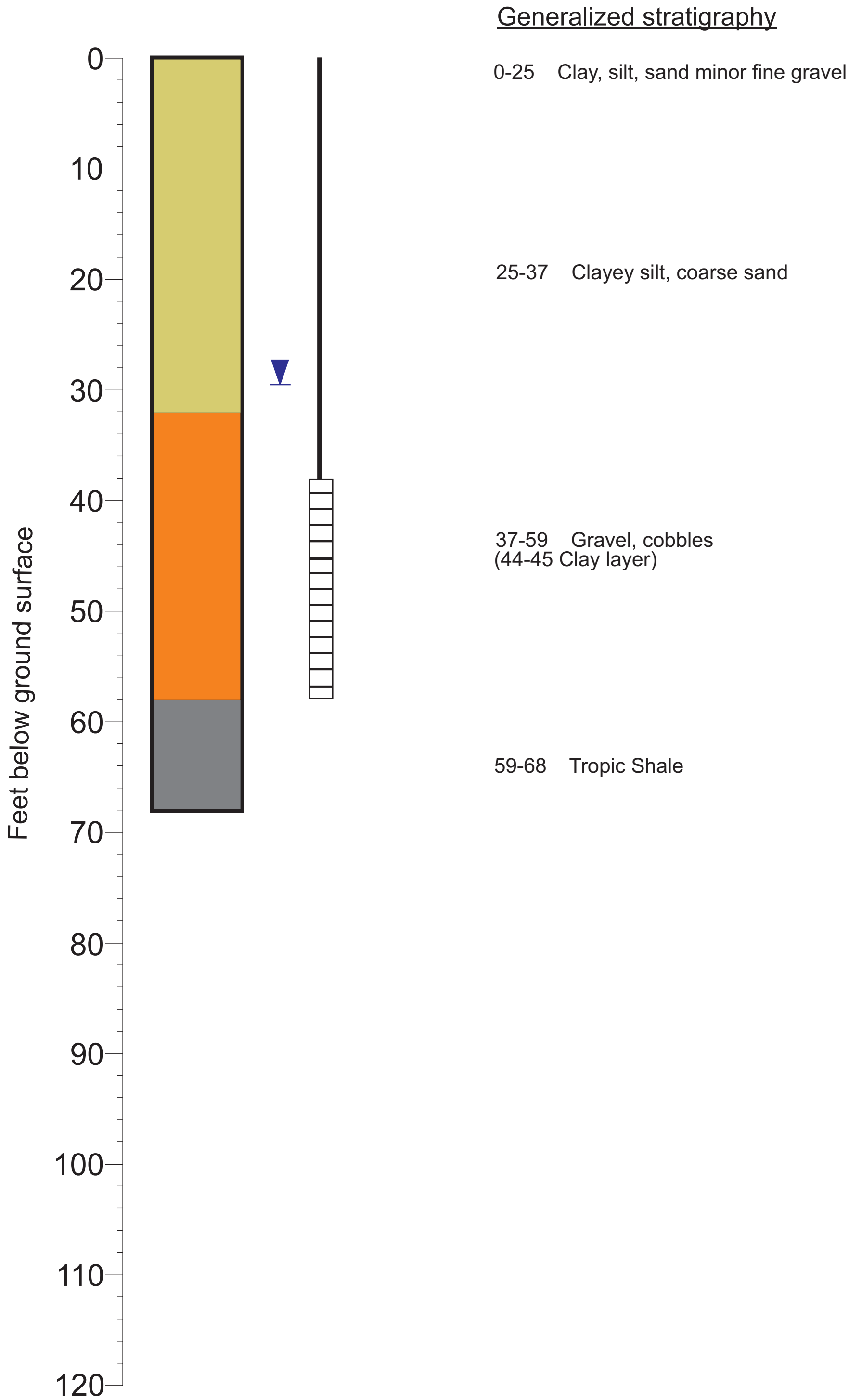
Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



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Well ID: CN1-58 (CN1-1)

Location: 1764167, 362758 ft.
Collar elevation: 6878.10 ft.
Date constructed: 7 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 38-58 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.79 ft.

Screened interval

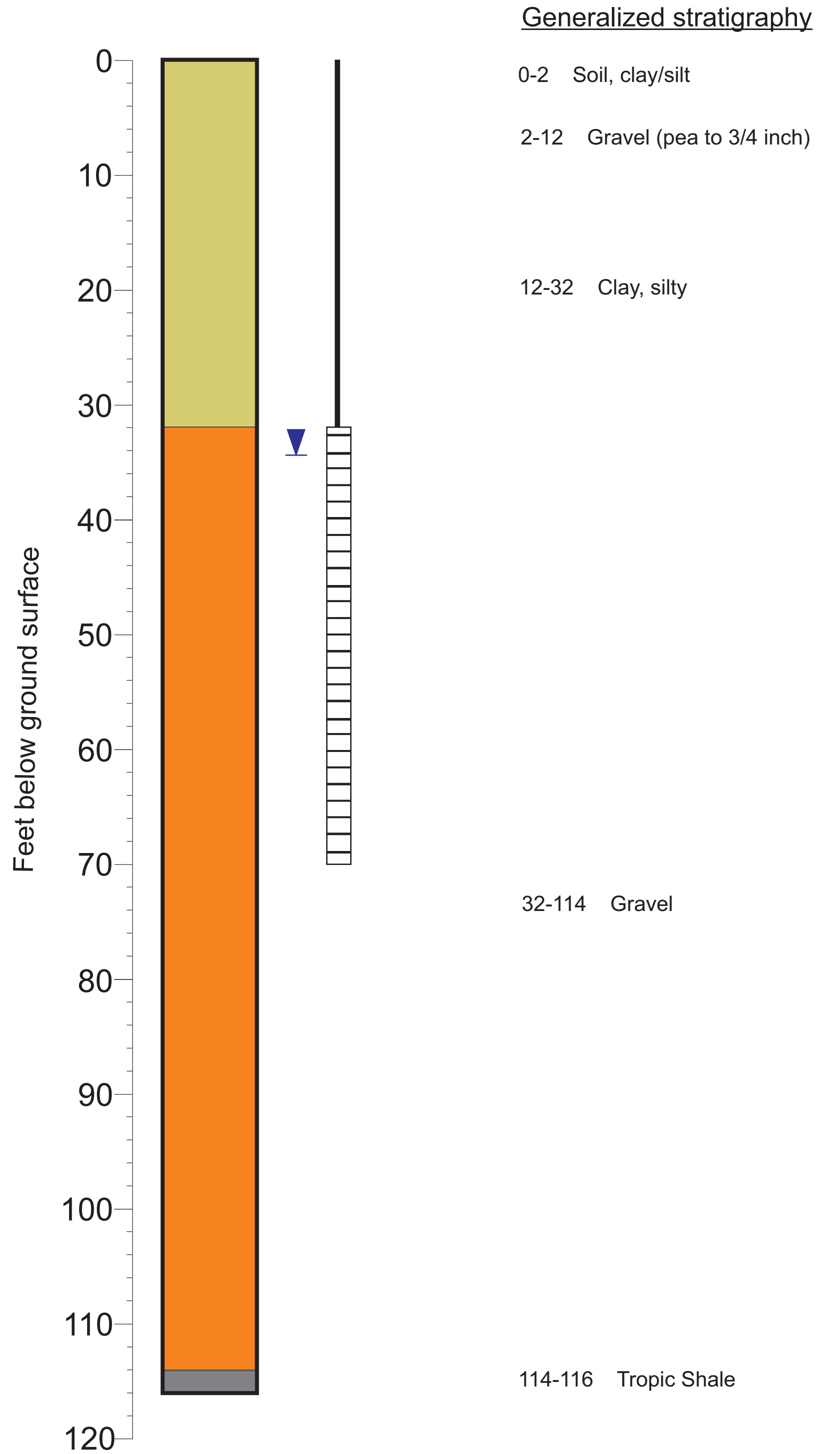
Hydrostratigraphic unit

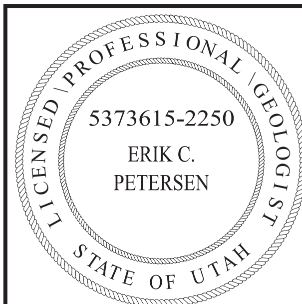
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine





Well ID: CN2-70 (CN2-1)

Location: 1764835, 365204 ft.
Collar elevation: 6937.37 ft.
Date constructed: 18 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 30-70 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.33 ft.

Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

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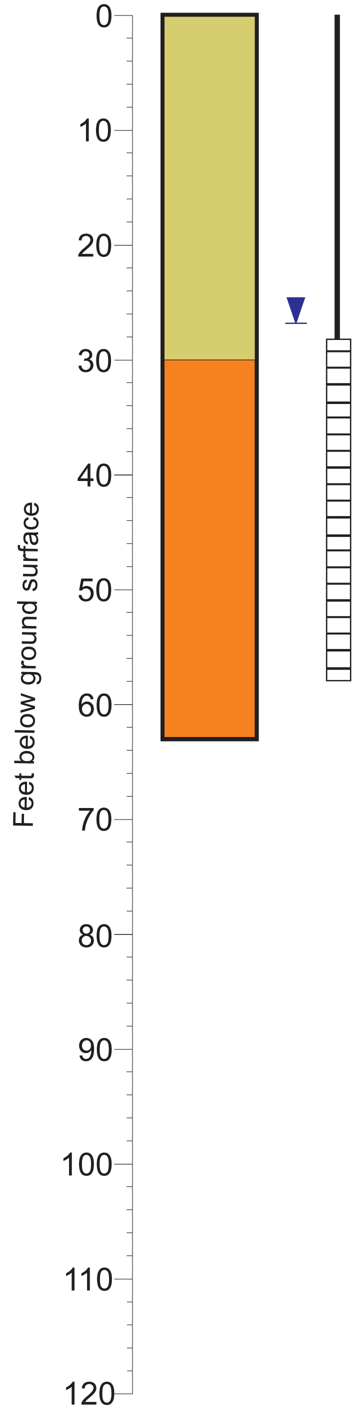
Coal Hollow Mine



Generalized stratigraphy

0-5 Soil, clayey silt, fine-grained sand

5-20 Clay, silty clay

15-20 Clay

20-30 Silty sand, minor fine gravel

30-63 Gravel
(mixed with sand)

LICENSED PROFESSIONAL GEOLOGIST
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ERIK C. PETERSEN
STATE OF UTAH

Well ID: CN5-58 (CN5-1)

Location: 1764167, 362758 ft.
Collar elevation: 6878.10 ft.
Date constructed: 1 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 28-58 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.79 ft.

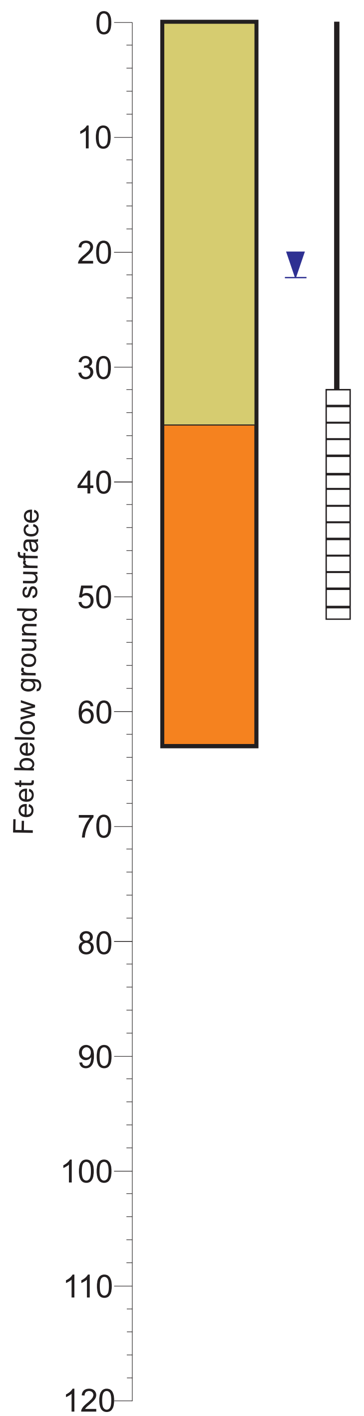
Screened interval

Hydrostratigraphic unit
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



Generalized stratigraphy

0-13 Silty clay

13-22 Sand, clay, minor silt

22-25 Fine gravel (3/16 inch), clay

25-35 Fine gravel (3/16 inch), silty fine-grained sand

35-63 Gravel
(mixed with sand)

(Gravel becoming coarser at 42 feet)

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Well ID: CN5-52 (CN5-2)

Location: 1763994, 362738 ft.
Collar elevation: 6875.40 ft.
Date constructed: 2 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 32-52 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 2.38 ft.

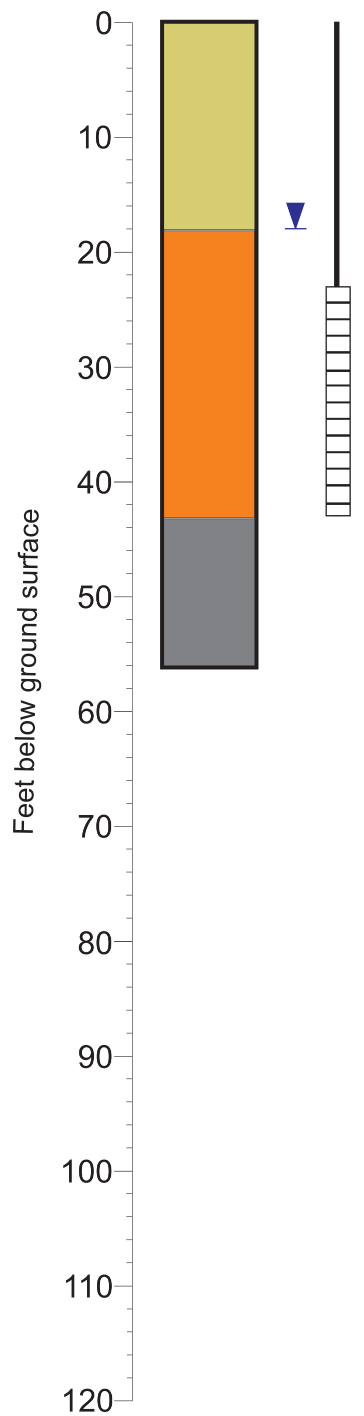
Screened interval

Hydrostratigraphic unit
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



Generalized stratigraphy

0-2 Soil, clay/silt

2-18 Silty clay

18-43 Gravel

43-51 Silty clay (weathered Tropic Shale)

51-56 Tropic Shale

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ERIK C. PETERSEN
STATE OF UTAH

Well ID: CN1-43 (CN1-2)

Location: 1764041, 365553 ft.
Collar elevation: 6931.16 ft.
Date constructed: 14 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 23-43 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 0.86 ft.

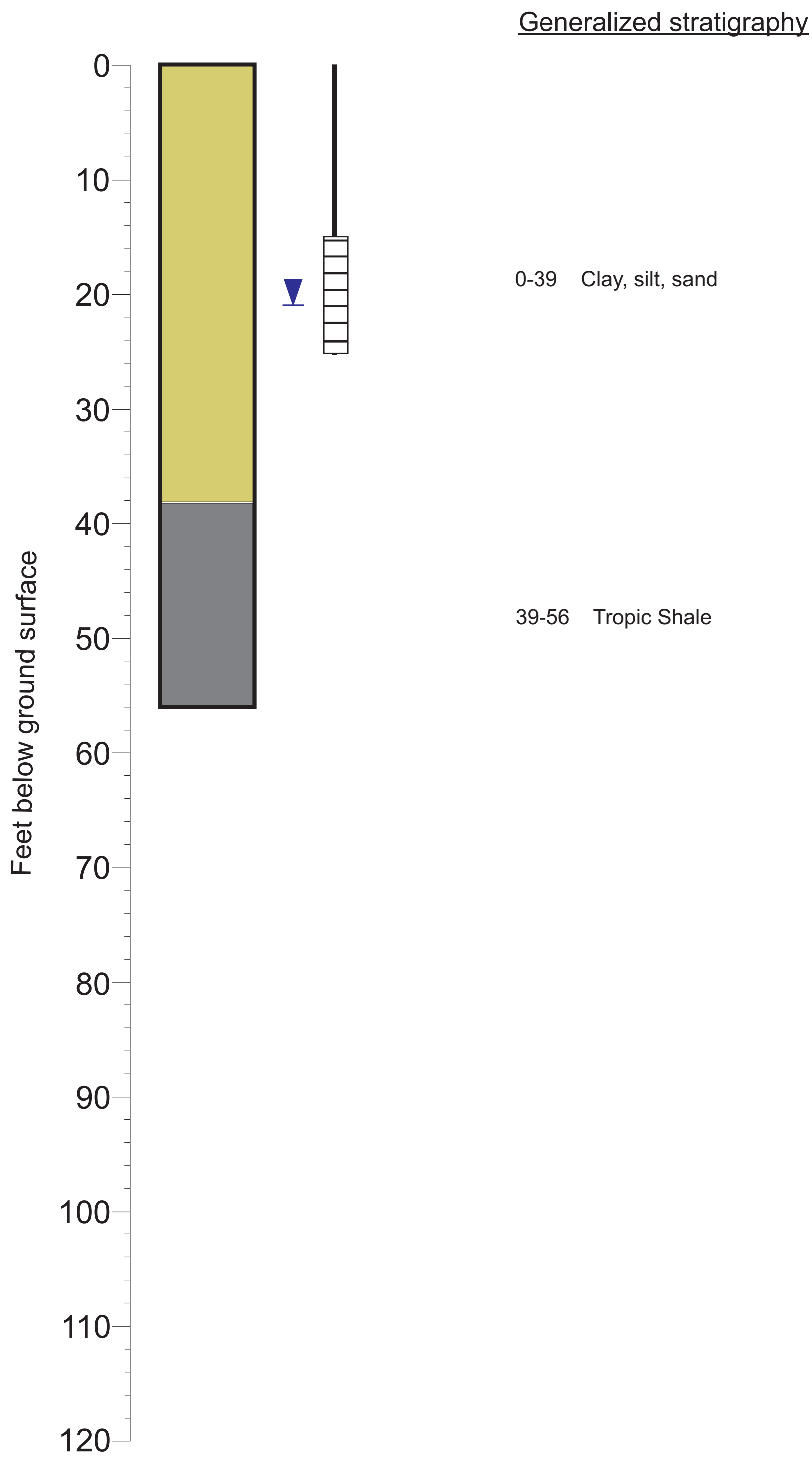
Screened interval

Hydrostratigraphic unit
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Coal Hollow Project

Alton Coal Development, LLC
Coal Hollow Mine



LICENSED PROFESSIONAL GEOLOGIST
5373615-2250
ERIK C. PETERSEN
STATE OF UTAH

Well ID: CN0-25 (CN0-2)

Location: 1764358, 365869 ft.
Collar elevation: 6939.28 ft.
Date constructed: 14 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 15-25 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 0.83 ft.

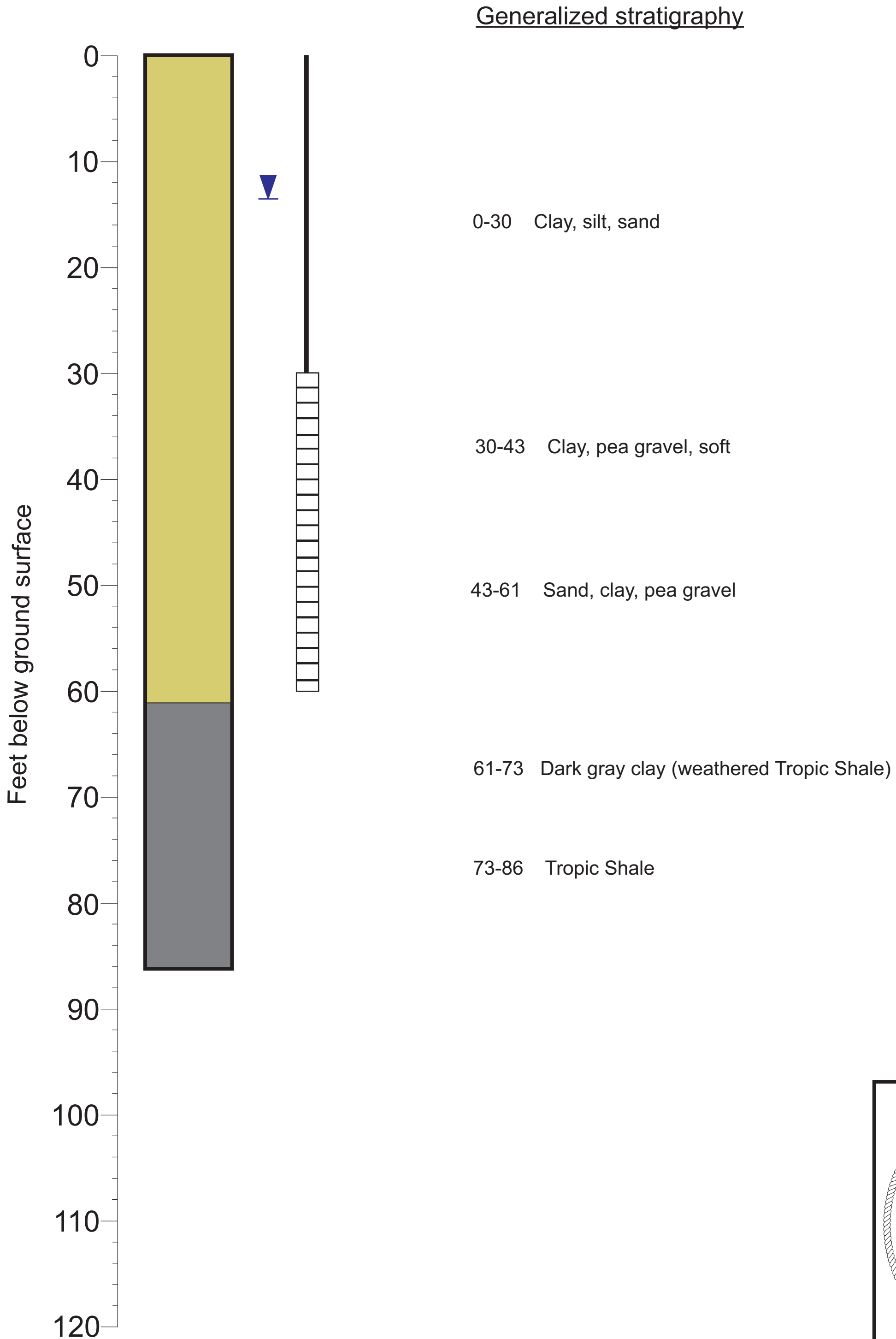
Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Alton Coal Development, LLC
Coal Hollow Mine



LICENSED PROFESSIONAL GEOLOGIST
5373615-2250
ERIK C. PETERSEN
STATE OF UTAH

Well ID: CN0-60 (CN0-1)

Location: 1763639, 365868 ft.
Collar elevation: 6932.16 ft.
Date constructed: 15 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

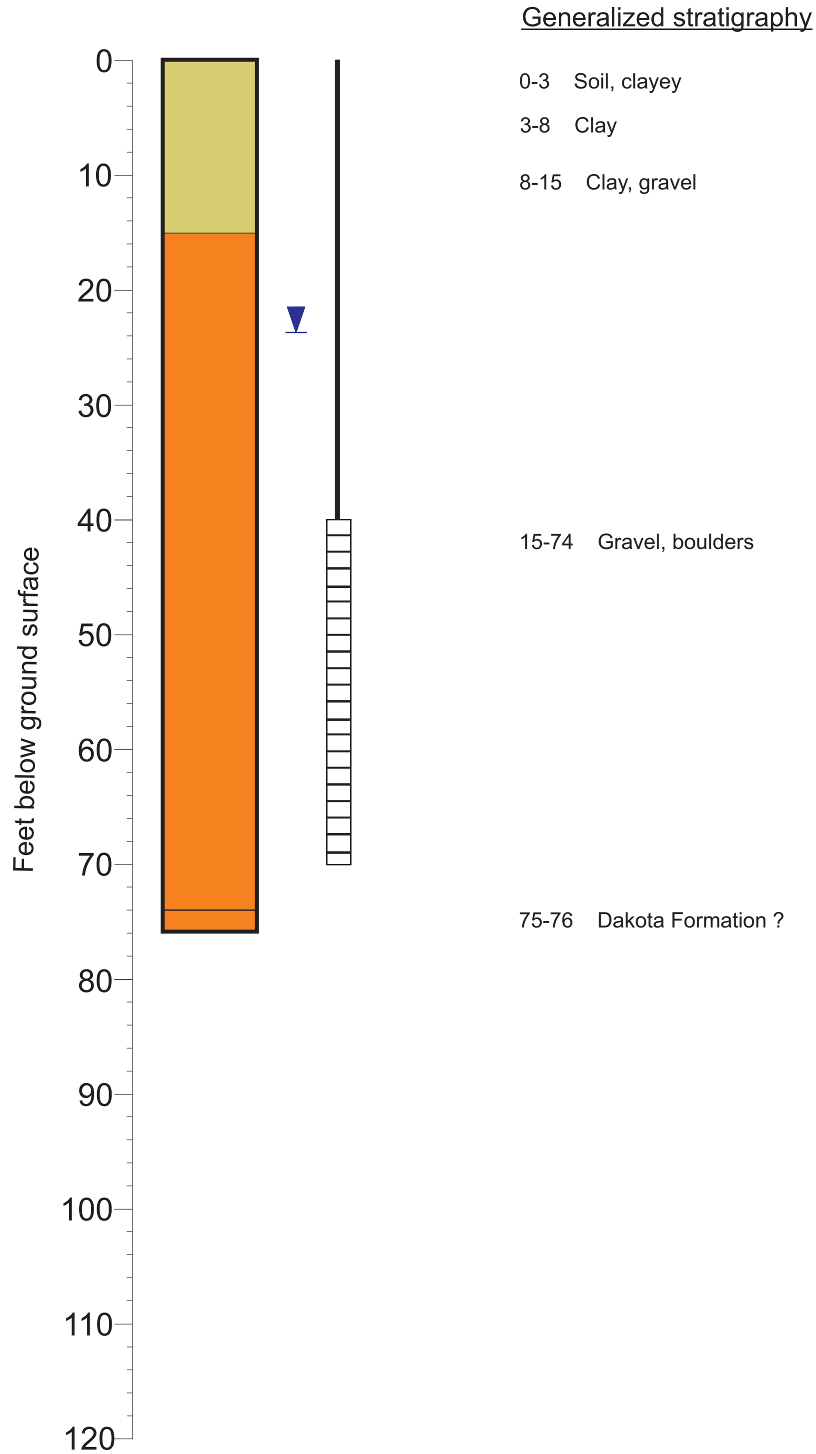
Drilling method: Mud rotary
Well screened interval: 30-60 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.75 ft.

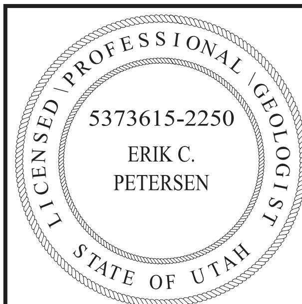
Screened interval

Hydrostratigraphic unit
- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

Petersen Hydrologic, LLC
Consultants in Hydrogeology

Alton Coal Development, LLC
Coal Hollow Mine





Well ID: CN7-70 (CN7-1)

Location: 1764373, 361791 ft.
Collar elevation: 6848.91 ft.
Date constructed: 16 March 2016
Drilled by: Grimshaw Drilling
Logged by: Erik Petersen, P.G.

Drilling method: Mud rotary
Well screened interval: 40-70 ft.
Well casing diameter: 2-inch
Borehole diameter: 6.25-inch
Casing stick-up: 1.42 ft.

Screened interval

Hydrostratigraphic unit

- Clay/silt/sand
- Gravel (mixed matrix)
- Tropic Shale
- Water level (March 2016)

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Alton Coal Development, LLC
Coal Hollow Mine

Attachment B

Aquifer pump test information for 2016 Test

In the North Private Lease area

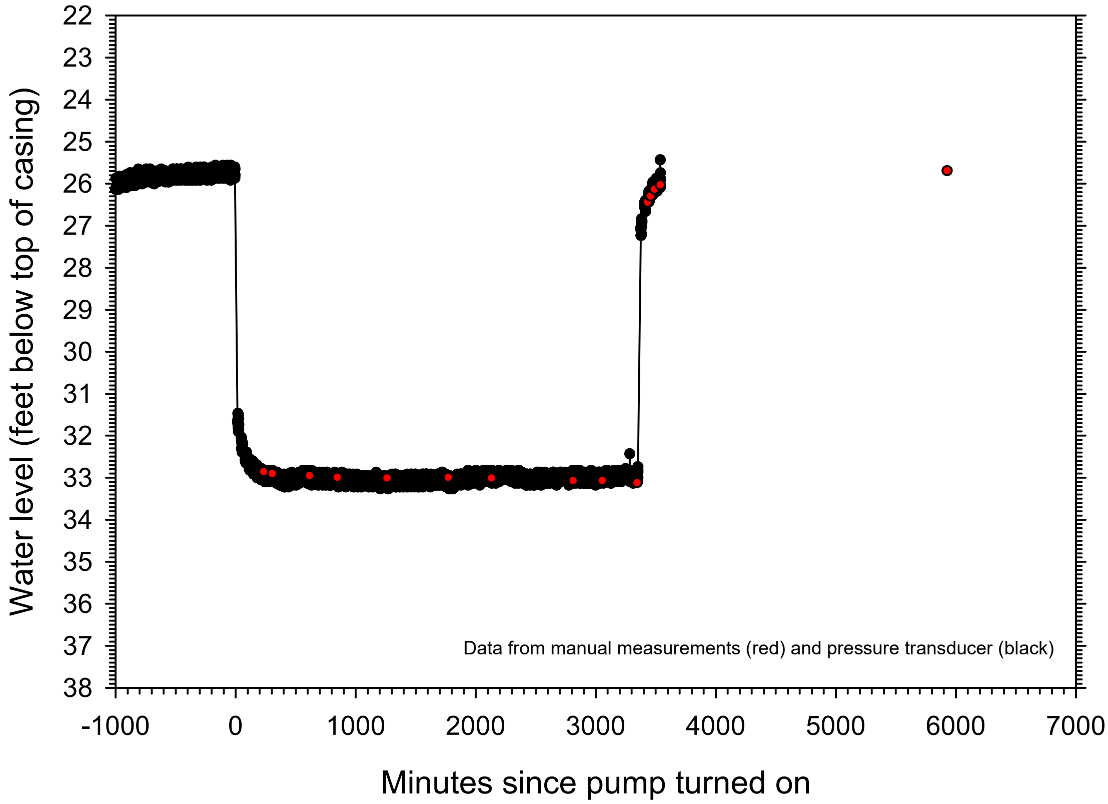
- Drawdown plots
- Pump test data

(Listed in order of increasing distance from pumping well CN3-81)

Groundwater wells monitored for 2016 pump test.

Well ID	Distance from pumped well (feet)
CN3-81	0.00
CN3-80	54.22
CN3-93	154.73
CN3-69	165.00
CN3-98	209.98
Y-103	426.91
CN4-49	508.16
Y-70	557.19
NLP-4	588.59
NLP-10	684.40
NLP-3	730.26
NLP-2	986.97
CN1-58	1150.98
CN2-70	1270.40
NLP-1	1297.25
CN5-58	1345.37
CN5-52	1380.57
CN1-43	1460.31
NLP-5	1674.23
CN0-25	1774.34
CN0-60	1849.52
NLP-12	2055.98
CN7-70	2307.79

CN3-81 - pumping well (water level)



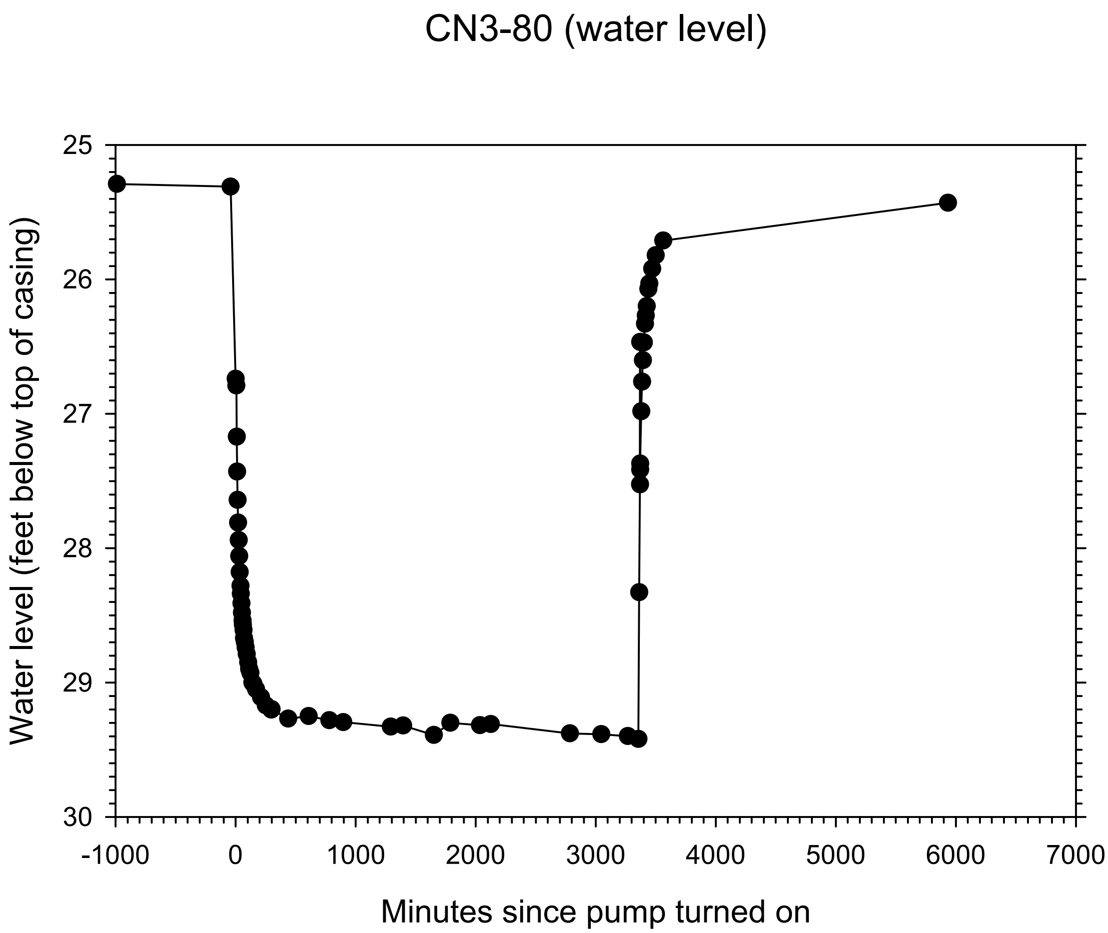
Black dots

Monitoring Well: CN3-81 (pumping well)

Elevation TOC	6910.8	Feet
Static level:	25.54	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	0.00	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:45	-2265.0	25.58	0.04	6885.22
4/28/2016 12:31	-1319.0	25.54	0	6885.26
4/29/2016 14:23	233.0	32.86	7.32	6877.94
4/29/2016 15:35	305.0	32.9	7.36	6877.9
4/29/2016 20:45	615.0	32.95	7.41	6877.85
4/30/2016 0:36	846.0	32.99	7.45	6877.81
4/30/2016 7:30	1260.0	33.01	7.47	6877.79
4/30/2016 16:00	1770.0	32.99	7.45	6877.81
4/30/2016 22:00	2130.0	33.01	7.47	6877.79
5/1/2016 9:20	2810.0	33.07	7.53	6877.73
5/1/2016 13:25	3055.0	33.07	7.53	6877.73
5/1/2016 18:15	3345.0	33.12	7.58	6877.68
5/1/2016 19:43	3433.0	26.44	0.9	6884.36
5/1/2016 20:08	3458.0	26.295	0.755	6884.505
5/1/2016 20:40	3490.0	26.13	0.59	6884.67
5/1/2016 21:28	3538.0	26.03	0.49	6884.77
5/3/2016 13:17	5927.0	25.69	0.15	6885.11

Note: Additional data available from pressure transducer/datalogger


CN3-80 (water level)
Water level (feet below top of casing)
25
26
27
28
29
30
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

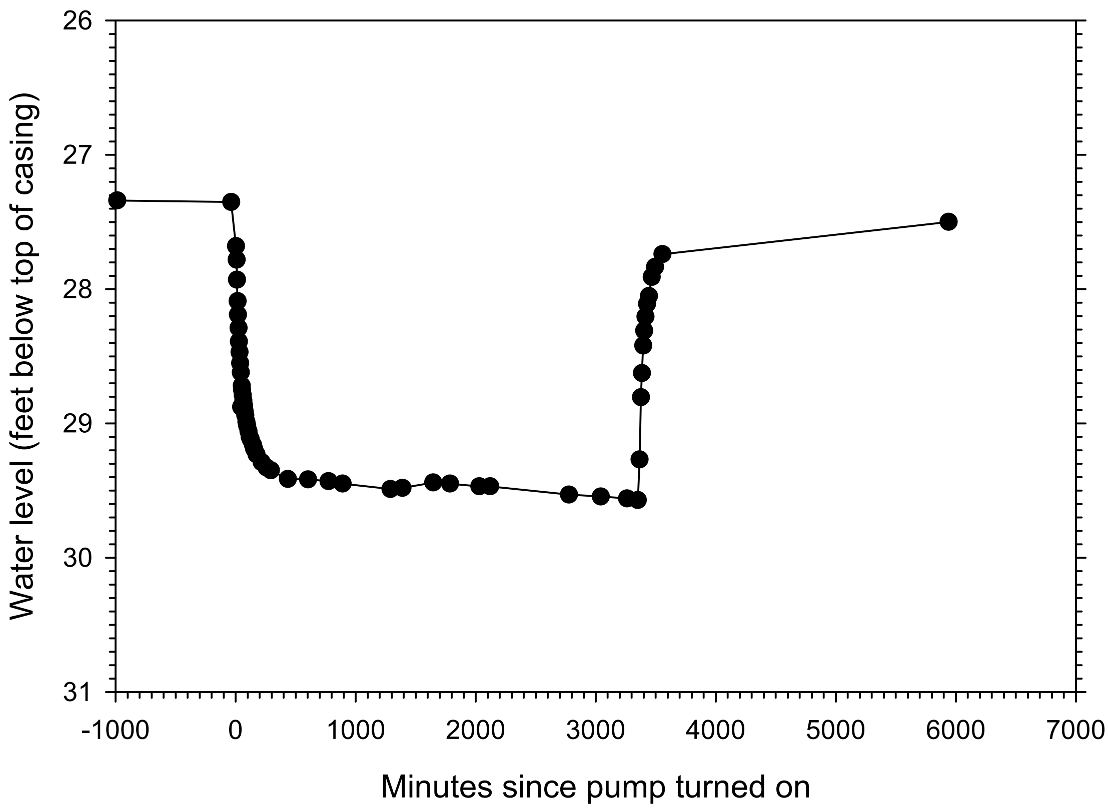
Monitoring Well: **CN3-80**

Elevation TOC	6910.29	Feet
Static level:	25.31	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	54.22	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:57	-2253.0	25.36	0.05	6884.93
4/28/2016 18:00	-990.0	25.29	-0.02	6885.00
4/29/2016 9:47	-43.0	25.31	0.00	6884.98
4/29/2016 10:30	0.0	26.74	1.43	6883.55
4/29/2016 10:35	5.0	26.79	1.48	6883.50
4/29/2016 10:38	8.0	27.17	1.86	6883.12
4/29/2016 10:42	12.0	27.43	2.12	6882.86
4/29/2016 10:46	16.0	27.64	2.33	6882.65
4/29/2016 10:50	20.0	27.81	2.50	6882.48
4/29/2016 10:54	24.0	27.94	2.63	6882.35
4/29/2016 10:59	29.0	28.06	2.75	6882.23
4/29/2016 11:03	33.0	28.18	2.87	6882.11
4/29/2016 11:09	39.0	28.28	2.97	6882.01
4/29/2016 11:13	43.0	28.34	3.03	6881.95
4/29/2016 11:18	48.0	28.41	3.10	6881.88
4/29/2016 11:22	52.0	28.48	3.17	6881.81
4/29/2016 11:26	56.0	28.54	3.23	6881.75
4/29/2016 11:30	60.0	28.57	3.26	6881.72
4/29/2016 11:35	65.0	28.61	3.30	6881.68
4/29/2016 11:40	70.0	28.67	3.36	6881.62
4/29/2016 11:46	76.0	28.70	3.39	6881.59
4/29/2016 11:53	83.0	28.74	3.43	6881.55
4/29/2016 12:02	92.0	28.79	3.48	6881.50
4/29/2016 12:13	103.0	28.85	3.54	6881.44
4/29/2016 12:22	112.0	28.90	3.59	6881.39
4/29/2016 12:32	122.0	28.93	3.62	6881.36
4/29/2016 12:49	139.0	29.00	3.69	6881.29
4/29/2016 12:58	148.0	29.01	3.70	6881.28
4/29/2016 13:19	169.0	29.05	3.74	6881.24
4/29/2016 14:01	211.0	29.11	3.80	6881.18
4/29/2016 14:41	251.0	29.17	3.86	6881.12
4/29/2016 15:27	297.0	29.20	3.89	6881.09
4/29/2016 15:29	299.0	29.20	3.89	6881.09
4/29/2016 17:48	438.0	29.27	3.96	6881.02
4/29/2016 20:37	607.0	29.25	3.94	6881.04
4/29/2016 23:30	780.0	29.28	3.97	6881.01

4/30/2016 1:26	896.0	29.30	3.99	6881.00
4/30/2016 8:02	1292.0	29.33	4.02	6880.96
4/30/2016 9:45	1395.0	29.32	4.01	6880.97
4/30/2016 14:00	1650.0	29.39	4.08	6880.90
4/30/2016 16:18	1788.0	29.30	3.99	6880.99
4/30/2016 20:24	2034.0	29.32	4.01	6880.97
4/30/2016 21:55	2125.0	29.31	4.00	6880.98
5/1/2016 8:53	2783.0	29.38	4.07	6880.91
5/1/2016 13:17	3047.0	29.39	4.08	6880.91
5/1/2016 16:58	3268.0	29.40	4.09	6880.89
5/1/2016 18:26	3356.0	29.42	4.11	6880.87
5/1/2016 18:32	3362.5	28.33	3.02	6881.96
5/1/2016 18:39	3369.0	27.53	2.22	6882.77
5/1/2016 18:39	3369.7	26.47	1.16	6883.83
5/1/2016 18:40	3370.5	27.42	2.11	6882.88
5/1/2016 18:41	3371.0	27.37	2.06	6882.92
5/1/2016 18:49	3379.5	26.98	1.67	6883.31
5/1/2016 18:57	3387.0	26.76	1.45	6883.53
5/1/2016 19:03	3393.0	26.60	1.29	6883.69
5/1/2016 19:11	3401.0	26.47	1.16	6883.82
5/1/2016 19:21	3411.0	26.33	1.02	6883.96
5/1/2016 19:26	3416.8	26.27	0.96	6884.02
5/1/2016 19:34	3424.0	26.20	0.89	6884.09
5/1/2016 19:49	3439.0	26.07	0.76	6884.22
5/1/2016 19:58	3448.0	26.03	0.72	6884.26
5/1/2016 20:21	3471.0	25.92	0.61	6884.37
5/1/2016 20:50	3500.0	25.82	0.51	6884.47
5/1/2016 21:52	3562.0	25.71	0.40	6884.58
5/3/2016 13:25	5935.0	25.43	0.12	6884.86

CN3-93 (water level)



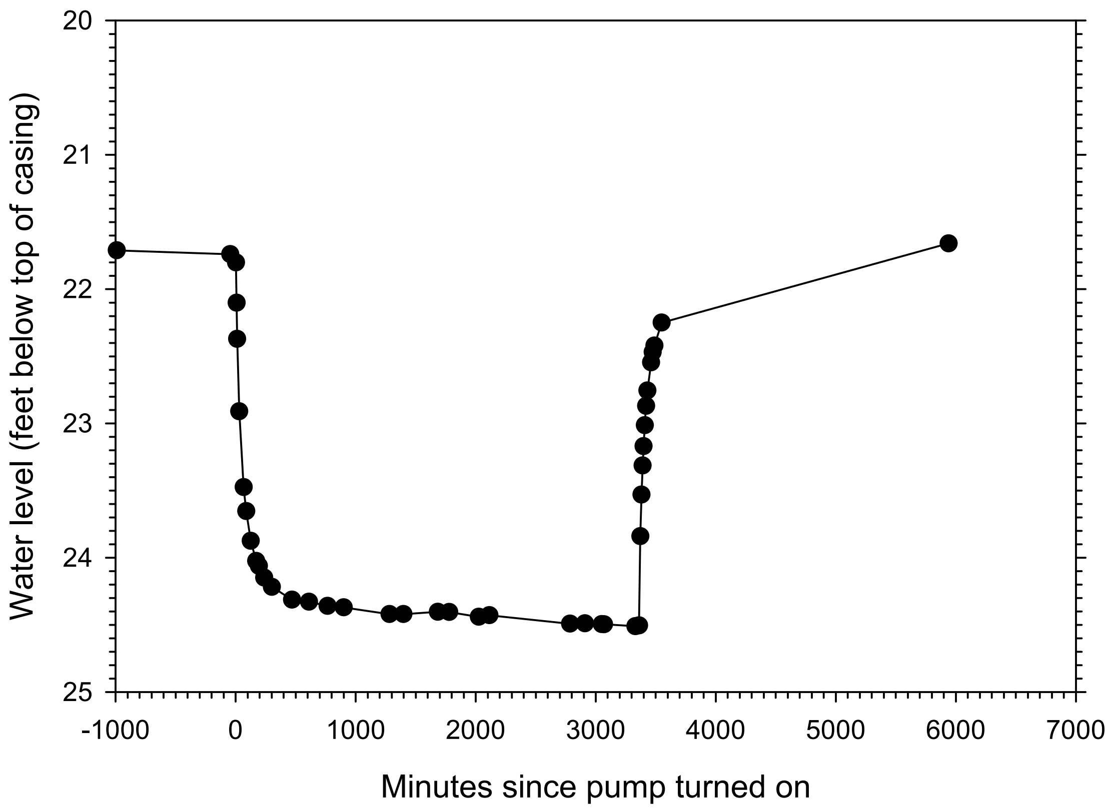
Monitoring Well: **CN3-93**

Elevation TOC	6912.34	Feet
Static level:	27.35	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	154.73	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:55	-2255.0	27.39	0.04	6884.95
4/28/2016 18:04	-986.0	27.34	-0.01	6885
4/29/2016 9:53	-37.0	27.35	0	6884.99
4/29/2016 10:33	3.0	27.68	0.33	6884.66
4/29/2016 10:37	7.0	27.78	0.43	6884.56
4/29/2016 10:41	11.0	27.93	0.58	6884.41
4/29/2016 10:45	15.0	28.09	0.74	6884.25
4/29/2016 10:49	19.0	28.19	0.84	6884.15
4/29/2016 10:53	23.0	28.29	0.94	6884.05
4/29/2016 10:57	27.0	28.39	1.04	6883.95
4/29/2016 11:02	32.0	28.47	1.12	6883.87
4/29/2016 11:07	37.0	28.55	1.2	6883.79
4/29/2016 11:12	42.0	28.62	1.27	6883.72
4/29/2016 11:16	46.0	28.88	1.53	6883.46
4/29/2016 11:20	50.0	28.72	1.37	6883.62
4/29/2016 11:24	54.0	28.75	1.4	6883.59
4/29/2016 11:29	59.0	28.79	1.44	6883.55
4/29/2016 11:33	63.0	28.83	1.48	6883.51
4/29/2016 11:39	69.0	28.87	1.52	6883.47
4/29/2016 11:39	69.0	28.87	1.52	6883.47
4/29/2016 11:44	74.0	28.91	1.56	6883.43
4/29/2016 11:50	80.0	28.94	1.59	6883.4
4/29/2016 11:58	88.0	28.99	1.64	6883.35
4/29/2016 12:06	96.0	29.02	1.67	6883.32
4/29/2016 12:17	107.0	29.06	1.71	6883.28
4/29/2016 12:26	116.0	29.1	1.75	6883.24
4/29/2016 12:36	126.0	29.12	1.77	6883.22
4/29/2016 12:53	143.0	29.16	1.81	6883.18
4/29/2016 13:02	152.0	29.19	1.84	6883.15
4/29/2016 13:24	174.0	29.23	1.88	6883.11
4/29/2016 14:05	215.0	29.29	1.94	6883.05
4/29/2016 14:45	255.0	29.33	1.98	6883.01
4/29/2016 15:23	293.0	29.35	2	6882.99
4/29/2016 17:45	435.0	29.415	2.065	6882.925
4/29/2016 20:32	602.0	29.418	2.068	6882.922
4/29/2016 23:23	773.0	29.43	2.08	6882.91

4/30/2016 1:20	890.0	29.45	2.1	6882.89
4/30/2016 7:59	1289.0	29.49	2.14	6882.85
4/30/2016 9:40	1390.0	29.48	2.13	6882.86
4/30/2016 13:55	1645.0	29.44	2.09	6882.9
4/30/2016 16:14	1784.0	29.45	2.1	6882.89
4/30/2016 20:20	2030.0	29.47	2.12	6882.87
4/30/2016 21:49	2119.0	29.47	2.12	6882.87
5/1/2016 8:46	2776.0	29.53	2.18	6882.81
5/1/2016 13:12	3042.0	29.545	2.195	6882.795
5/1/2016 16:52	3262.0	29.56	2.21	6882.78
5/1/2016 18:22	3352.0	29.572	2.222	6882.768
5/1/2016 18:35	3365.0	29.27	1.92	6883.07
5/1/2016 18:47	3377.0	28.805	1.455	6883.535
5/1/2016 18:54	3384.5	28.625	1.275	6883.715
5/1/2016 19:06	3396.5	28.42	1.07	6883.92
5/1/2016 19:14	3404.0	28.31	0.96	6884.03
5/1/2016 19:24	3414.7	28.205	0.855	6884.135
5/1/2016 19:38	3428.0	28.11	0.76	6884.23
5/1/2016 19:54	3444.0	28.05	0.7	6884.29
5/1/2016 20:16	3466.0	27.91	0.56	6884.43
5/1/2016 20:45	3495.0	27.835	0.485	6884.505
5/1/2016 21:46	3556.0	27.74	0.39	6884.6
5/3/2016 13:30	5940.0	27.5	0.15	6884.84

CN3-69 (water level)

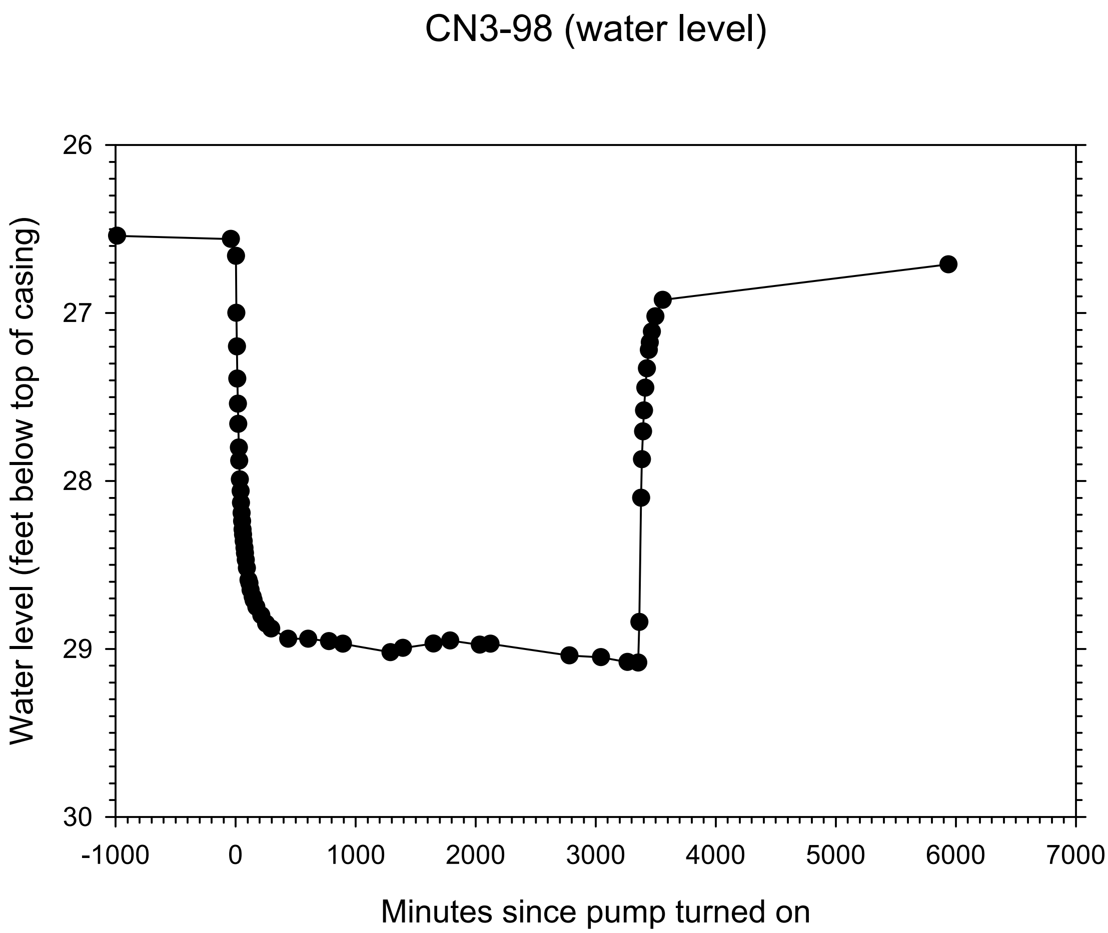


Monitoring Well: **CN3-69**

Elevation TOC	6907.54	Feet
Static level:	21.74	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	165.00	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:25	-2225.0	21.74	0	6885.8
4/28/2016 12:38	-1312.0	21.72	-0.02	6885.82
4/28/2016 17:58	-992.0	21.71	-0.03	6885.83
4/29/2016 9:45	-45.0	21.74	0	6885.8
4/29/2016 10:32	2.2	21.8	0.06	6885.74
4/29/2016 10:37	7.0	22.1	0.36	6885.44
4/29/2016 10:42	12.5	22.37	0.63	6885.17
4/29/2016 10:59	29.7	22.91	1.17	6884.63
4/29/2016 11:36	66.5	23.475	1.735	6884.065
4/29/2016 11:57	87.5	23.653	1.913	6883.887
4/29/2016 12:36	126.0	23.875	2.135	6883.665
4/29/2016 13:21	171.0	24.025	2.285	6883.515
4/29/2016 13:43	193.0	24.062	2.322	6883.478
4/29/2016 14:27	237.0	24.15	2.41	6883.39
4/29/2016 15:32	302.0	24.218	2.478	6883.322
4/29/2016 18:20	470.0	24.313	2.573	6883.227
4/29/2016 20:41	611.0	24.33	2.59	6883.21
4/29/2016 23:15	765.0	24.36	2.62	6883.18
4/30/2016 1:30	900.0	24.37	2.63	6883.17
4/30/2016 7:51	1281.0	24.42	2.68	6883.12
4/30/2016 9:48	1398.0	24.42	2.68	6883.12
4/30/2016 14:34	1684.0	24.403	2.663	6883.137
4/30/2016 16:08	1778.0	24.405	2.665	6883.135
4/30/2016 20:15	2025.0	24.44	2.7	6883.1
4/30/2016 21:43	2113.0	24.43	2.69	6883.11
5/1/2016 8:55	2785.0	24.492	2.752	6883.048
5/1/2016 11:00	2910.0	24.49	2.75	6883.05
5/1/2016 13:21	3051.0	24.495	2.755	6883.045
5/1/2016 13:40	3070.0	24.496	2.756	6883.044
5/1/2016 18:01	3331.0	24.51	2.77	6883.03
5/1/2016 18:31	3361.0	24.505	2.765	6883.035
5/1/2016 18:42	3372.5	23.84	2.1	6883.7
5/1/2016 18:52	3382.0	23.53	1.79	6884.01
5/1/2016 19:00	3390.5	23.315	1.575	6884.225
5/1/2016 19:08	3398.5	23.17	1.43	6884.37
5/1/2016 19:18	3408.5	23.015	1.275	6884.525

5/1/2016 19:29	3419.5	22.87	1.13	6884.67
5/1/2016 19:40	3430.5	22.755	1.015	6884.785
5/1/2016 20:11	3461.0	22.545	0.805	6884.995
5/1/2016 20:24	3474.0	22.47	0.73	6885.07
5/1/2016 20:39	3489.0	22.42	0.68	6885.12
5/1/2016 21:39	3549.0	22.25	0.51	6885.29
5/3/2016 13:30	5940.0	21.66	-0.08	6885.88

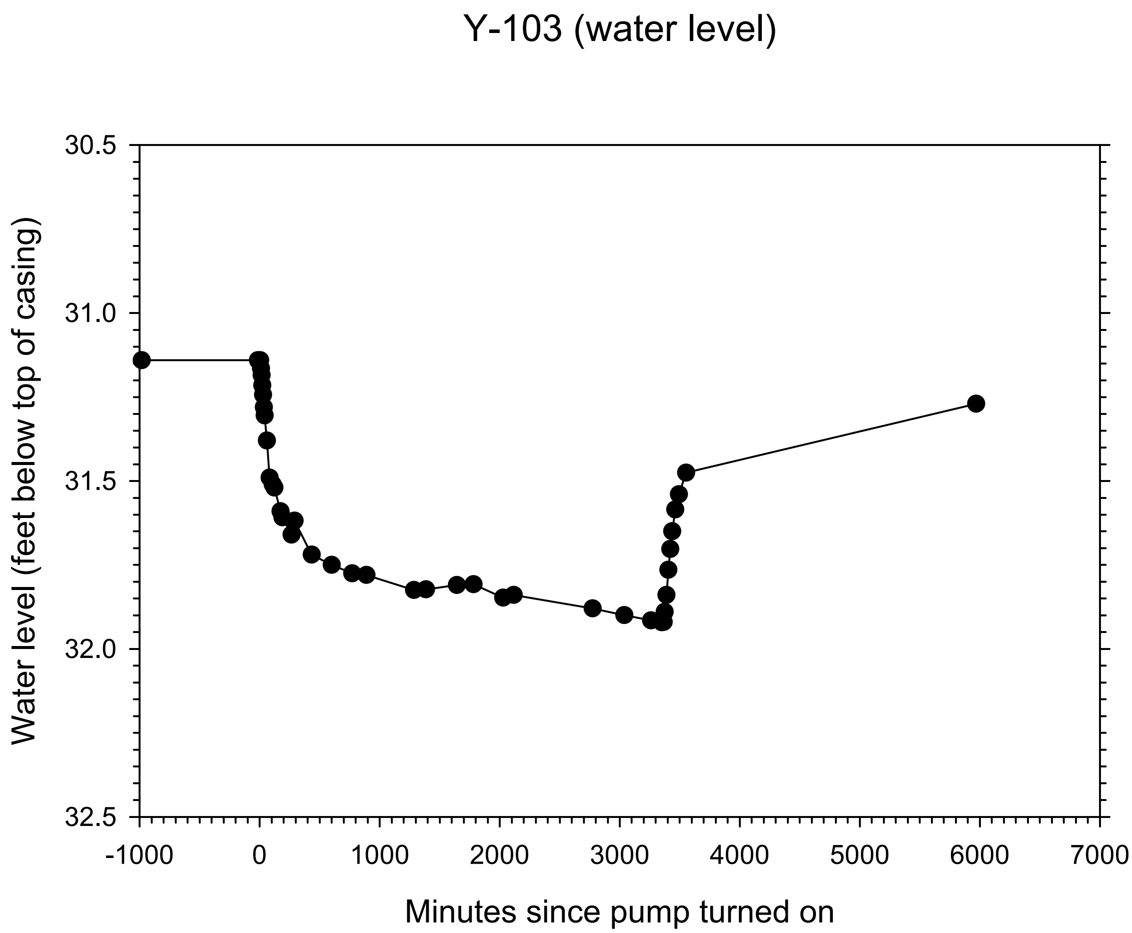

CN3-98 (water level)
Water level (feet below top of casing)
26
27
28
29
30
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **CN3-98**

Elevation TOC	6911.07	Feet
Static level:	26.56	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	209.98	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:59	-2251.0	26.6	0.04	6884.47
4/28/2016 13:34	-1256.0	26.56	0	6884.51
4/28/2016 18:02	-988.0	26.54	-0.02	6884.53
4/29/2016 9:50	-40.0	26.56	0	6884.51
4/29/2016 10:32	2.0	26.66	0.1	6884.41
4/29/2016 10:36	6.0	27	0.44	6884.07
4/29/2016 10:40	10.0	27.2	0.64	6883.87
4/29/2016 10:44	14.0	27.39	0.83	6883.68
4/29/2016 10:48	18.0	27.54	0.98	6883.53
4/29/2016 10:52	22.0	27.66	1.1	6883.41
4/29/2016 10:56	26.0	27.8	1.24	6883.27
4/29/2016 11:00	30.0	27.88	1.32	6883.19
4/29/2016 11:05	35.0	27.99	1.43	6883.08
4/29/2016 11:10	40.0	28.06	1.5	6883.01
4/29/2016 11:14	44.0	28.13	1.57	6882.94
4/29/2016 11:19	49.0	28.19	1.63	6882.88
4/29/2016 11:23	53.0	28.24	1.68	6882.83
4/29/2016 11:27	57.0	28.29	1.73	6882.78
4/29/2016 11:32	62.0	28.32	1.76	6882.75
4/29/2016 11:37	67.0	28.36	1.8	6882.71
4/29/2016 11:42	72.0	28.4	1.84	6882.67
4/29/2016 11:48	78.0	28.43	1.87	6882.64
4/29/2016 11:54	84.0	28.47	1.91	6882.6
4/29/2016 12:04	94.0	28.52	1.96	6882.55
4/29/2016 12:16	106.0	28.59	2.03	6882.48
4/29/2016 12:24	114.0	28.61	2.05	6882.46
4/29/2016 12:34	124.0	28.65	2.09	6882.42
4/29/2016 12:51	141.0	28.69	2.13	6882.38
4/29/2016 13:00	150.0	28.71	2.15	6882.36
4/29/2016 13:22	172.0	28.75	2.19	6882.32
4/29/2016 14:03	213.0	28.8	2.24	6882.27
4/29/2016 14:43	253.0	28.85	2.29	6882.22
4/29/2016 15:25	295.0	28.88	2.32	6882.19
4/29/2016 17:45	435.0	29.415	2.855	6881.655
4/29/2016 17:47	437.0	28.94	2.38	6882.13
4/29/2016 20:34	604.0	28.94	2.38	6882.13

4/29/2016 23:26	776.0	28.955	2.395	6882.115
4/30/2016 1:23	893.0	28.97	2.41	6882.1
4/30/2016 7:59	1289.0	29.02	2.46	6882.05
4/30/2016 9:42	1392.0	28.995	2.435	6882.075
4/30/2016 13:57	1647.0	28.968	2.408	6882.102
4/30/2016 16:16	1786.0	28.95	2.39	6882.12
4/30/2016 20:22	2032.0	28.975	2.415	6882.095
4/30/2016 21:52	2122.0	28.97	2.41	6882.1
5/1/2016 8:50	2780.0	29.04	2.48	6882.03
5/1/2016 13:14	3044.0	29.05	2.49	6882.02
5/1/2016 16:55	3265.0	29.078	2.518	6881.992
5/1/2016 18:24	3354.0	29.082	2.522	6881.988
5/1/2016 18:33	3363.8	28.84	2.28	6882.23
5/1/2016 18:48	3378.0	28.1	1.54	6882.97
5/1/2016 18:55	3385.5	27.87	1.31	6883.2
5/1/2016 19:04	3394.5	27.705	1.145	6883.365
5/1/2016 19:12	3402.3	27.58	1.02	6883.49
5/1/2016 19:23	3413.0	27.445	0.885	6883.625
5/1/2016 19:36	3426.0	27.33	0.77	6883.74
5/1/2016 19:52	3442.0	27.22	0.66	6883.85
5/1/2016 20:00	3450.0	27.175	0.615	6883.895
5/1/2016 20:18	3468.0	27.11	0.55	6883.96
5/1/2016 20:47	3497.0	27.02	0.46	6884.05
5/1/2016 21:49	3559.0	26.922	0.362	6884.148
5/3/2016 13:28	5938.0	26.71	0.15	6884.36



Y-103 (water level)
Water level (feet below top of casing)
30.5
31.0
31.5
32.0
32.5
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

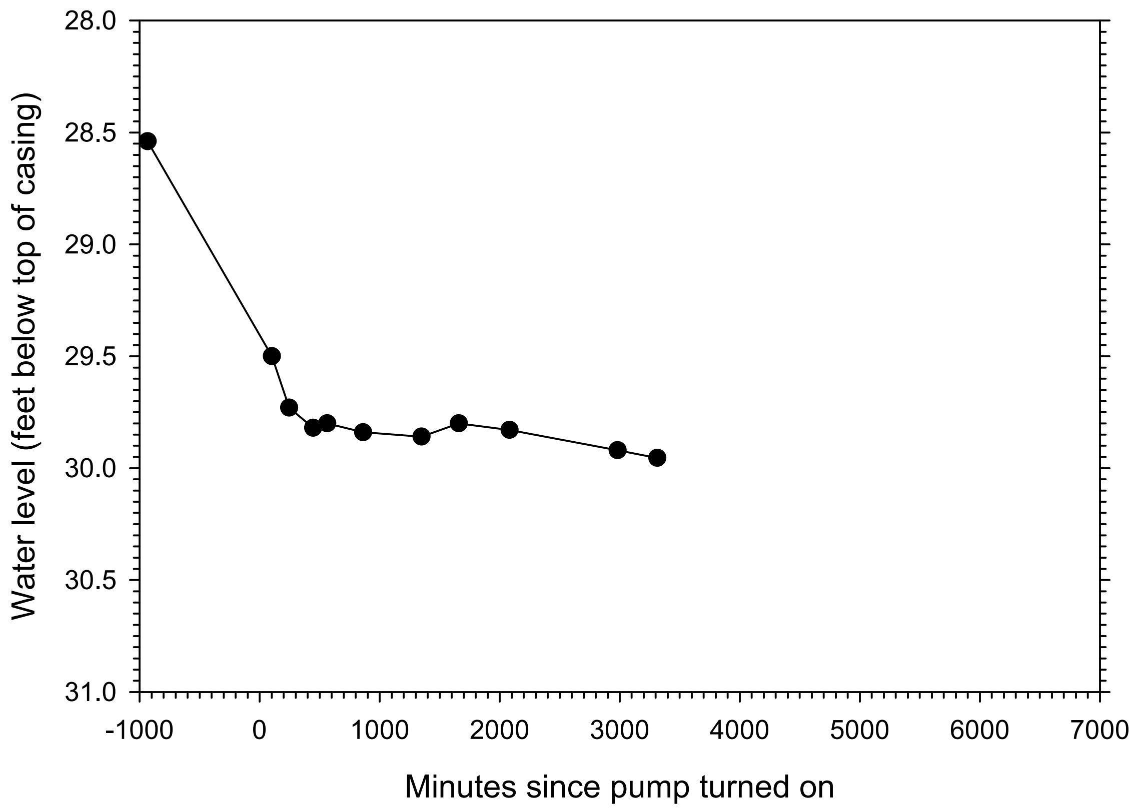
Monitoring Well: **Y-103**

Elevation TOC	6921.75	Feet
Static level:	31.14	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	426.91	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:50	-2260.0	31.15	0.01	6890.6
4/28/2016 18:07	-983.0	31.14	0	6890.61
4/29/2016 10:14	-16.0	31.14	0	6890.61
4/29/2016 10:34	4.7	31.14	0	6890.61
4/29/2016 10:40	10.5	31.165	0.025	6890.585
4/29/2016 10:44	14.8	31.185	0.045	6890.565
4/29/2016 10:51	21.0	31.215	0.075	6890.535
4/29/2016 10:58	28.5	31.243	0.103	6890.507
4/29/2016 11:04	34.8	31.28	0.14	6890.47
4/29/2016 11:11	41.5	31.305	0.165	6890.445
4/29/2016 11:30	60.0	31.38	0.24	6890.37
4/29/2016 11:52	82.0	31.49	0.35	6890.26
4/29/2016 12:18	108.0	31.51	0.37	6890.24
4/29/2016 12:33	123.0	31.52	0.38	6890.23
4/29/2016 13:24	174.0	31.59	0.45	6890.16
4/29/2016 13:40	190.0	31.608	0.468	6890.142
4/29/2016 14:54	264.0	31.66	0.52	6890.09
4/29/2016 15:21	291.0	31.618	0.478	6890.132
4/29/2016 17:43	433.0	31.72	0.58	6890.03
4/29/2016 20:30	600.0	31.75	0.61	6890.00
4/29/2016 23:20	770.0	31.775	0.635	6889.975
4/30/2016 1:18	888.0	31.78	0.64	6889.97
4/30/2016 7:55	1285.0	31.825	0.685	6889.925
4/30/2016 9:35	1385.0	31.823	0.683	6889.927
4/30/2016 13:53	1643.0	31.81	0.67	6889.94
4/30/2016 16:12	1782.0	31.808	0.668	6889.942
4/30/2016 20:18	2028.0	31.848	0.708	6889.902
4/30/2016 21:46	2116.0	31.84	0.7	6889.91
5/1/2016 8:44	2774.0	31.88	0.74	6889.87
5/1/2016 13:10	3040.0	31.9	0.76	6889.85
5/1/2016 16:51	3261.0	31.915	0.775	6889.835
5/1/2016 18:21	3351.0	31.921	0.781	6889.829
5/1/2016 18:37	3367.0	31.92	0.78	6889.83
5/1/2016 18:45	3375.5	31.89	0.75	6889.86
5/1/2016 18:59	3389.0	31.84	0.7	6889.91
5/1/2016 19:16	3406.0	31.765	0.625	6889.985

5/1/2016 19:32	3422.0	31.703	0.563	6890.047
5/1/2016 19:47	3437.0	31.65	0.51	6890.1
5/1/2016 20:14	3464.0	31.585	0.445	6890.165
5/1/2016 20:43	3493.0	31.54	0.4	6890.21
5/1/2016 21:43	3553.0	31.475	0.335	6890.275
5/3/2016 13:59	5969.0	31.27	0.13	6890.48

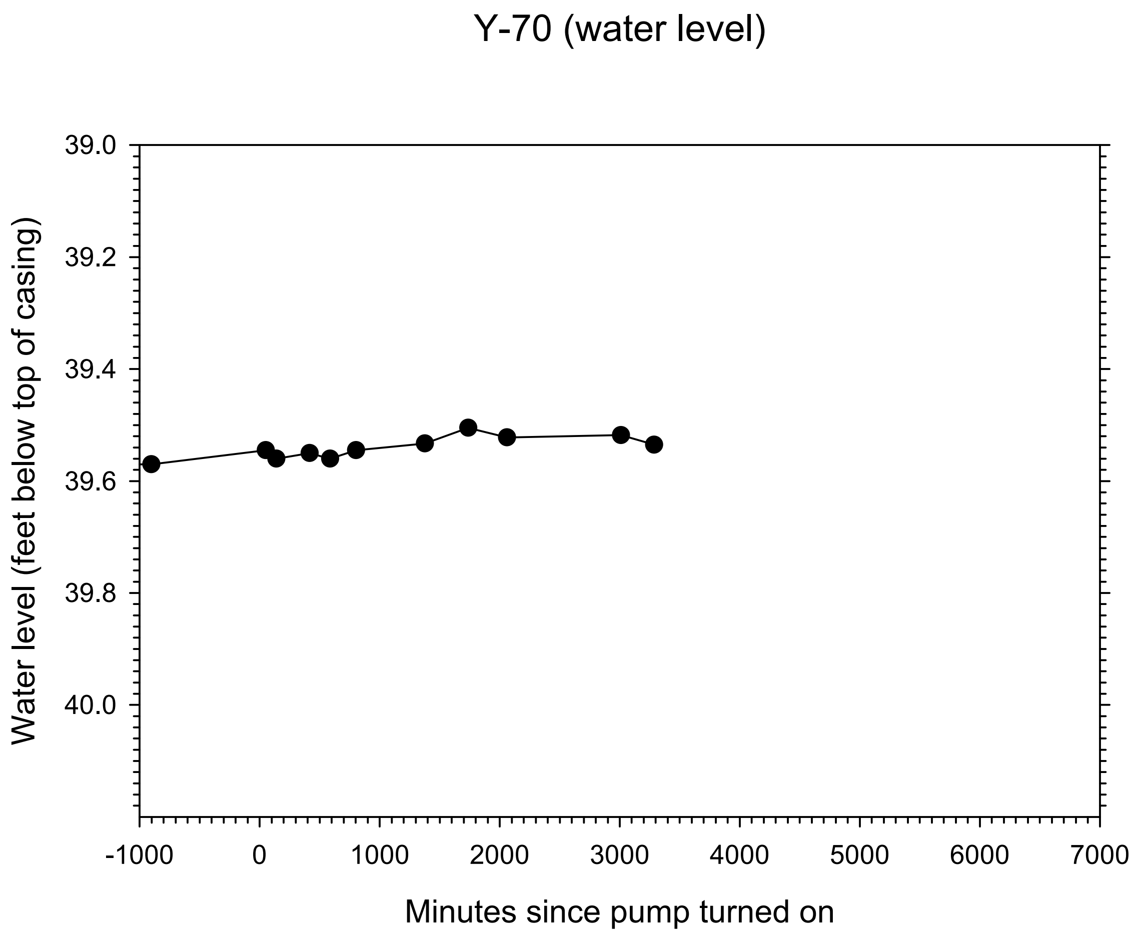
CN4-49 (water level)



Monitoring Well: **CN4-49**

Elevation TOC	6912.09	Feet
Static level:	28.55	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	508.16	Feet

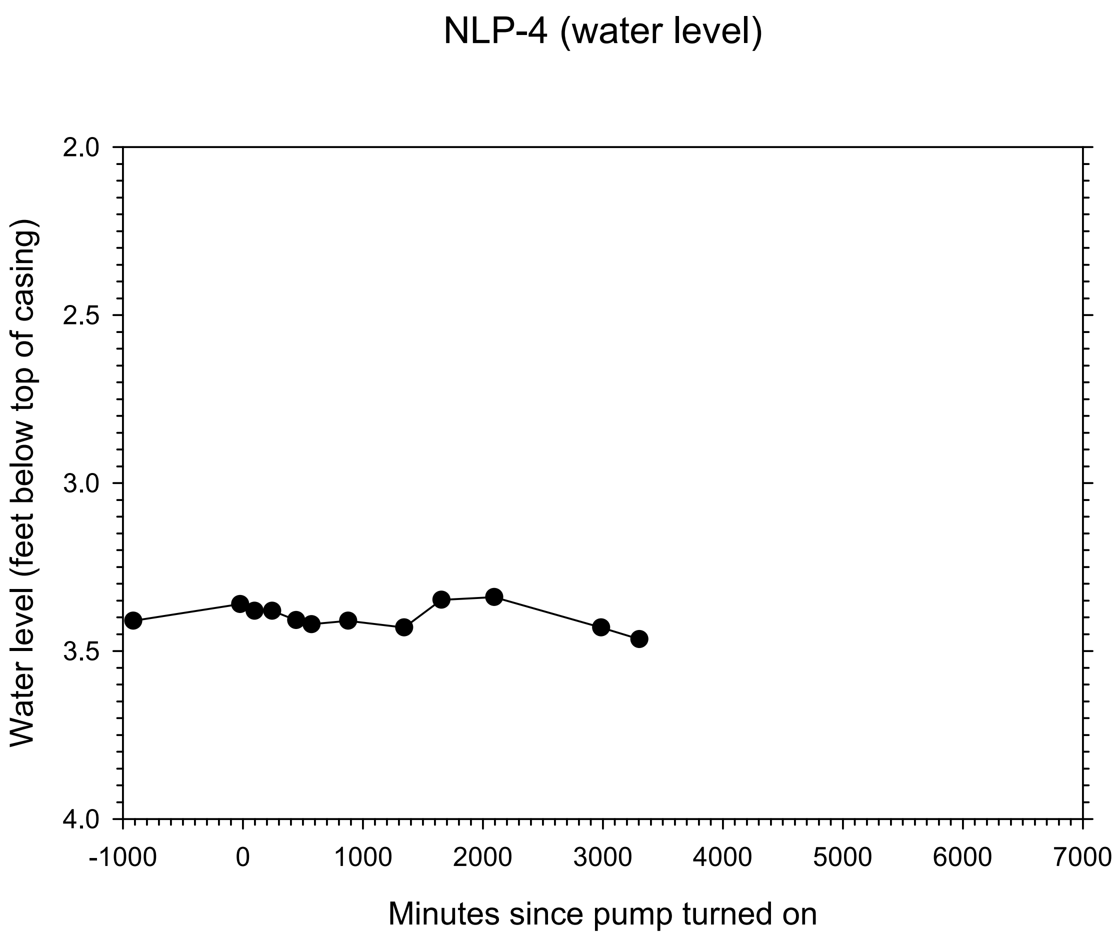
Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:40	-2210.0	28.59	0.04	6883.5
4/28/2016 18:57	-933.0	28.54	-0.01	6883.55
4/29/2016 12:11	101.0	29.5	0.95	6882.59
4/29/2016 14:36	246.0	29.73	1.18	6882.36
4/29/2016 17:56	446.0	29.82	1.27	6882.27
4/29/2016 19:53	563.0	29.8	1.25	6882.29
4/30/2016 0:51	861.0	29.84	1.29	6882.25
4/30/2016 8:58	1348.0	29.86	1.31	6882.23
4/30/2016 14:09	1659.0	29.8	1.25	6882.29
4/30/2016 21:10	2080.0	29.83	1.28	6882.26
5/1/2016 12:12	2982.0	29.92	1.37	6882.17
5/1/2016 17:42	3312.0	29.955	1.41	6882.135


Y-70 (water level)
Water level (feet below top of casing)
39.0
39.2
39.4
39.6
39.8
40.0
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **Y-70**

Elevation TOC	6902.78	Feet
Static level:	39.57	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	557.19	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 22:15	-2175.0	39.57	0.00	6863.21
4/28/2016 19:27	-903.0	39.57	0.00	6863.21
4/29/2016 11:20	50.0	39.545	-0.025	6863.235
4/29/2016 12:49	139.0	39.56	-0.01	6863.22
4/29/2016 17:25	415.0	39.55	-0.02	6863.23
4/29/2016 20:16	586.0	39.56	-0.01	6863.22
4/29/2016 23:52	802.0	39.545	-0.025	6863.235
4/30/2016 9:25	1375.0	39.533	-0.037	6863.247
4/30/2016 15:26	1736.0	39.505	-0.065	6863.275
4/30/2016 20:50	2060.0	39.522	-0.048	6863.258
5/1/2016 12:40	3010.0	39.518	-0.052	6863.262
5/1/2016 17:18	3288.0	39.535	-0.035	6863.245

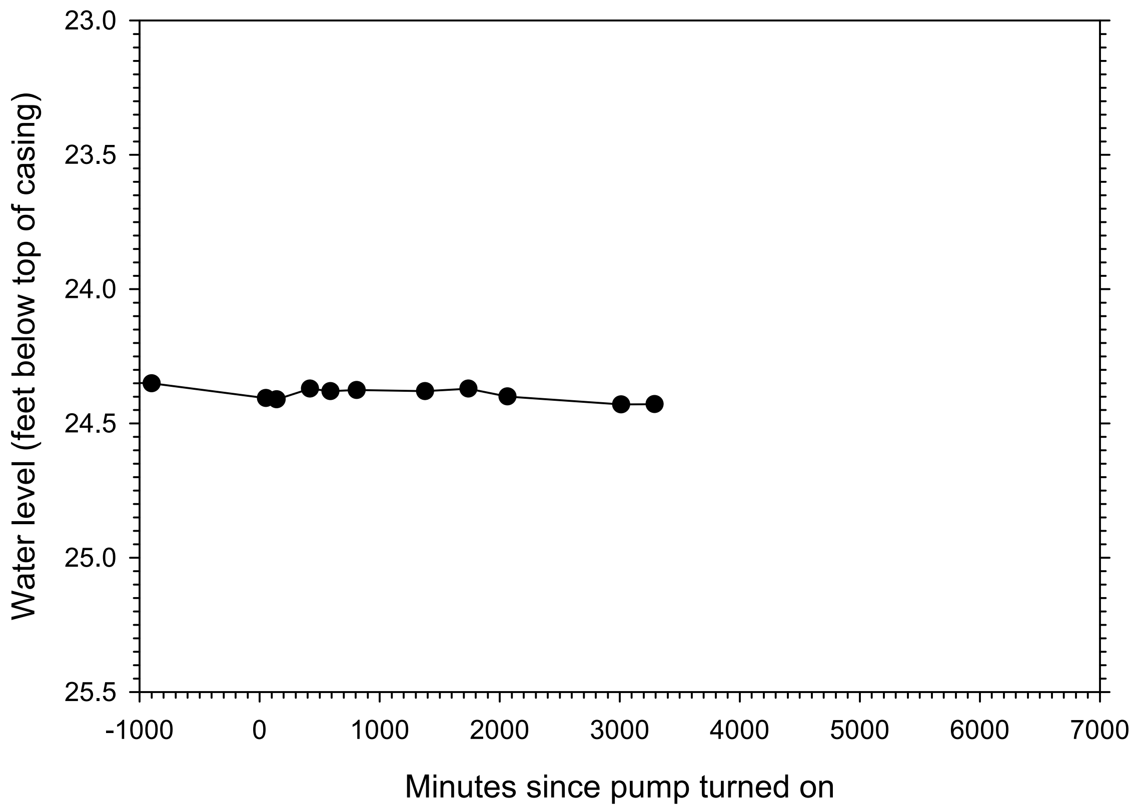

NLP-4 (water level)
Water level (feet below top of casing)
2.0
2.5
3.0
3.5
4.0
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **NLP-4**

Elevation TOC	6871.86	Feet
Static level:	3.41	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	588.59	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/28/2016 19:15	-915.0	3.41	0.00	6868.45
4/29/2016 10:07	-23.0	3.36	-0.05	6868.5
4/29/2016 12:07	97.0	3.38	-0.03	6868.48
4/29/2016 14:32	242.0	3.38	-0.03	6868.48
4/29/2016 17:53	443.0	3.408	0.00	6868.452
4/29/2016 20:00	570.0	3.42	0.01	6868.44
4/30/2016 1:06	876.0	3.41	0.00	6868.45
4/30/2016 8:53	1343.0	3.43	0.02	6868.43
4/30/2016 14:04	1654.0	3.348	-0.06	6868.512
4/30/2016 21:24	2094.0	3.34	-0.07	6868.52
5/1/2016 12:17	2987.0	3.43	0.02	6868.43
5/1/2016 17:35	3305.0	3.465	0.05	6868.395

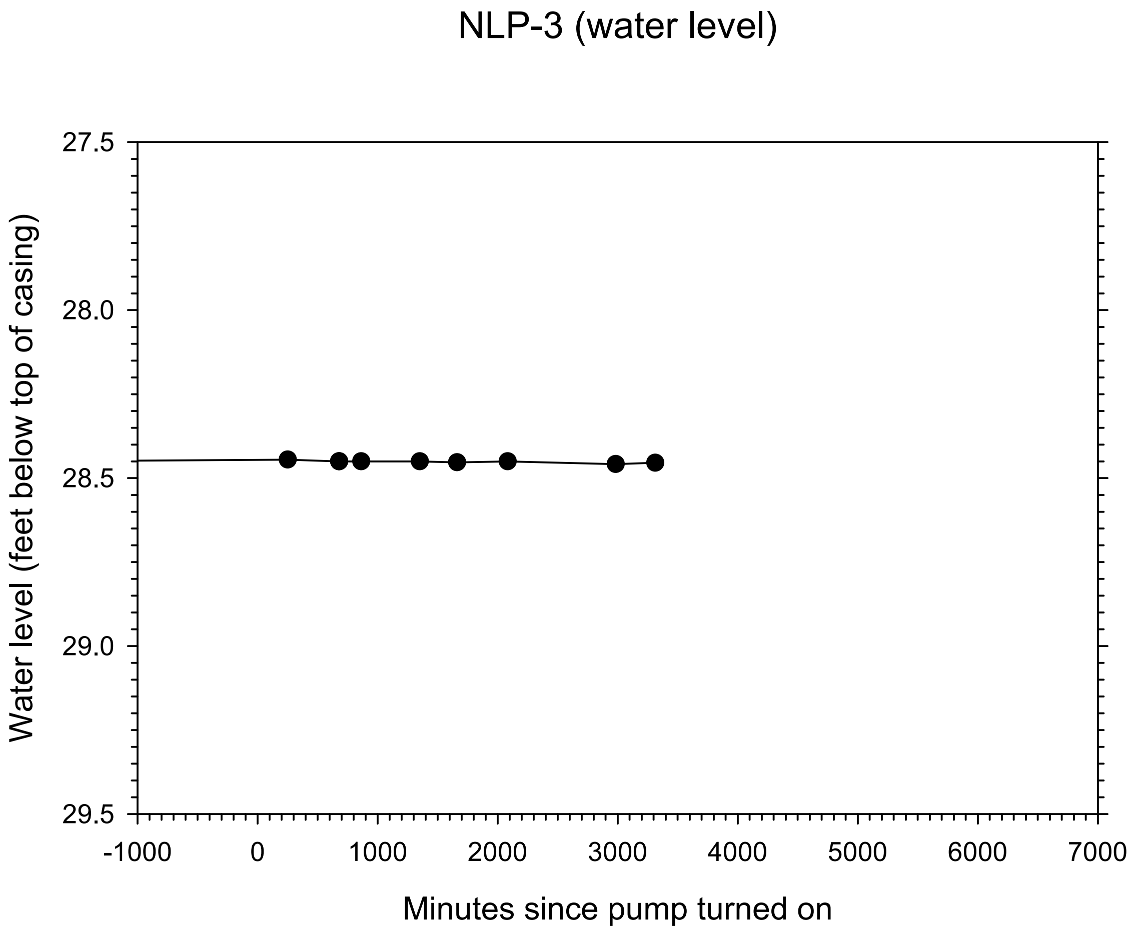
NLP-10 (water level)



Monitoring Well: **NLP-10**

Elevation TOC	6902.62	Feet
Static level:	24.35	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	684.40	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 22:20	-2170.0	24.34	-0.01	6878.28
4/28/2016 19:30	-900.0	24.35	0.00	6878.27
4/29/2016 11:22	52.1	24.405	0.05	6878.22
4/29/2016 12:51	141.0	24.41	0.06	6878.21
4/29/2016 17:28	418.0	24.37	0.02	6878.25
4/29/2016 20:19	589.0	24.38	0.03	6878.24
4/29/2016 23:57	807.0	24.375	0.02	6878.25
4/30/2016 9:27	1377.0	24.38	0.03	6878.24
4/30/2016 15:28	1738.0	24.37	0.02	6878.25
4/30/2016 20:53	2063.0	24.4	0.05	6878.22
5/1/2016 12:42	3012.0	24.43	0.08	6878.19
5/1/2016 17:21	3291.0	24.429	0.08	6878.19

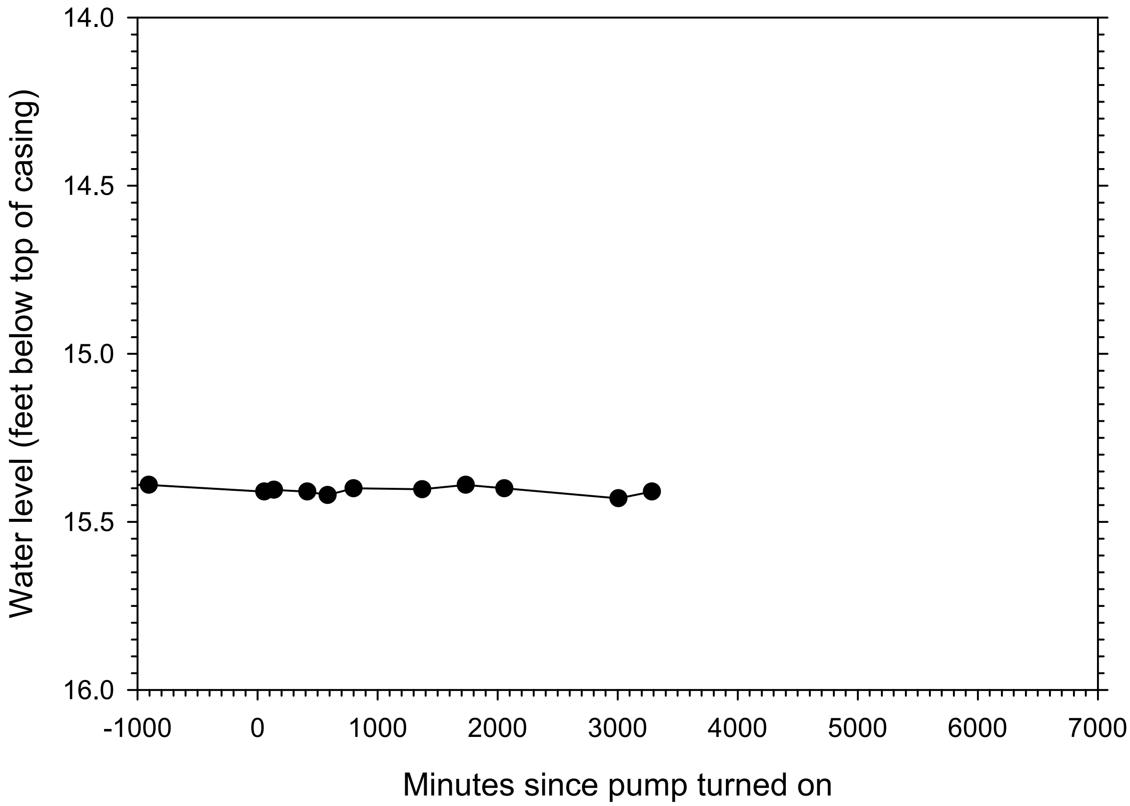

NLP-3 (water level)
Water level (feet below top of casing)
27.5
28.0
28.5
29.0
29.5
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **NLP-3**

Elevation TOC	6917.98	Feet
Static level:	28.45	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	730.26	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:55	-2195.0	28.45	0.00	6889.53
4/29/2016 14:40	250.0	28.445	0.00	6889.535
4/29/2016 21:50	680.0	28.45	0.00	6889.53
4/29/2016 21:50	680.0	28.45	0.00	6889.53
4/30/2016 0:54	864.0	28.45	0.00	6889.53
4/30/2016 9:01	1351.0	28.45	0.00	6889.53
4/30/2016 14:12	1662.0	28.453	0.00	6889.527
4/30/2016 21:12	2082.0	28.45	0.00	6889.53
5/1/2016 12:14	2984.0	28.458	0.01	6889.522
5/1/2016 17:44	3314.0	28.454	0.00	6889.526

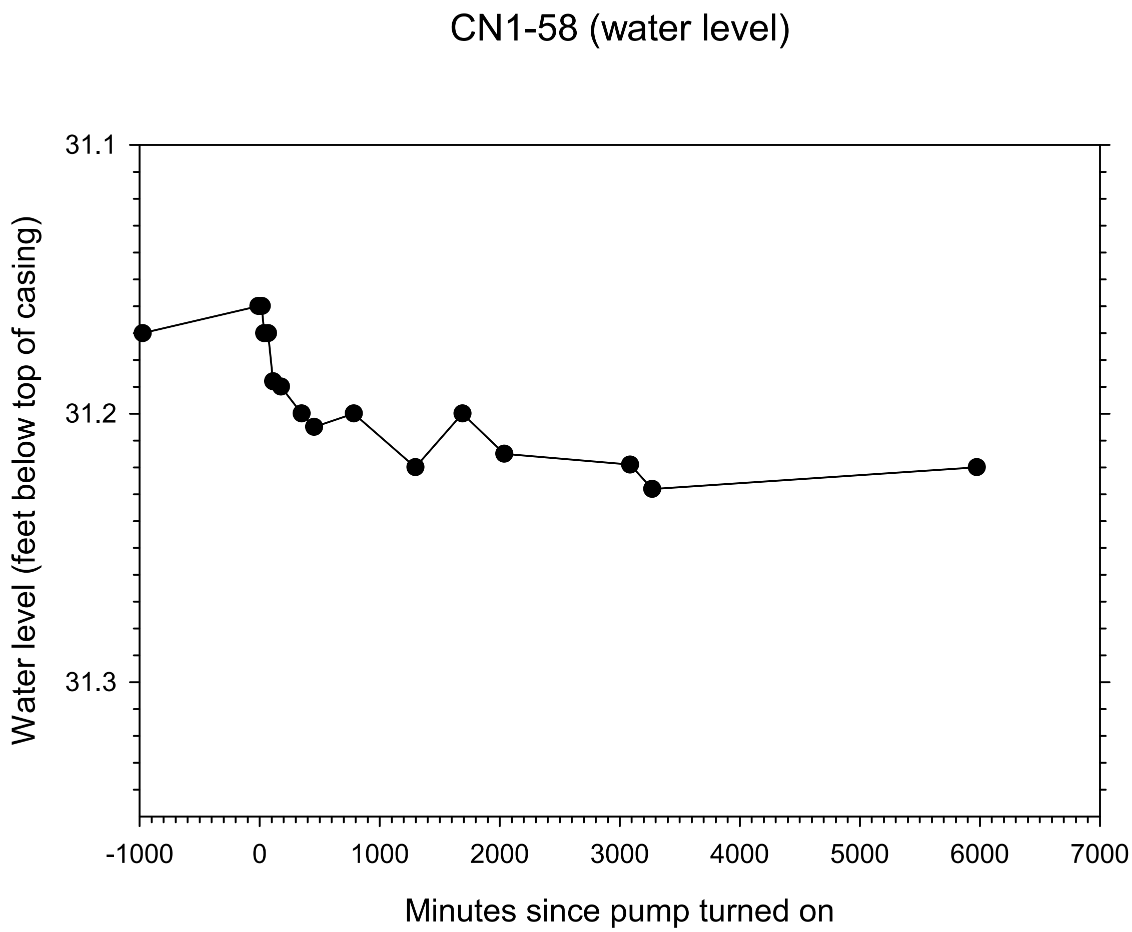
NLP-2 (water level)



Monitoring Well: **NLP-2**

Elevation TOC	6910.39	Feet
Static level:	15.39	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	986.97	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 22:10	-2180.0	15.39	0.00	6895
4/28/2016 19:24	-906.0	15.39	0.00	6895
4/29/2016 11:25	55.2	15.41	0.02	6894.98
4/29/2016 12:46	136.5	15.405	0.01	6894.985
4/29/2016 17:23	413.0	15.41	0.02	6894.98
4/29/2016 20:13	583.0	15.42	0.03	6894.97
4/29/2016 23:49	799.0	15.4	0.01	6894.99
4/30/2016 9:21	1371.0	15.403	0.01	6894.987
4/30/2016 15:23	1733.0	15.39	0.00	6895
4/30/2016 20:46	2056.0	15.4	0.01	6894.99
5/1/2016 12:38	3008.0	15.43	0.04	6894.96
5/1/2016 17:16	3286.0	15.41	0.02	6894.98

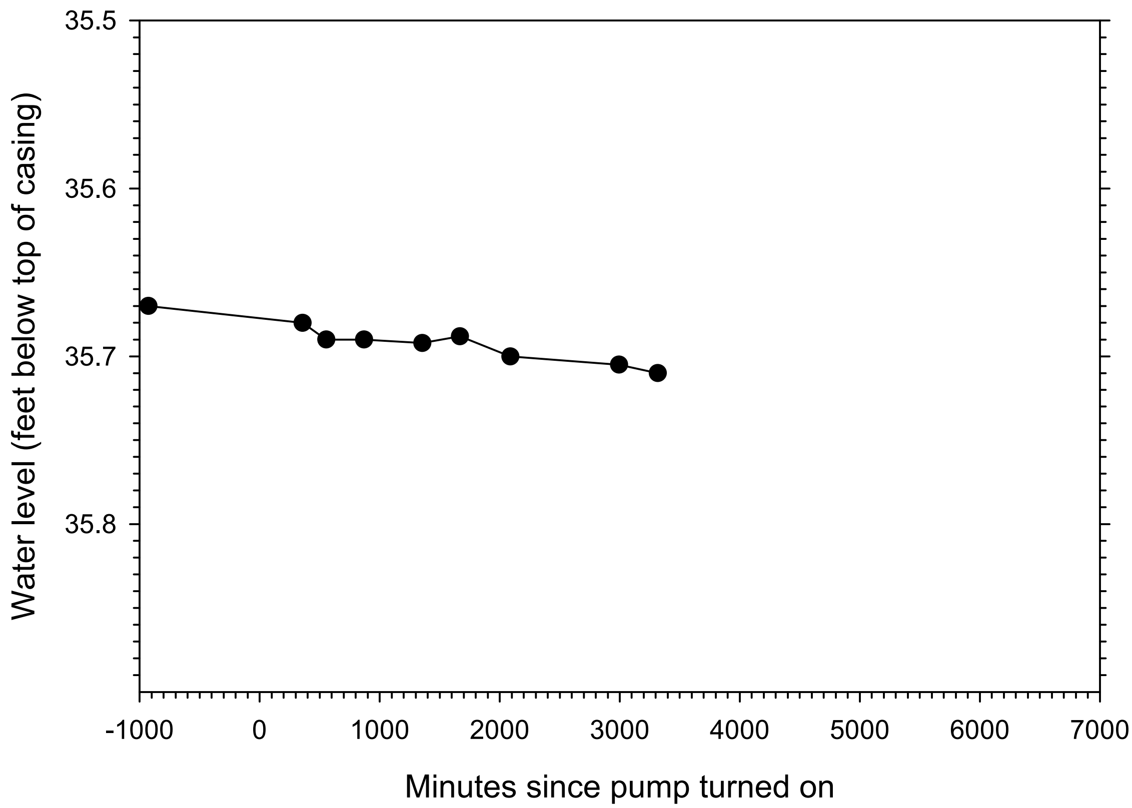

CN1-58 (water level)
Water level (feet below top of casing)
31.1
31.2
31.3
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **CN1-58**

Elevation TOC	6878.1	Feet
Static level:	31.16	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1150.98	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:08	-2242.0	31.18	0	6846.92
4/28/2016 18:15	-975.0	31.17	-0.01	6846.93
4/29/2016 10:20	-10.0	31.16	-0.02	6846.94
4/29/2016 10:46	16.7	31.16	-0.02	6846.94
4/29/2016 11:06	36.8	31.17	-0.01	6846.93
4/29/2016 11:39	69.5	31.17	-0.01	6846.93
4/29/2016 12:20	110.7	31.188	0.008	6846.912
4/29/2016 13:27	177.0	31.19	0.01	6846.91
4/29/2016 16:20	350.0	31.2	0.02	6846.9
4/29/2016 18:04	454.0	31.205	0.025	6846.895
4/29/2016 23:34	784.0	31.2	0.02	6846.9
4/30/2016 8:06	1296.0	31.22	0.04	6846.88
4/30/2016 14:38	1688.0	31.2	0.02	6846.9
4/30/2016 20:28	2038.0	31.215	0.035	6846.885
5/1/2016 13:58	3088.0	31.219	0.039	6846.881
5/1/2016 17:01	3271.0	31.228	0.048	6846.872
5/3/2016 14:05	5975.0	31.22	0.04	6846.88

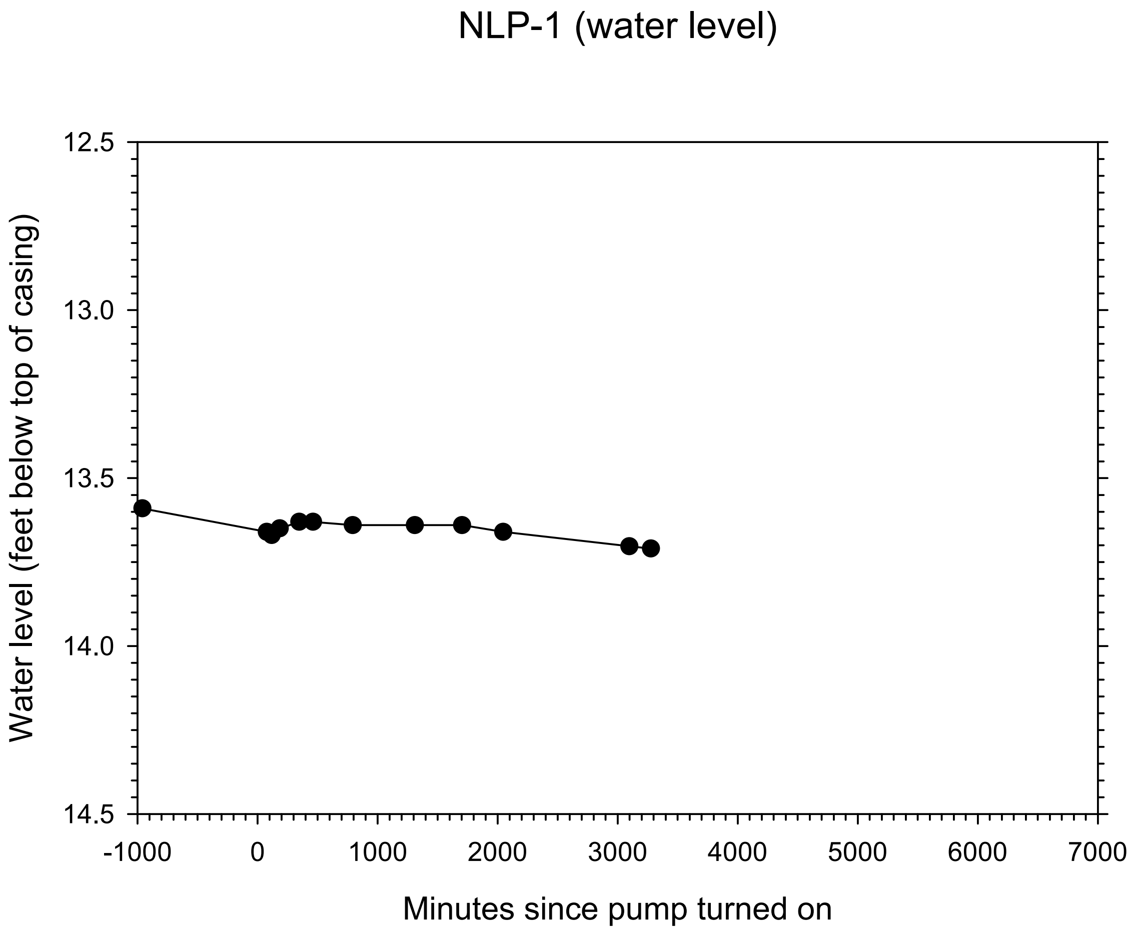
CN2-70 (water level)



Monitoring Well: **CN2-70**

Elevation TOC	6937.37	Feet
Static level:	35.67	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1270.40	Feet

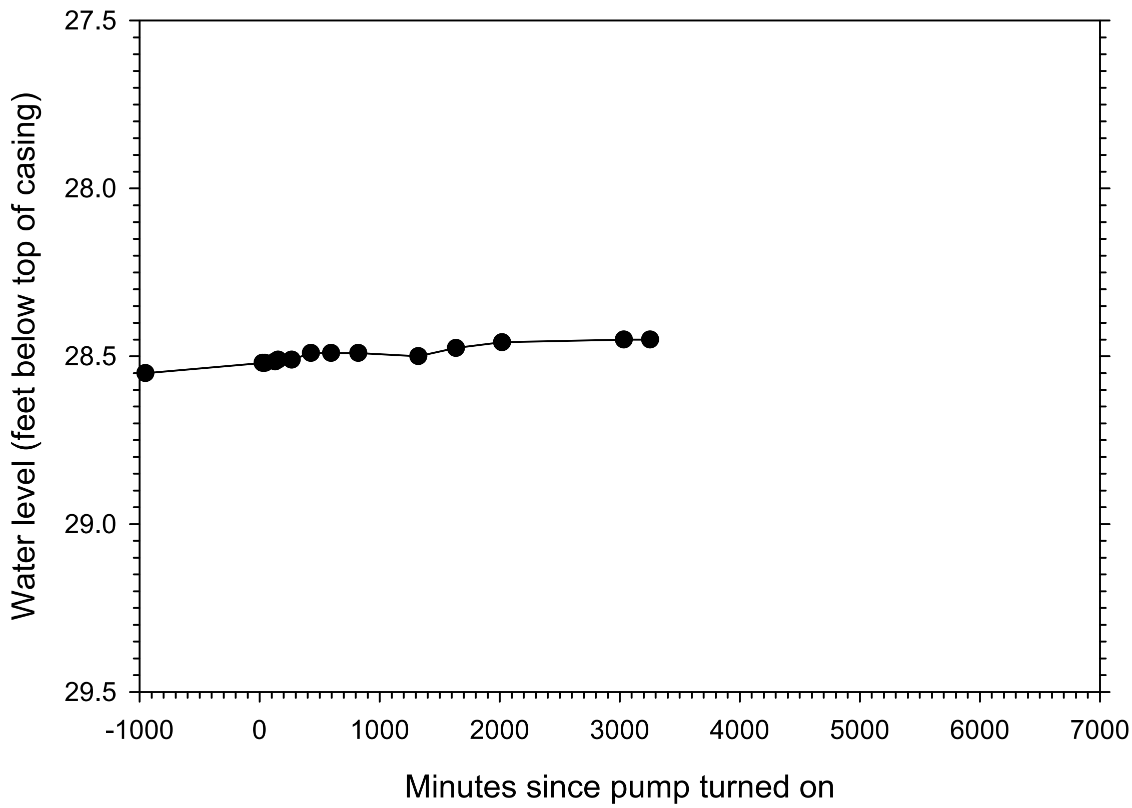
Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:49	-2201.0	35.67	0.00	6901.69
4/28/2016 19:03	-927.0	35.67	0.00	6901.69
4/29/2016 16:27	357.0	35.68	0.01	6901.68
4/29/2016 19:45	555.0	35.69	0.02	6901.67
4/30/2016 0:59	869.0	35.69	0.02	6901.67
4/30/2016 9:05	1355.0	35.692	0.02	6901.668
4/30/2016 14:18	1668.0	35.688	0.02	6901.672
4/30/2016 21:17	2087.0	35.7	0.03	6901.66
5/1/2016 12:23	2993.0	35.705	0.03	6901.655
5/1/2016 17:47	3317.0	35.71	0.04	6901.65


NLP-1 (water level)
12.5
13.0
13.5
14.0
14.5
Water level (feet below top of casing)
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well:	**NLP-1**	
Elevation TOC	6920.23	Feet
Static level:	13.59	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1297.25	Feet

Date and Time	**Elapsed minutes since pump on (minutes)**	**Depth to water (feet below toc)**	**Drawdown (feet)**	**Wat el. (feet)**
4/27/2016 22:32	-2158.0	13.57	-0.02	6906.66
4/28/2016 18:30	-960.0	13.59	0.00	6906.64
4/29/2016 11:46	76.3	13.66	0.07	6906.57
4/29/2016 12:27	117.8	13.67	0.08	6906.56
4/29/2016 13:34	184.0	13.65	0.06	6906.58
4/29/2016 16:16	346.0	13.63	0.04	6906.6
4/29/2016 18:11	461.0	13.63	0.04	6906.6
4/29/2016 23:42	792.0	13.64	0.05	6906.59
4/30/2016 8:20	1310.0	13.64	0.05	6906.59
4/30/2016 14:53	1703.0	13.64	0.05	6906.59
4/30/2016 20:35	2045.0	13.66	0.07	6906.57
5/1/2016 14:09	3099.0	13.703	0.11	6906.527
5/1/2016 17:08	3278.0	13.71	0.12	6906.52

CN5-58 (water level)

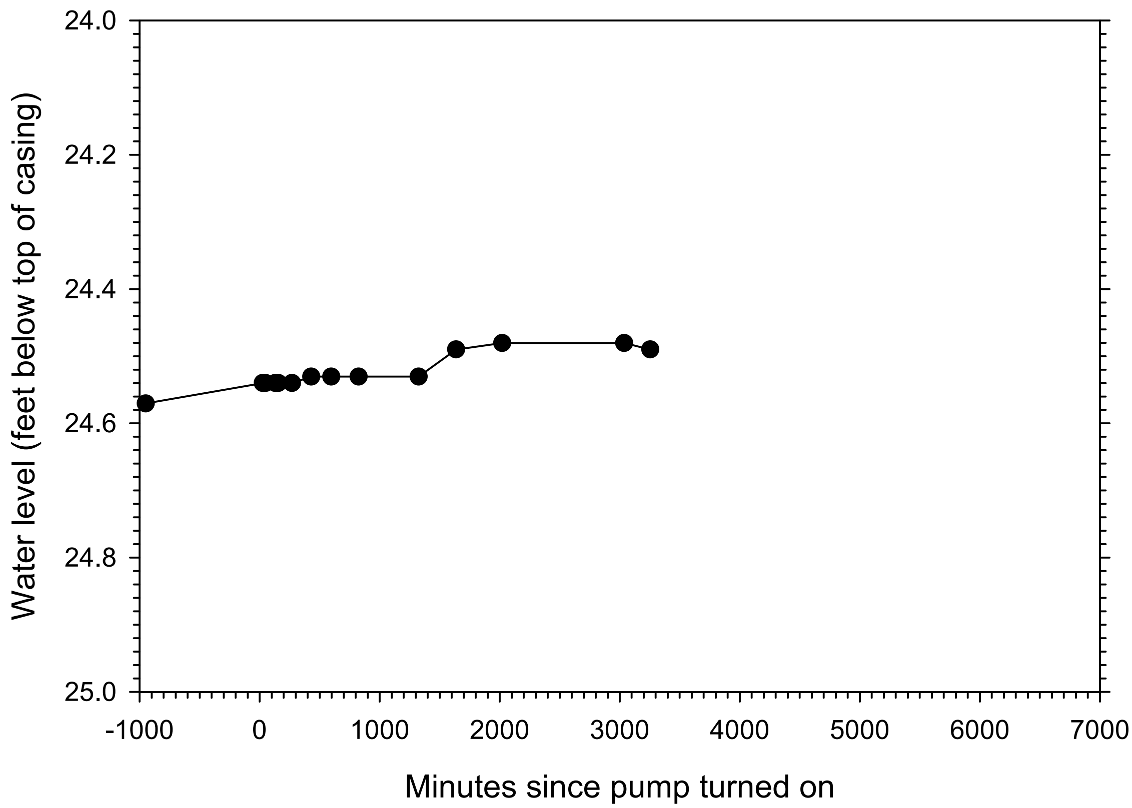


Monitoring Well: **CN5-58**

Elevation TOC	6878.1	Feet
Static level:	28.55	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1345.37	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:40	-2270.0	28.58	0.03	6849.52
4/28/2016 18:38	-952.0	28.55	0.00	6849.55
4/29/2016 10:53	23.8	28.52	-0.03	6849.58
4/29/2016 11:14	44.5	28.52	-0.03	6849.58
4/29/2016 12:39	129.2	28.515	-0.04	6849.585
4/29/2016 13:03	153.0	28.51	-0.04	6849.59
4/29/2016 14:57	267.0	28.51	-0.04	6849.59
4/29/2016 17:37	427.0	28.49	-0.06	6849.61
4/29/2016 20:24	594.0	28.49	-0.06	6849.61
4/30/2016 0:11	821.0	28.49	-0.06	6849.61
4/30/2016 8:31	1321.0	28.5	-0.05	6849.6
4/30/2016 13:44	1634.0	28.475	-0.07	6849.625
4/30/2016 20:08	2018.0	28.458	-0.09	6849.642
5/1/2016 13:04	3034.0	28.45	-0.10	6849.65
5/1/2016 16:43	3253.0	28.45	-0.10	6849.65

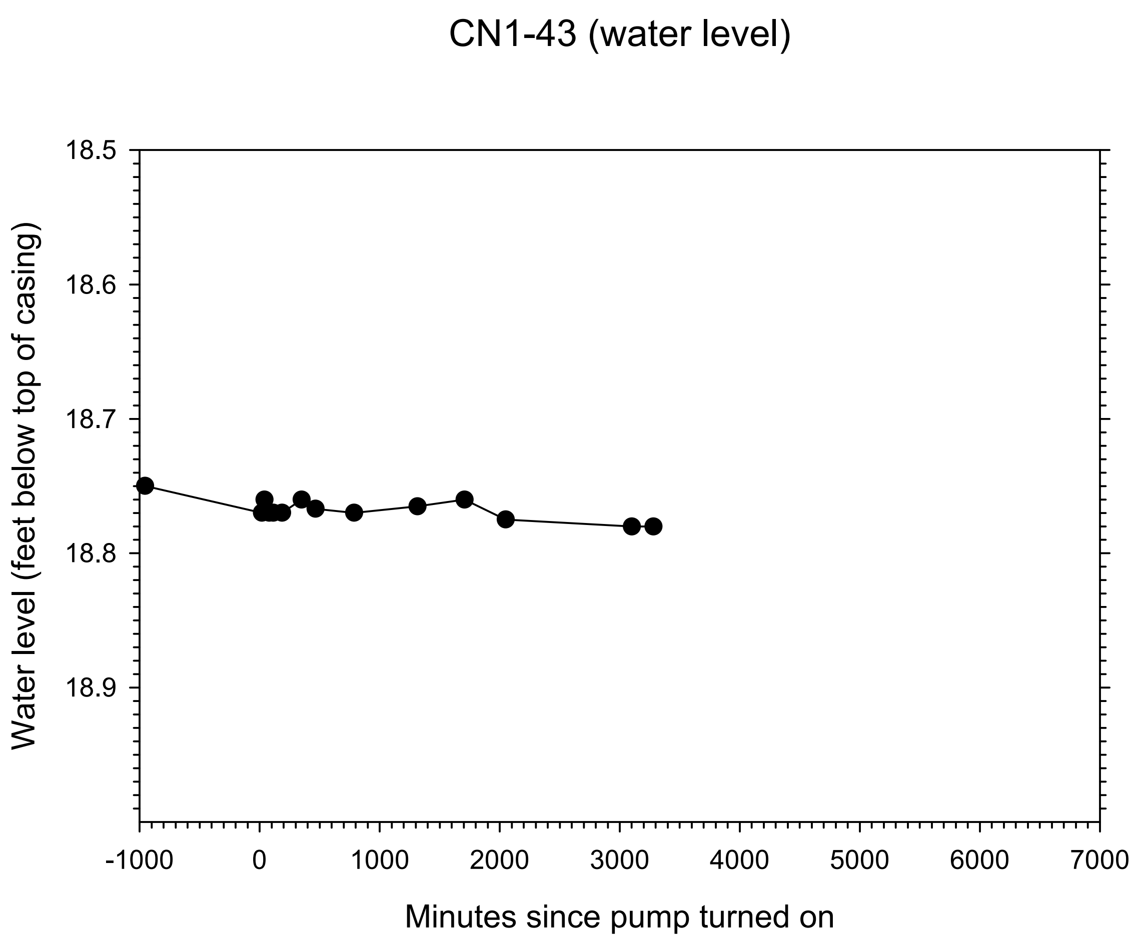
CN5-52 (water level)



Monitoring Well: **CN5-52**

Elevation TOC	6875.4	Feet
Static level:	24.54	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1380.57	Feet

Date and Time	**Elapsed minutes since pump on (minutes)**	**Depth to water (feet below toc)**	**Drawdown (feet)**	**Wat el. (feet)**
4/27/2016 20:42	-2268.0	24.62	0.08	6850.78
4/28/2016 18:40	-950.0	24.57	0.03	6850.83
4/29/2016 10:55	25.5	24.54	0.00	6850.86
4/29/2016 11:16	46.5	24.54	0.00	6850.86
4/29/2016 12:41	131.0	24.54	0.00	6850.86
4/29/2016 13:05	155.0	24.54	0.00	6850.86
4/29/2016 15:00	270.0	24.54	0.00	6850.86
4/29/2016 17:39	429.0	24.53	-0.01	6850.87
4/29/2016 20:26	596.0	24.53	-0.01	6850.87
4/30/2016 0:13	823.0	24.53	-0.01	6850.87
4/30/2016 8:34	1324.0	24.53	-0.01	6850.87
4/30/2016 13:46	1636.0	24.49	-0.05	6850.91
4/30/2016 20:10	2020.0	24.48	-0.06	6850.92
5/1/2016 13:07	3037.0	24.48	-0.06	6850.92
5/1/2016 16:46	3256.0	24.49	-0.05	6850.91

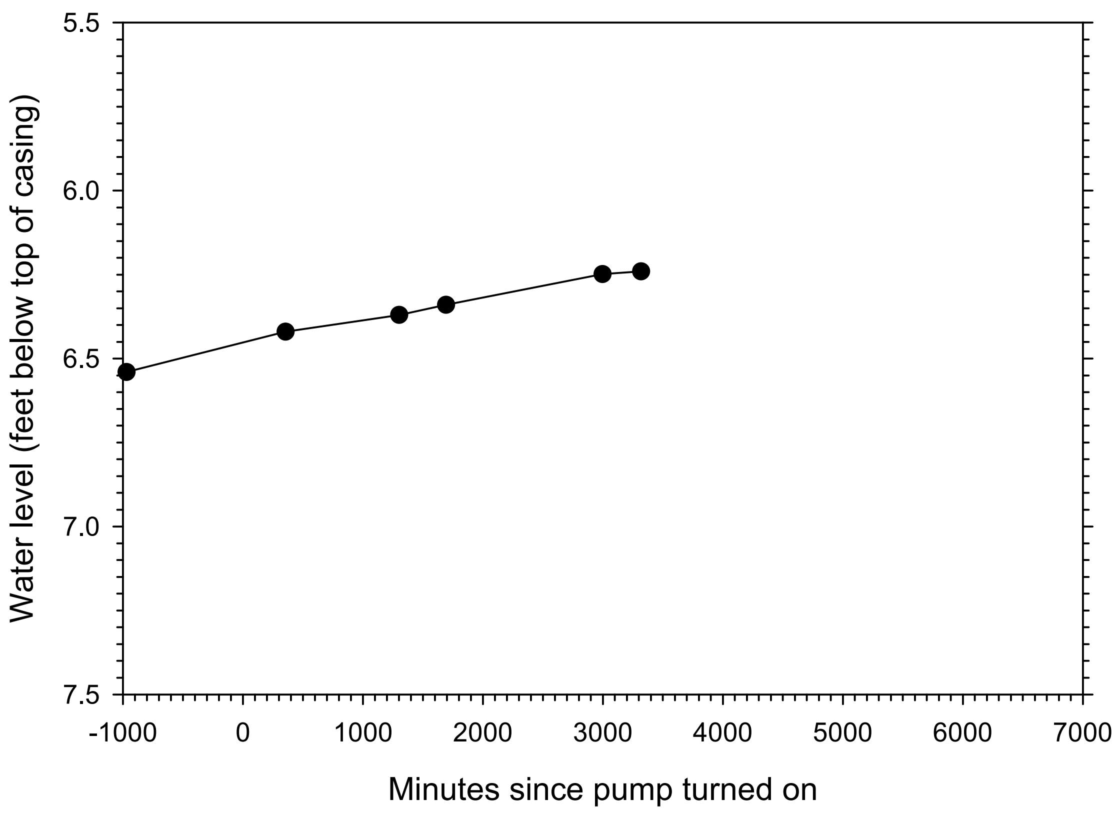

CN1-43 (water level)
Water level (feet below top of casing)
18.5
18.6
18.7
18.8
18.9
-1000
0
1000
2000
3000
4000
5000
6000
7000
Minutes since pump turned on

Monitoring Well: **CN1-43**

Elevation TOC	6931.16	Feet
Static level:	18.75	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1460.31	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:11	-2239.0	18.74	-0.01	6912.42
4/28/2016 18:35	-955.0	18.75	0	6912.41
4/29/2016 10:48	18.5	18.77	0.02	6912.39
4/29/2016 11:08	38.7	18.76	0.01	6912.4
4/29/2016 11:49	79.3	18.77	0.02	6912.39
4/29/2016 12:23	113.0	18.77	0.02	6912.39
4/29/2016 13:37	187.0	18.77	0.02	6912.39
4/29/2016 16:20	350.0	18.76	0.01	6912.4
4/29/2016 18:15	465.0	18.767	0.017	6912.393
4/29/2016 23:37	787.0	18.77	0.02	6912.39
4/30/2016 8:24	1314.0	18.765	0.015	6912.395
4/30/2016 14:56	1706.0	18.76	0.01	6912.4
4/30/2016 20:38	2048.0	18.775	0.025	6912.385
5/1/2016 14:12	3102.0	18.78	0.03	6912.38
5/1/2016 17:11	3281.0	18.78	0.03	6912.38

NLP-5 (water level)

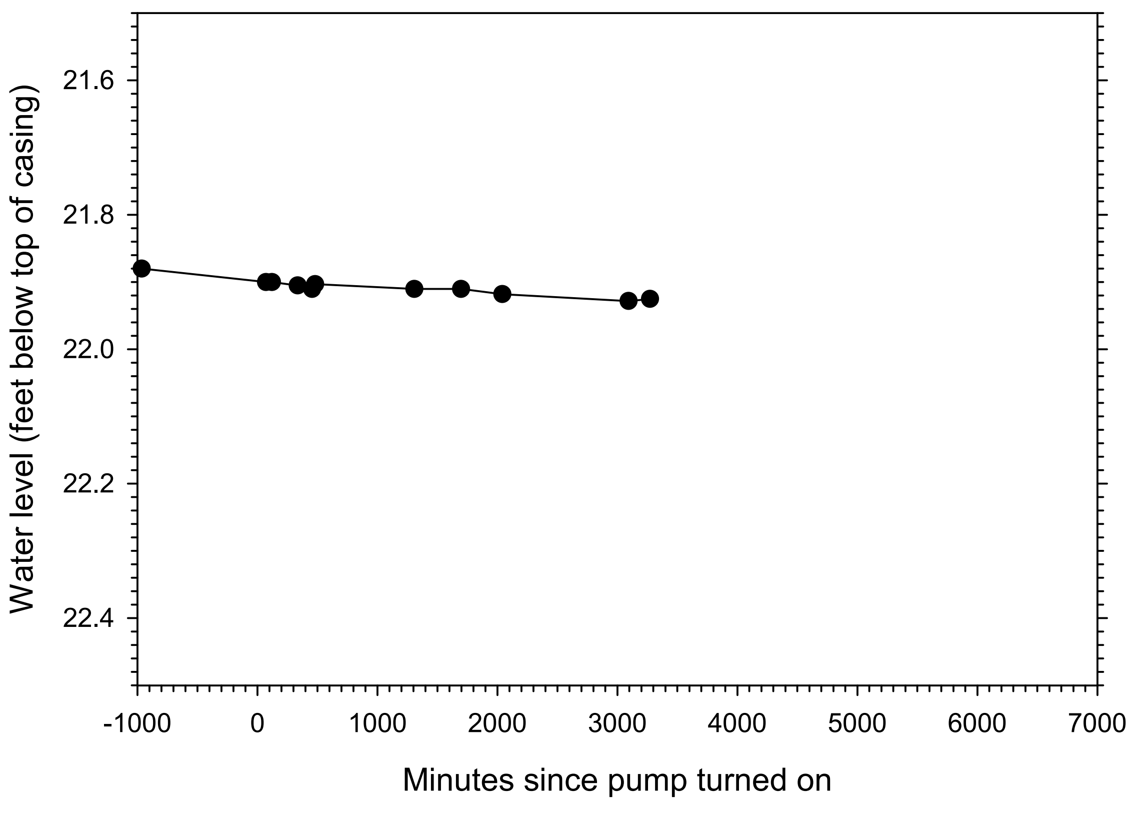


Monitoring Well: **NLP-5**

Elevation TOC	6921.45	Feet
Static level:	6.54	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1674.23	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/28/2016 18:20	-970.0	6.54	0.00	6914.91
4/29/2016 16:24	354.0	6.42	-0.12	6915.03
4/30/2016 8:11	1301.0	6.37	-0.17	6915.08
4/30/2016 14:42	1692.0	6.34	-0.20	6915.11
5/1/2016 12:27	2997.0	6.248	-0.29	6915.202
5/1/2016 17:50	3320.0	6.24	-0.30	6915.21

CN0-25 (water level)

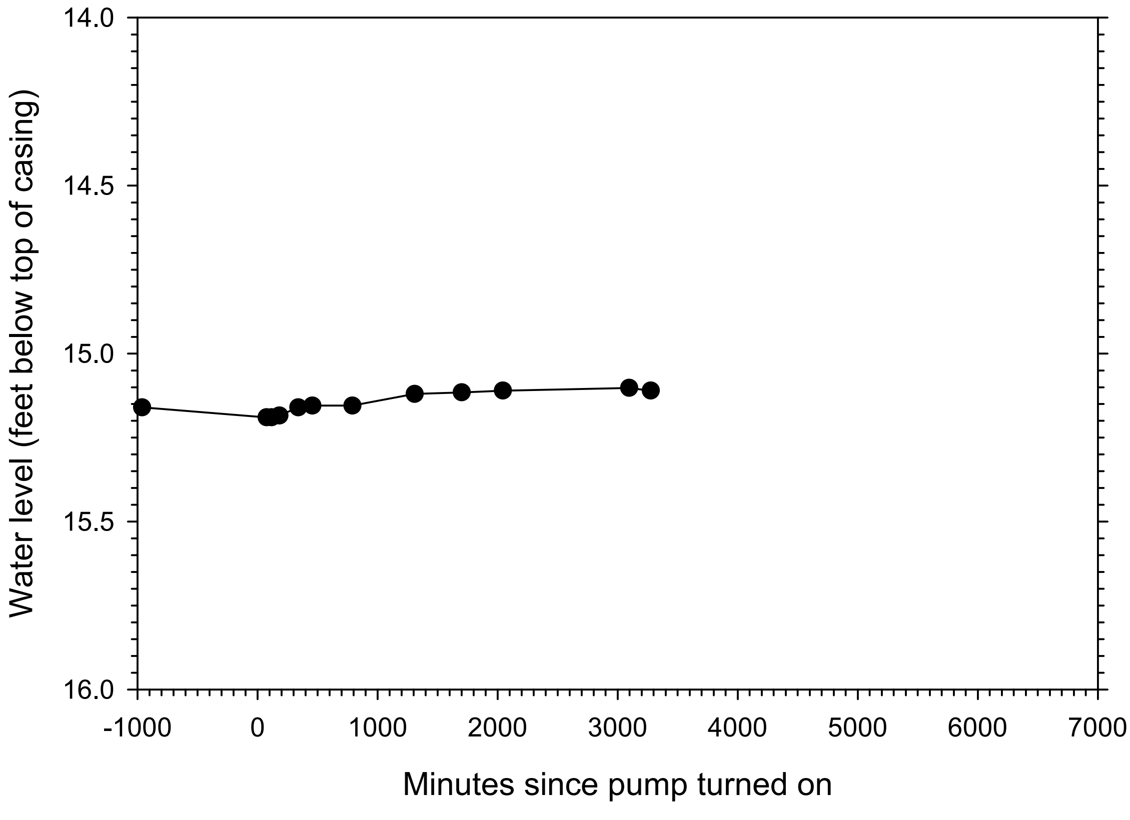


Monitoring Well: **CN0-25**

Elevation TOC	6939.28	Feet
Static level:	21.88	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1774.34	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:20	-2230.0	21.87	-0.01	6917.41
4/28/2016 18:25	-965.0	21.88	0.00	6917.4
4/29/2016 11:41	71.8	21.9	0.02	6917.38
4/29/2016 12:30	120.8	21.9	0.02	6917.38
4/29/2016 16:06	336.0	21.905	0.03	6917.375
4/29/2016 18:05	455.0	21.91	0.03	6917.37
4/29/2016 18:30	480.0	21.903	0.02	6917.377
4/30/2016 8:16	1306.0	21.91	0.03	6917.37
4/30/2016 14:47	1697.0	21.91	0.03	6917.37
4/30/2016 20:31	2041.0	21.918	0.04	6917.362
5/1/2016 14:04	3094.0	21.928	0.05	6917.352
5/1/2016 17:03	3273.0	21.925	0.05	6917.355

CN0-60 (water level)

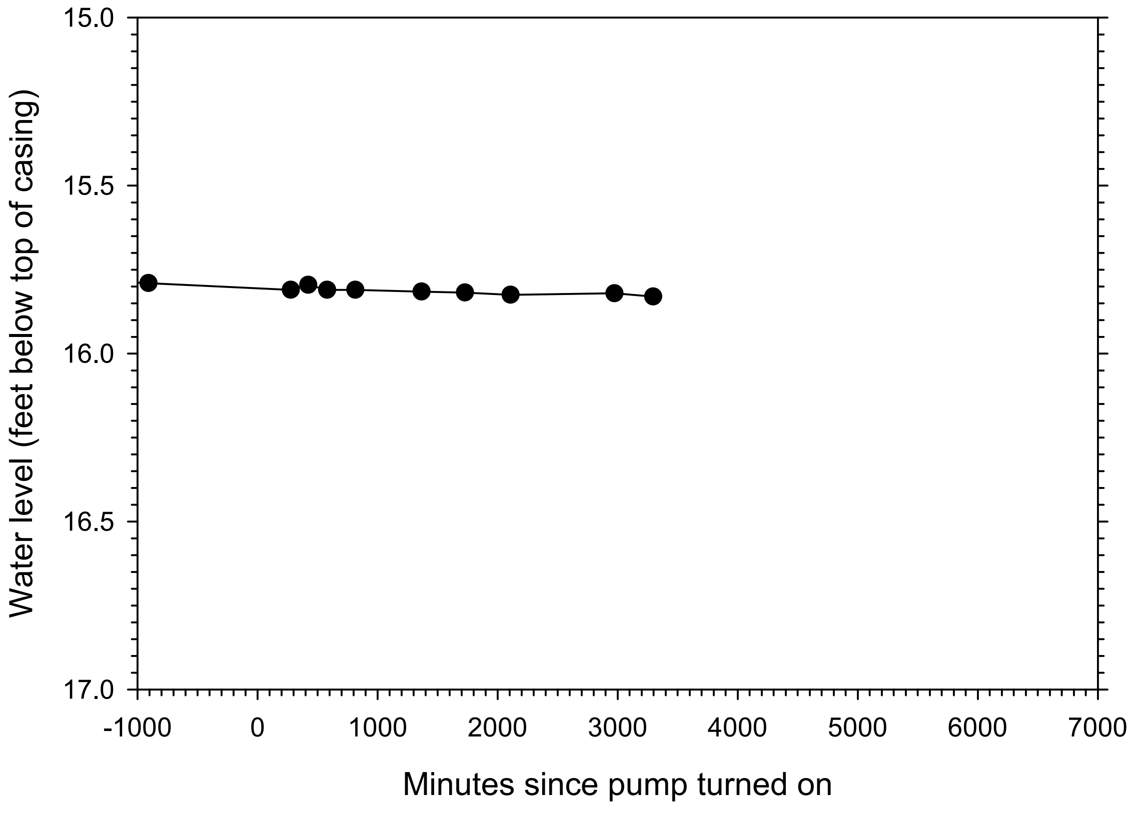


Monitoring Well: **CN0-60**

Elevation TOC	6932.16	Feet
Static level:	15.16	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	1849.52	Feet

Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 21:15	-2235.0	15.16	0.00	6917
4/28/2016 18:27	-963.0	15.16	0.00	6917
4/29/2016 11:44	74.0	15.19	0.03	6916.97
4/29/2016 12:25	115.3	15.19	0.03	6916.97
4/29/2016 13:32	182.0	15.185	0.03	6916.975
4/29/2016 16:09	339.0	15.16	0.00	6917
4/29/2016 18:07	457.0	15.155	-0.01	6917.005
4/29/2016 23:40	790.0	15.155	-0.01	6917.005
4/30/2016 8:18	1308.0	15.12	-0.04	6917.04
4/30/2016 14:50	1700.0	15.115	-0.04	6917.045
4/30/2016 20:33	2043.0	15.11	-0.05	6917.05
5/1/2016 14:06	3096.0	15.102	-0.06	6917.058
5/1/2016 17:06	3276.0	15.11	-0.05	6917.05

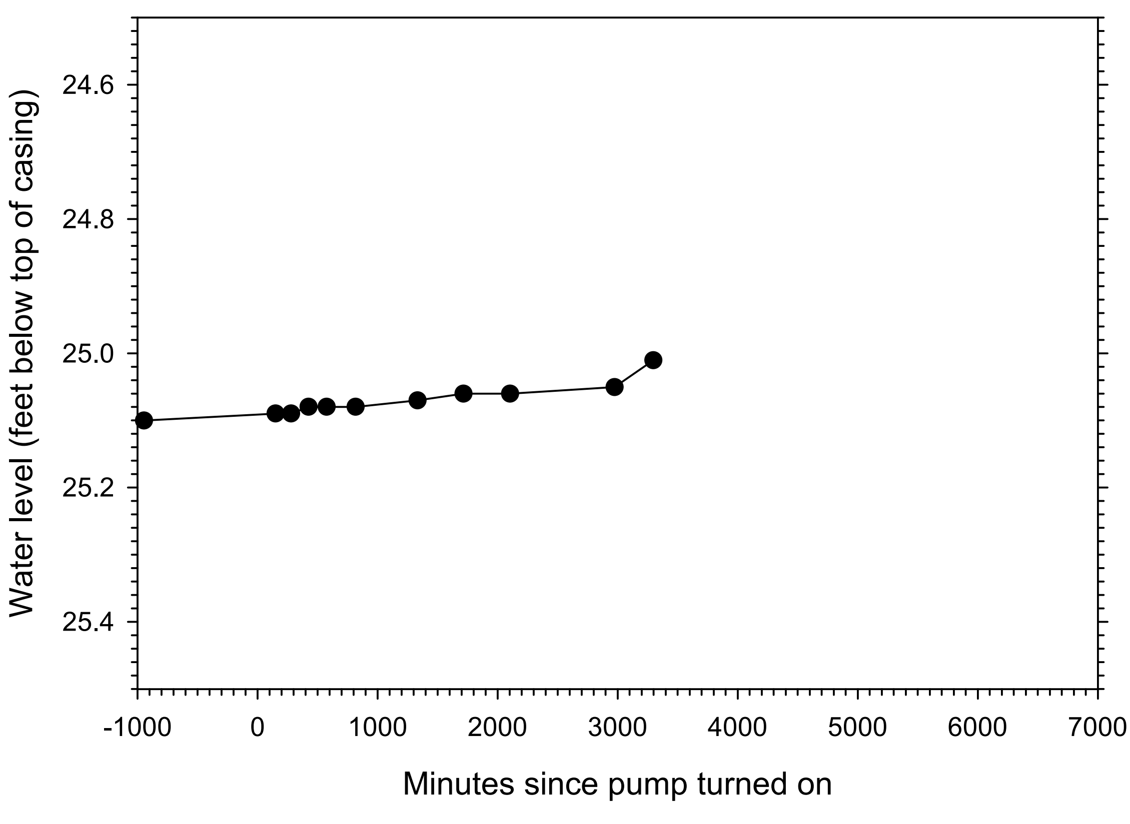
NLP-12 (water level)



Monitoring Well:	**NLP-12**	
Elevation TOC	6848.57	Feet
Static level:	15.79	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	2055.98	Feet

Date and Time	**Elapsed minutes since pump on (minutes)**	**Depth to water (feet below toc)**	**Drawdown (feet)**	**Wat el. (feet)**
4/27/2016 22:00	-2190.0	15.77	-0.02	6832.8
4/28/2016 19:20	-910.0	15.79	0.00	6832.78
4/29/2016 15:06	276.0	15.81	0.02	6832.76
4/29/2016 17:32	422.0	15.795	0.01	6832.775
4/29/2016 20:09	579.0	15.81	0.02	6832.76
4/30/2016 0:04	814.0	15.81	0.02	6832.76
4/30/2016 9:16	1366.0	15.815	0.03	6832.755
4/30/2016 15:18	1728.0	15.818	0.03	6832.752
4/30/2016 21:37	2107.0	15.825	0.04	6832.745
5/1/2016 12:03	2973.0	15.82	0.03	6832.75
5/1/2016 17:26	3296.0	15.83	0.04	6832.74

CN7-70 (water level)



Monitoring Well: **CN7-70**

Elevation TOC	6848.91	Feet
Static level:	25.10	(feet below toc)
Pump on:	4/29/2016 10:30	Time
Pump off	5/1/2016 18:30	Time
Pump dist.	2307.79	Feet

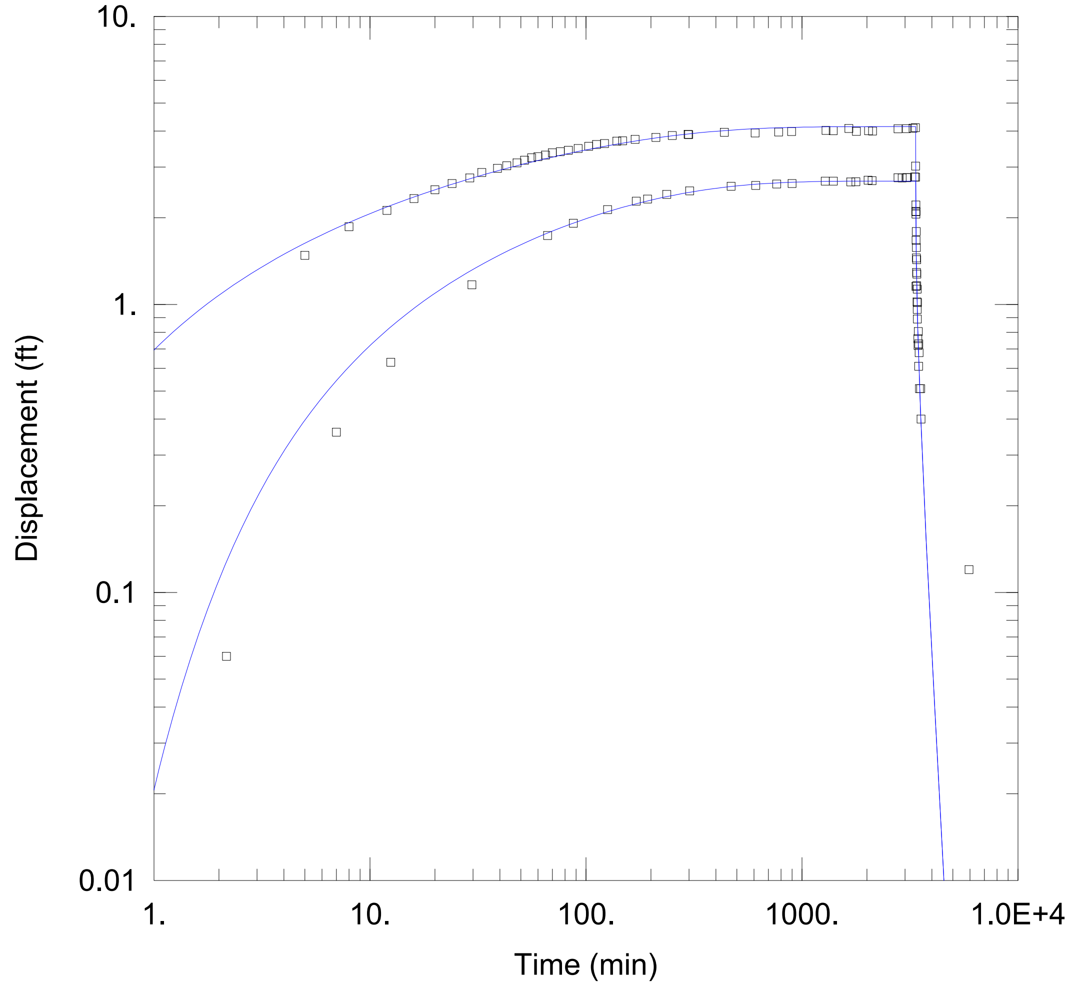
Date and Time	Elapsed minutes since pump on (minutes)	Depth to water (feet below toc)	Drawdown (feet)	Wat el. (feet)
4/27/2016 20:30	-2280.0	25.08	-0.02	6823.83
4/28/2016 18:43	-947.0	25.1	0.00	6823.81
4/29/2016 12:59	149.0	25.09	-0.01	6823.82
4/29/2016 15:09	279.0	25.09	-0.01	6823.82
4/29/2016 17:35	425.0	25.08	-0.02	6823.83
4/29/2016 20:05	575.0	25.08	-0.02	6823.83
4/30/2016 0:07	817.0	25.08	-0.02	6823.83
4/30/2016 8:42	1332.0	25.07	-0.03	6823.84
4/30/2016 15:04	1714.0	25.06	-0.04	6823.85
4/30/2016 21:33	2103.0	25.06	-0.04	6823.85
5/1/2016 12:06	2976.0	25.05	-0.05	6823.86
5/1/2016 17:28	3298.0	25.01	-0.09	6823.9

Attachment C

Alluvial groundwater system

2016 Aquifer pump test analysis results

(Aqtesolv v. 4.50.002)



WELL TEST ANALYSIS

Data Set: C:\...\Pump and two obs wells VX.aqt
Date: 06/20/16 Time: 15:12:38

PROJECT INFORMATION

Company: Petersen Hydrologic, LLC
Client: Alton Coal Development, LLC
Test Well: CN3-81
Test Date: 29 April 2016

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CN3-81	1764206	364102

Observation Wells

Well Name	X (ft)	Y (ft)
□ CN3-69	1764043	364077
□ CN3-80	1764246	364066

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 666.9 ft^2/day
1/B = 0.0009133 ft^{-1}
b = 40. ft

S = 0.0001588
Kz/Kr = 1.

Data Set: C:\Users\Erik\Documents\AAA PH LLC\Coal Hollow\AAA North Lease Permitting\2016 Pump Testing\We
Date: 06/20/16
Time: 15:11:55

PROJECT INFORMATION

Company: Petersen Hydrologic, LLC
Client: Alton Coal Development, LLC
Test Date: 29 April 2016
Test Well: CN3-81

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 20. ft
Aquitard Thickness (b"): 300. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: CN3-81

X Location: 1764206. ft
Y Location: 364102. ft

Casing Radius: 0.167 ft
Well Radius: 0.328 ft

Fully Penetrating Well

No. of pumping periods: 2

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	28.8	3360.	0.

OBSERVATION WELL DATA

No. of observation wells: 2

Observation Well No. 1: CN3-69

X Location: 1764043. ft
Y Location: 364077. ft

Radial distance from CN3-81: 164.9060338 ft

Fully Penetrating Well

No. of Observations: 39

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
2.167	0.06	2113.	2.69
7.	0.36	2785.	2.752
12.5	0.63	2910.	2.75
29.67	1.17	3051.	2.755
66.5	1.735	3070.	2.756
87.5	1.913	3331.	2.77
126.	2.135	3361.	2.765
171.	2.285	3372.5	2.1
193.	2.322	3382.	1.79
237.	2.41	3390.5	1.575
302.	2.478	3398.5	1.43
470.	2.573	3408.5	1.275

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
611.	2.59	3419.5	1.13
765.	2.62	3430.5	1.015
900.	2.63	3461.	0.805
1281.	2.68	3474.	0.73
1398.	2.68	3489.	0.68
1684.	2.663	3549.	0.51
1778.	2.665	5940.	-0.08
2025.	2.7		

Observation Well No. 2: CN3-80

X Location: 1764246. ft
Y Location: 364066. ft

Radial distance from CN3-81: 53.81449619 ft

Fully Penetrating Well

No. of Observations: 61

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
5.	1.48	780.	3.97
8.	1.86	896.	3.985
12.	2.12	1292.	4.02
16.	2.33	1395.	4.01
20.	2.5	1650.	4.08
24.	2.63	1788.	3.99
29.	2.75	2034.	4.008
33.	2.87	2125.	4.
39.	2.97	2783.	4.07
43.	3.03	3047.	4.075
48.	3.1	3268.	4.09
52.	3.17	3356.	4.11
56.	3.23	3362.5	3.02
60.	3.26	3369.	2.215
65.	3.3	3369.8	1.155
70.	3.36	3370.5	2.105
76.	3.39	3371.	2.06
83.	3.43	3379.5	1.67
92.	3.48	3387.	1.45
103.	3.54	3393.	1.29
112.	3.59	3401.	1.16
122.	3.62	3411.	1.02
139.	3.69	3416.8	0.96
148.	3.7	3424.	0.89
169.	3.74	3439.	0.76
211.	3.8	3448.	0.72
251.	3.86	3471.	0.61
297.	3.892	3500.	0.51
299.	3.889	3562.	0.4
438.	3.96	5935.	0.12
607.	3.94		

SOLUTION

Pumping Test
Aquifer Model: Leaky
Solution Method: Hantush-Jacob

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	666.9	ft^2/day

S	0.0001588	
1/B	0.0009133	ft^{-1}
Kz/Kr	1.	
b	40.	ft

K = T/b = 16.67 ft/day (0.005881 cm/sec)
Ss = S/b = 3.969E-6 1/ft
K'/b' = 3.863E-7 min^{-1}
K' = 0.01113 ft/day

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	666.9	14.54	+/- 28.86	45.86	ft^2/day
S	0.0001588	1.071E-5	+/- 2.126E-5	14.82	
1/B	0.0009133	5.723E-5	+/- 0.0001136	15.96	ft^{-1}
Kz/Kr	1.	not estimated			
b	40.	not estimated			ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 16.67 ft/day (0.005881 cm/sec)
Ss = S/b = 3.969E-6 1/ft
K'/b' = 3.863E-7 min^{-1}
K' = 0.01113 ft/day

Parameter Correlations

	T	S	1/B
T	1.00	-0.88	-0.97
S	-0.88	1.00	0.89
1/B	-0.97	0.89	1.00

Residual Statistics

for weighted residuals

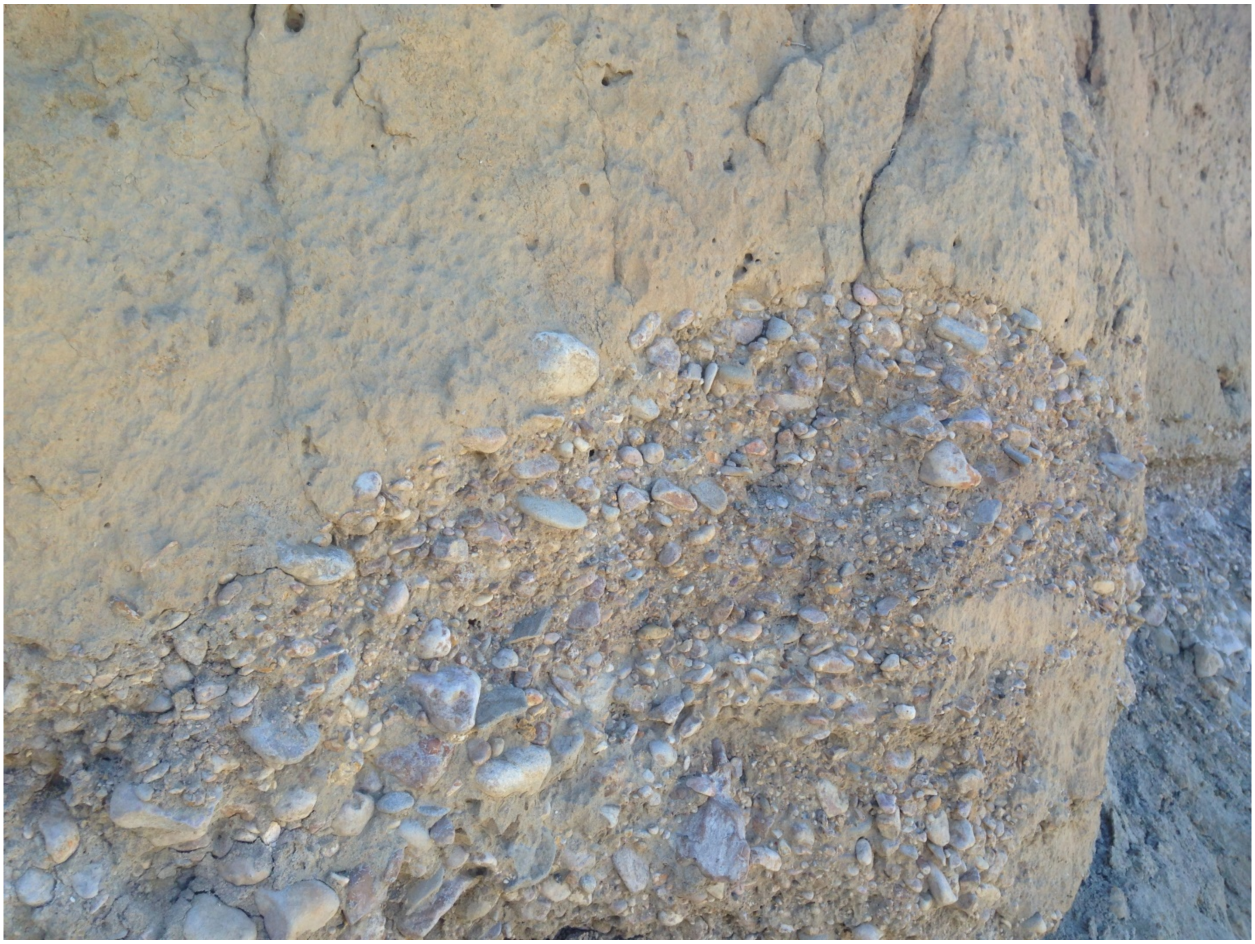
Sum of Squares . . . . . . 1.777 ft^2
Variance . . . . 0.01832 ft^2
Std. Deviation . . . . 0.1353 ft
Mean . . . . 0.005847 ft
No. of Residuals 100
No. of Estimates 3

Attachment D

Photographs Section

Photographs from the North Private Lease area

(2016)



Interbedded alluvial gravel and silty, clayey deposits in Kanab Creek stream bank.

Kanab Creek stream channel near pump test area – note presence of fine-grained (clayey, silty) deposits in the stream channel with the gravels and boulders.

Kanab Creek flowing through North Private Lease area under high flow conditions – March 2016.

Kanab Creek flowing through North Private Lease area under high flow conditions – March 2016.

Rotary drilling operation in the North Private Lease area – March 2016.

Direct-push drilling operation adjacent to Kanab Creek – March 2016.

Attachment E

Water quality analyses
From selected monitoring wells in the
North Private Lease area
Chemtech-Ford Laboratories
(2016)

Field measurements for March 2016 samples

Well	Date	Time	Wat. Lev. (ft b. toc)	T (°C)	pH (S.U.)	Sp. Conductance μS/cm)
CN2-70	22-Mar-16	11:50	34.99	10.6	7.05	2042
CN7-70	22-Mar-16	16:00	24.04	10.6	6.77	1984
CN5-58	22-Mar-16	16:50	27.85	10.1	6.84	1934
CN1-43	23-Mar-16	19:50	18.78	9.8	6.93	1678
CN1-58	23-Mar-16	20:40	30.58	9.4	7.01	2122
CN4-49	24-Mar-16	10:15	28.55	10.9	7.05	1865
CN3-98	24-Mar-16	15:15	26.55	11.3	7.01	1794
CN0-60	23-Mar-16	18:10	14.76	10	6.89	2083
CN0-25	23-Mar-16	18:30	22.01	Not enough water to sample		
CN6-1	24-Mar-16	11:00	26.00	Not enough water to sample		

CHEMTECH-FORD
LABORATORIES

4/7/2016

Work Order: 16C1056

Alton Coal Development, LLC

Attn: Kirk Nicholes

463 North 100 West Ste 1

Cedar City, UT 84721

Client Service Contact: 801.262.7299

NELAP ACCREDITED TNI LABORATORY

Approved By: Dave Gayer, Laboratory Director

Certificate of Analysis

CHEMTECH-FORD LABORATORIES

Lab Sample No.: 16C1056-01

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/22/2016 11:50 AM
Sample Site:	CN2-70	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	28.1		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	-3.3		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	26.3		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1190	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	650	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	497	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	533	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	0.3	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	29	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	0.2	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	SPH
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 23:00	3/25/2016 23:00	SPH
Phosphorus, Total as P	0.03	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	800	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1620	20	mg/L	SM 2540 C	03/29/2016 07:00	3/29/2016 7:00	
Total Suspended Solids (TSS)	44	4	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 14:55	
Aluminum, Total	0.09	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Boron, Total	0.09	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Barium, Dissolved	0.036	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Calcium, Dissolved	188	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:11	
Iron, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	

Certificate of Analysis

Lab Sample No.: 16C1056-01

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/22/2016 11:50 AM
Sample Site:	CN2-70	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	0.70	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	176	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Manganese, Dissolved	0.290	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Manganese, Total	0.315	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:06	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:11	
Potassium, Dissolved	5.1	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 14:55	
Selenium, Total	0.47	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:03	
Sodium, Dissolved	53.3	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:25	
Zinc, Dissolved	0.01	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:11	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-02

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/22/2016 4:00 PM
Sample Site:	CN7-70	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	26.9		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	-3.0		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	25.4		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1150	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	654	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	499	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	537	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	0.4	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	22	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	SPH
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 23:00	3/25/2016 23:00	SPH
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	750	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1550	20	mg/L	SM 2540 C	03/29/2016 07:00	3/29/2016 7:00	
Total Suspended Solids (TSS)	11	4	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 14:59	
Aluminum, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Boron, Total	0.05	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Barium, Dissolved	0.021	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Calcium, Dissolved	139	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:15	
Iron, Dissolved	0.11	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-02

Name:	Alton Coal Development, LLC	***Sample Date:***	3/22/2016 4:00 PM
Sample Site:	CN7-70	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	1.28	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	194	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Manganese, Dissolved	0.145	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Manganese, Total	0.155	0.005	mg/L	EPA 200.7	03/28/2016 11:05	3/28/2016 18:43	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:15	
Potassium, Dissolved	5.2	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 14:59	
Selenium, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:55	
Sodium, Dissolved	53.4	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:29	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:15	

Certificate of Analysis

CHEMTECH-FORD LABORATORIES

Lab Sample No.: 16C1056-03

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/22/2016 4:50 PM
Sample Site:	CN5-58	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	26.1		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	0.9		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	26.6		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1240	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	653	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	492	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	535	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	0.3	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	16	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 23:00	3/25/2016 23:00	SPH
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	720	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1400	20	mg/L	SM 2540 C	03/29/2016 07:00	3/29/2016 7:00	
Total Suspended Solids (TSS)	13	4	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:03	
Aluminum, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Boron, Dissolved	0.06	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Boron, Total	0.10	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Barium, Dissolved	0.019	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Calcium, Dissolved	149	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:18	
Iron, Dissolved	0.28	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-03

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/22/2016 4:50 PM
Sample Site:	CN5-58	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	0.98	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	210	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Manganese, Dissolved	0.216	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Manganese, Total	0.193	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:18	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:18	
Potassium, Dissolved	5.7	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:03	
Selenium, Total	0.40	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:07	
Sodium, Dissolved	39.3	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:33	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:18	

Certificate of Analysis

Lab Sample No.: 16C1056-04

Name:	Alton Coal Development, LLC	**Sample Date:**	3/23/2016 7:50 PM
Sample Site:	CN1-43	**Receipt Date:**	3/25/2016 2:50 PM
Comments:		**Sampler:**	Erik Petersen
Sample Matrix:	Water	**Site No.:**	
Field pH:		**Field Temp. Deg. C :**	
Field Flow g/Min.:		**Field Cond. umhos/cm:**	
PO Number:		**Project:**	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	22.0		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	2.6		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	23.2		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1020	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	817	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	649	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	670	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	26	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 18:00	3/25/2016 18:00	
Phosphorus, Total as P	0.05	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	380	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1120	20	mg/L	SM 2540 C	03/30/2016 16:08	3/30/2016 16:08	
Total Suspended Solids (TSS)	68	5	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:07	
Aluminum, Total	0.4	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Boron, Total	0.05	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Barium, Dissolved	0.032	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Calcium, Dissolved	161	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:22	
Iron, Dissolved	0.02	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	

Certificate of Analysis

Lab Sample No.: 16C1056-04

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/23/2016 7:50 PM
Sample Site:	CN1-43	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	3.30	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	151	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Manganese, Dissolved	0.271	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Manganese, Total	0.259	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:21	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:22	
Potassium, Dissolved	5.3	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:07	
Selenium, Total	0.38	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:10	
Sodium, Dissolved	60.4	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:36	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:22	

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Certificate of Analysis

Lab Sample No.: 16C1056-05

Name:	Alton Coal Development, LLC	***Sample Date:***	3/23/2016 8:40 PM
Sample Site:	CN1-58	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	29.1		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	-4.3		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	26.7		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1270	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	712	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	537	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	584	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	14	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 18:00	3/25/2016 18:00	
Phosphorus, Total as P	0.02	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	820	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1720	20	mg/L	SM 2540 C	03/30/2016 16:08	3/30/2016 16:08	
Total Suspended Solids (TSS)	32	4	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:10	
Aluminum, Total	0.07	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Boron, Total	0.07	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Barium, Dissolved	0.020	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Calcium, Dissolved	211	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:25	
Iron, Dissolved	0.02	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	

Certificate of Analysis

CHEMTECH-FORD LABORATORIES

Lab Sample No.: 16C1056-05

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/23/2016 8:40 PM
Sample Site:	CN1-58	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	0.62	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	180	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Manganese, Dissolved	0.203	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Manganese, Total	0.221	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:25	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:25	
Potassium, Dissolved	4.9	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:10	
Selenium, Total	0.55	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:14	
Sodium, Dissolved	28.5	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:40	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:25	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-06

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/24/2016 10:15 AM
Sample Site:	CN4-49	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	24.8		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	1.1		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	25.3		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1140	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	672	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	547	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	551	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	0.6	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	23	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 23:00	3/25/2016 23:00	
Phosphorus, Total as P	0.01	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	630	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1450	20	mg/L	SM 2540 C	03/30/2016 16:08	3/30/2016 16:08	
Total Suspended Solids (TSS)	96	10	mg/L	SM 2540 D	03/30/2016 10:00	3/30/2016 10:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:14	
Aluminum, Total	0.3	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Boron, Dissolved	0.08	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Boron, Total	0.12	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Barium, Dissolved	0.035	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Calcium, Dissolved	161	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:29	
Iron, Dissolved	0.46	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	

Certificate of Analysis

Lab Sample No.: 16C1056-06

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/24/2016 10:15 AM
Sample Site:	CN4-49	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	3.31	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	180	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Manganese, Dissolved	0.088	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Manganese, Total	0.092	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:29	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:29	
Potassium, Dissolved	5.7	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:14	
Selenium, Total	0.35	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:17	
Sodium, Dissolved	52.9	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:44	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:29	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-07

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/24/2016 3:15 PM
Sample Site:	CN3-98	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	24.7		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	-1.4		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	24.0		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1110	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	672	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	504	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	552	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	0.5	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	20	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 19:00	3/25/2016 19:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 23:00	3/25/2016 23:00	
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	630	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1340	20	mg/L	SM 2540 C	03/31/2016 10:16	3/31/2016 10:16	
Total Suspended Solids (TSS)	6	4	mg/L	SM 2540 D	03/30/2016 10:00	3/30/2016 10:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:18	
Aluminum, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Boron, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Barium, Dissolved	0.019	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Calcium, Dissolved	177	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:33	
Iron, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16C1056-07

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/24/2016 3:15 PM
Sample Site:	CN3-98	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	163	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Manganese, Dissolved	0.642	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Manganese, Total	0.609	0.005	mg/L	EPA 200.7	03/28/2016 11:05	3/28/2016 18:46	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:33	
Potassium, Dissolved	4.7	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:18	
Selenium, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:05	3/29/2016 20:59	
Sodium, Dissolved	37.1	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:48	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:33	

Certificate of Analysis

Lab Sample No.: 16C1056-08

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/23/2016 6:10 PM
Sample Site:	CN0-60	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	28.9		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cation/Anion Balance	-1.0		%	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Cations, Total	28.3		meq/L	SM 1030 E	04/06/2016 09:01	4/6/2016 9:03	
Hardness, Dissolved as CaCO3	1270	1	mg/L	SM 2340 B	04/06/2016 09:01	4/6/2016 9:11	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	04/01/2016 11:35	4/1/2016 11:35	
Alkalinity - Bicarbonate (HCO3)	1020	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - CO2	791	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Alkalinity - Total (as CaCO3)	841	1.0	mg/L	SM 2320 B	03/31/2016 12:48	3/31/2016 12:48	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	03/31/2016 08:30	3/31/2016 8:30	
Chloride	32	1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Fluoride	0.4	0.1	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Nitrate as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 18:00	3/25/2016 18:00	
Nitrite as N	ND	0.1	mg/L	EPA 300.0	03/25/2016 18:00	3/25/2016 18:00	
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	03/31/2016 15:00	4/3/2016 12:30	
Sulfate	540	10	mg/L	EPA 300.0	03/25/2016 17:00	3/25/2016 17:00	
Total Dissolved Solids (TDS)	1380	20	mg/L	SM 2540 C	03/30/2016 16:08	3/30/2016 16:08	
Total Suspended Solids (TSS)	42	5	mg/L	SM 2540 D	03/29/2016 08:00	3/29/2016 8:00	
Metals							
Aluminum, Dissolved	ND	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:22	
Aluminum, Total	0.1	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Boron, Dissolved	0.08	0.05	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Boron, Total	0.13	0.05	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Barium, Dissolved	0.050	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Calcium, Dissolved	122	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:36	
Iron, Dissolved	0.27	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	

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Certificate of Analysis

CHEMTECH-FORD LABORATORIES

Lab Sample No.: 16C1056-08

Name:	**Alton Coal Development, LLC**	***Sample Date:***	3/23/2016 6:10 PM
Sample Site:	CN0-60	***Receipt Date:***	3/25/2016 2:50 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Private Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Total	3.81	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Lead, Total	ND	0.02	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	03/28/2016 10:35	3/29/2016 9:30	
Magnesium, Dissolved	235	0.2	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Manganese, Dissolved	0.123	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Manganese, Total	0.131	0.005	mg/L	EPA 200.7	03/28/2016 08:30	4/1/2016 18:33	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:36	
Potassium, Dissolved	3.8	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	03/28/2016 11:11	3/30/2016 15:22	
Selenium, Total	0.24	0.20	mg/L	EPA 200.7	03/28/2016 08:30	4/4/2016 15:21	
Sodium, Dissolved	63.7	0.5	mg/L	EPA 200.7	03/28/2016 11:11	3/29/2016 22:51	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	03/28/2016 11:11	3/28/2016 20:36	

CHEMTECH - FORD ANALYTICAL LABORATORY

CHAIN OF COUSTODY

COMPANY: Alton Coal Development, LLC
ADDRESS:
CITY/STATE/ZIP: Cedar City, UT
PHONE #: FAX:
CONTACT: Kirk Nicholes PROJECT:
EMAIL: knicholes@altoncoal.com

BILLING ADDRESS:
BILLING CITY/STATE/ZIP:
PURCHASE ORDER #: North Private Lease BASELINE

TURNAROUND REQUIRED:*
* Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX: DW = Drinking Water, WW = Wastewater, W = Water, S = Soil, SO = Solid, SL = Sludge, O = Other

ANALYTICAL TESTS REQUESTED: SEE ATTACHED @ 03-28-16

Bacteriological: FIELD: Residual Chlorine; Total Coliform + E. coli (Present/Absent); Total Coliform + E. coli (Enumerated); HPC (Plate Count); E. coli only; WW: Total Coliform + Fecal Coliform

R = Routine, I = Investigative, TG = Trigger Source, CO = Confirmation

REPEAT: OR = Original Location, UP = Upstream, DN = Downstream

Lab ID # C1056	SAMPLE NAME	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	Repeat (Fail #)	SYSTEM #
01	1. CN 2-70	22Mar16	11:50			
02	2. CN 7-70	22Mar16	16:00			
03	3. CN5-58	22Mar16	16:50			
04	4. CN1-43	23Mar16	19:50			
05	5. CN1-58	23Mar16	20:40			
06	6. CN4-49	24Mar16	10:15			
07	7. CN 3-98	24Mar16	15:15			
08	8. CN0-60	23Mar16	18:10			
	9.					
	10.					

Sampled by: [print] Erik Petersen
Sampled by: [signature]

ON ICE NOT ON ICE 2.3

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	3/25/2016 14:00	Received by: [signature]	3-25-16 14:00
Relinquished by: [signature]	3-25-16 14:50	Received by: [signature]	3/26/16 1450
Relinquished by: [signature]	Date/Time	Received by: [signature]	25 @ 03-28-16

CHEMTECH-FORD 6100 South Stratler Street (380 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-7378 www.chemtechford.com

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agress to pay collection costs and attorney's fees.

Alton Coal Development samples for 3/25/2016 drop off

Sample ID	Date	Time	Parameter list requested	Billing Project
SP-14	23-Mar-16	13:30	Alton Qtr GW	Coal Hollow Mine quarterly monitoring
UR-70	23-Mar-16	15:45	Alton Qtr GW	Coal Hollow Mine quarterly monitoring
CN2-70	22-Mar-16	11:50	Alton BGW	North Private Lease Baseline
CN7-70	22-Mar-16	16:00	Alton BGW	North Private Lease Baseline
CN5-58	22-Mar-16	16:50	Alton BGW	North Private Lease Baseline
CN0-60	23-Mar-16	18:10	Alton BGW	North Private Lease Baseline
CN1-43	23-Mar-16	19:50	Alton BGW	North Private Lease Baseline
CN1-58	23-Mar-16	20:40	Alton BGW	North Private Lease Baseline
CN4-49	24-Mar-16	10:15	Alton BGW	North Private Lease Baseline
CN3-98	24-Mar-16	15:15	Alton BGW	North Private Lease Baseline

Work Order # C1056

CHEMTECH FORD LABORATORIES

Sample Receipt

CHEMTECH-FORD LABORATORIES

Delivery Method:

- ☐ UPS
- ☐ USPS
- ☐ FedEx
- ☐ Chemtech Courier
- ☑ Walk-in
- ☐ Customer Courier

Receiving Temperature 23 °C

Sample #	Container	Chemtech Lot # Preservative	Number of Subsamples	Preserved by Client/Third Party	Preserved in Receiving/Laboratory	Filtered in Field by Client	Misc. Volume (ml)	Comments
01-04	AQ							
	M	670						
	N	669						
05-06	AQ							
	M	537						
	N	669						
07	AQ							
	M	604						
	N	669						
08	AQ							
	M	670						
	N	669						

Sample Condition (check if *yes*)

- ☐ Custody Seals
- ☑ Containers Intact
- ☑ COC/Labels Agree
- ☑ Preservation Confirmed
- ☑ Received on Ice
- ☑ Correct Containers(s)
- ☑ Sufficent Sample Volume
- ☐ Headspace Present (VOC)
- ☐ Temperature Blank
- ☑ Received within Holding Time

Plastic Containers

- A- Plastic Unpreserved
- B- Miscellaneous Plastic
- C- Cyanide Qt (NaOH)
- E- Coliform/Ecoli/HPC
- F- Sulfide Qt (Zn Acetate)
- L- Mercury 1631
- M- Metals Pint (HNO3)
- N- Nutrient Pint (H2SO4)
- R- Radiological (HNO3)
- S- Sludge Cups/Tubs
- Q- Plastic Bag

Glass Containers

- D- 625 (Na2S2O3)
- G- Glass Unpreserved
- H- HAAs (NH4Cl)
- J- 508/515/525 (Na2SO3)
- K- 515.3 Herbicides
- O- Oil & Grease (HCl)
- P- Phenols (H2SO4)
- T- TOC/TOX (H3PO4)
- U- 531 (MCAA, Na2S2O3)
- V- 524/THMs (Ascorbic Acid)
- W- 8260 VOC (1:1 HCl)
- X- Vial Unpreserved
- Y- 624/504 (Na2S2O3)
- Z- Miscellaneous Glass

Report Footnotes

Abbreviations

ND = Not detected at the corresponding Minimum Reporting Limit.
1 mg/L = one milligram per liter or 1 mg/Kg = one milligram per kilogram = 1 part per million.
1 ug/L = one microgram per liter or 1 ug/Kg = one microgram per kilogram = 1 part per billion.
1 ng/L = one nanogram per liter or 1 ng/Kg = one nanogram per kilogram = 1 part per trillion.

Flag Descriptions

SPH = Sample submitted past method specified holding time.

Additional Report Information

The analyses presented on this report were performed in accordance with the National Environmental Laboratory Accreditation Program (NELAP) unless noted in the comments, flags or case narrative. If the report is to be used for regulatory compliance, it should be presented in its entirety, and not be altered.

Chemtech-Ford Contact Information

Labortory Director	Dave Gayer	dgayer@chemtechford.com	801.262.7299 (Main)	801.639.1172 (Direct)
QA Officer	Ron Fuller	rfuller@chemtechford.com	801.262.7299 (Main)	801.693.1171 (Direct)

CHEMTECH-FORD
LABORATORIES

6/22/2016

Work Order: 16F0483

Alton Coal Development, LLC

Attn: Kirk Nicholes

463 North 100 West Ste 1

Cedar City, UT 84721

Client Service Contact: 801.262.7299

NELAP ACCREDITED TNI LABORATORY

Approved By:

Dave Gayer, Laboratory Director

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-01

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/6/2016 8:50 PM
Sample Site:	CN2-70	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	260
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	28.2		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	3.7		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	30.4		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1410	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	634	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - CO2	473	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Total (as CaCO3)	520	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Ammonia as N	0.5	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	28	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	0.02	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	820	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1690	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	24	7	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Aluminum, Total	0.5	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Boron, Dissolved	0.09	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Boron, Total	0.09	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Barium, Dissolved	0.015	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Calcium, Dissolved	223	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-01

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/6/2016 8:50 PM
Sample Site:	CN2-70	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	260
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.05	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Iron, Total	0.92	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	207	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Manganese, Dissolved	0.491	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Manganese, Total	0.461	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Potassium, Dissolved	4.7	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 19:49	
Selenium, Total	0.06	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:53	
Sodium, Dissolved	48.2	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:29	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-02

Name:	Alton Coal Development, LLC	***Sample Date:***	6/6/2016 9:30 PM
Sample Site:	CN4-49	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	261
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	25.4		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	1.1		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	26.0		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1190	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	698	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - CO2	521	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Total (as CaCO3)	573	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Ammonia as N	0.7	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	22	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	0.02	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	640	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1420	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	56	20	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Aluminum, Total	0.6	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Boron, Dissolved	0.12	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Boron, Total	0.14	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Barium, Dissolved	0.022	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Calcium, Dissolved	170	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	

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Lab Sample No.: 16F0483-02

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/6/2016 9:30 PM
Sample Site:	CN4-49	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	261
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.08	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Iron, Total	4.56	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	187	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Manganese, Dissolved	0.075	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Manganese, Total	0.084	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Potassium, Dissolved	5.7	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 19:53	
Selenium, Total	0.06	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:22	
Sodium, Dissolved	44.4	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:33	

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Lab Sample No.: 16F0483-03

Name:	Alton Coal Development, LLC	***Sample Date:***	6/6/2016 10:10 PM
Sample Site:	CN7-70	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	262
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	26.2		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	3.2		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	27.9		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1280	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	626	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - CO2	453	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Total (as CaCO3)	513	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Ammonia as N	0.5	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	19	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	740	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1560	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	7	7	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Aluminum, Total	0.1	0.05	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Boron, Dissolved	0.09	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Boron, Total	0.07	0.05	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Barium, Dissolved	0.014	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Calcium, Dissolved	155	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	

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Certificate of Analysis

Lab Sample No.: 16F0483-03

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/6/2016 10:10 PM
Sample Site:	CN7-70	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	262
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.26	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Iron, Total	1.71	0.02	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	216	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Manganese, Dissolved	0.136	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Manganese, Total	0.119	0.005	mg/L	EPA 200.7	06/13/2016 13:05	6/13/2016 20:42	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Potassium, Dissolved	5.3	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 19:56	
Selenium, Total	0.05	0.02	mg/L	EPA 200.7	06/13/2016 13:05	6/14/2016 15:32	
Sodium, Dissolved	51.5	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:37	

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Lab Sample No.: 16F0483-04

Name:	Alton Coal Development, LLC	**Sample Date:**	6/7/2016 9:00 AM
Sample Site:	CN5-58	**Receipt Date:**	6/8/2016 2:11 PM
Comments:		**Sampler:**	Erik Petersen
Sample Matrix:	Water	**Site No.:**	263
Field pH:		**Field Temp. Deg. C :**	
Field Flow g/Min.:		**Field Cond. umhos/cm:**	
PO Number:		**Project:**	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	25.4		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	-5.8		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	22.7		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1060	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	664	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - CO2	489	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Alkalinity - Total (as CaCO3)	544	1.0	mg/L	SM 2320 B	06/16/2016 08:53	6/16/2016 9:27	
Ammonia as N	0.3	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	15	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	680	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1530	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	11	7	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Aluminum, Total	0.2	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Boron, Dissolved	0.08	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Boron, Total	0.11	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Barium, Dissolved	0.013	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Calcium, Dissolved	129	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-04

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/7/2016 9:00 AM
Sample Site:	CN5-58	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	263
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.67	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Iron, Total	1.43	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	180	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Manganese, Dissolved	0.157	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Manganese, Total	0.181	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Potassium, Dissolved	4.5	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 20:00	
Selenium, Total	0.06	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:26	
Sodium, Dissolved	29.2	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:41	

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Lab Sample No.: 16F0483-05

Name:	Alton Coal Development, LLC	***Sample Date:***	6/7/2016 9:40 AM
Sample Site:	CN3-98	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	264
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	24.6		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	-0.2		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	24.4		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1150	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	641	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - CO2	485	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Total (as CaCO3)	526	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Ammonia as N	0.5	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	19	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	0.02	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	650	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1360	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	21	7	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Aluminum, Total	0.5	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Boron, Dissolved	0.06	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Boron, Total	0.08	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Barium, Dissolved	0.015	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Calcium, Dissolved	183	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	

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Certificate of Analysis

Lab Sample No.: 16F0483-05

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/7/2016 9:40 AM
Sample Site:	CN3-98	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	264
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Iron, Total	0.39	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	168	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Manganese, Dissolved	0.615	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Manganese, Total	0.623	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Potassium, Dissolved	4.2	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 20:04	
Selenium, Total	0.06	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:30	
Sodium, Dissolved	31.7	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:44	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-06

Name:	Alton Coal Development, LLC	***Sample Date:***	6/7/2016 10:50 AM
Sample Site:	CN1-58	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	265
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	28.3		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	1.2		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	29.0		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1390	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	700	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - CO2	525	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Total (as CaCO3)	574	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	14	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.2	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	0.01	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	790	10	mg/L	EPA 300.0	06/09/2016 12:30	6/9/2016 12:30	
Total Dissolved Solids (TDS)	1840	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	13	7	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Aluminum, Total	0.3	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Boron, Dissolved	0.06	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Boron, Total	0.09	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Barium, Dissolved	0.016	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Calcium, Dissolved	234	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	

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Certificate of Analysis

Lab Sample No.: 16F0483-06

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/7/2016 10:50 AM
Sample Site:	CN1-58	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	265
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.05	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Iron, Total	0.36	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	195	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Manganese, Dissolved	0.193	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Manganese, Total	0.218	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Potassium, Dissolved	4.9	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 20:15	
Selenium, Total	0.07	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:41	
Sodium, Dissolved	25.5	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:48	

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Certificate of Analysis

Lab Sample No.: 16F0483-07

Name:	Alton Coal Development, LLC	***Sample Date:***	6/7/2016 11:30 AM
Sample Site:	CN1-43	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	266
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	21.8		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	-3.2		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	20.4		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	903	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	818	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - CO2	606	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Total (as CaCO3)	671	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	25	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.3	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	ND	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	370	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1150	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	32	20	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Aluminum, Total	0.09	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Boron, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Boron, Total	0.06	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Barium, Dissolved	0.023	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Calcium, Dissolved	139	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-07

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/7/2016 11:30 AM
Sample Site:	CN1-43	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	266
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.52	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Iron, Total	2.61	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	135	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Manganese, Dissolved	0.220	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Manganese, Total	0.229	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Potassium, Dissolved	4.2	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 20:19	
Selenium, Total	0.05	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:45	
Sodium, Dissolved	52.0	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:52	

Certificate of Analysis

Lab Sample No.: 16F0483-08

Name:	Alton Coal Development, LLC	***Sample Date:***	6/7/2016 12:20 PM
Sample Site:	CN0-60	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	267
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Calculations							
Anions, Total	27.9		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cation/Anion Balance	1.8		%	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Cations, Total	28.9		meq/L	SM 1030 E	06/22/2016 07:48	6/22/2016 8:06	
Hardness, Dissolved as CaCO3	1320	1	mg/L	SM 2340 B	06/22/2016 07:48	6/22/2016 8:06	
Inorganic							
Acidity	ND	5.0	mg/L	SM 2310 B	06/10/2016 14:10	6/10/2016 14:10	
Alkalinity - Bicarbonate (HCO3)	1000	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - CO2	746	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Alkalinity - Total (as CaCO3)	823	1.0	mg/L	SM 2320 B	06/17/2016 09:03	6/17/2016 9:36	
Ammonia as N	ND	0.2	mg/L	SM 4500 NH3 H	06/10/2016 08:15	6/10/2016 8:15	
Chloride	32	1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Fluoride	0.4	0.1	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Nitrate as N	ND	0.1	mg/L	SM 4500 NO3- F	06/08/2016 18:00	6/8/2016 18:00	
Nitrite as N	ND	0.1	mg/L	SM 4500 NO2-B	06/08/2016 19:00	6/8/2016 19:00	
Phosphorus, Total as P	0.02	0.01	mg/L	SM 4500 P-E/F	06/12/2016 09:00	6/13/2016 13:30	
Sulfate	510	10	mg/L	EPA 300.0	06/09/2016 09:00	6/9/2016 9:00	
Total Dissolved Solids (TDS)	1430	20	mg/L	SM 2540 C	06/13/2016 10:54	6/13/2016 10:54	
Total Suspended Solids (TSS)	30	20	mg/L	SM 2540 D	06/09/2016 10:49	6/9/2016 10:49	
Metals							
Aluminum, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Aluminum, Total	0.2	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Arsenic, Dissolved	ND	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Arsenic, Total	ND	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Boron, Dissolved	0.11	0.05	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Boron, Total	0.13	0.05	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Barium, Dissolved	0.028	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Calcium, Dissolved	119	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Cadmium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Chromium, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Copper, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	

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CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 16F0483-08

Name:	**Alton Coal Development, LLC**	***Sample Date:***	6/7/2016 12:20 PM
Sample Site:	CN0-60	***Receipt Date:***	6/8/2016 2:11 PM
Comments:		***Sampler:***	Erik Petersen
Sample Matrix:	Water	***Site No.:***	267
Field pH:		***Field Temp. Deg. C :***	
Field Flow g/Min.:		***Field Cond. umhos/cm:***	
PO Number:		***Project:***	North Lease Baseline

Parameter	Sample Result	Minimum Reporting Limit	Units	Analytical Method	Preparation Date/Time	Analysis Date/Time	Flag
Metals							
Iron, Dissolved	0.51	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Iron, Total	5.13	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Lead, Dissolved	ND	0.02	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Lead, Total	ND	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Mercury, Dissolved	ND	0.0002	mg/L	EPA 245.1	06/09/2016 12:00	6/10/2016 17:00	
Magnesium, Dissolved	249	0.2	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Manganese, Dissolved	0.106	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Manganese, Total	0.116	0.005	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Molybdenum, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Nickel, Dissolved	ND	0.005	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Potassium, Dissolved	2.8	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Selenium, Dissolved	ND	0.20	mg/L	EPA 200.7	06/13/2016 16:07	6/14/2016 20:23	
Selenium, Total	0.05	0.02	mg/L	EPA 200.7	06/13/2016 10:36	6/14/2016 19:49	
Sodium, Dissolved	54.9	0.5	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	
Zinc, Dissolved	ND	0.01	mg/L	EPA 200.7	06/13/2016 16:07	6/13/2016 21:56	

CHEMTECH - FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: Alton Coal Development, LLC
ADDRESS:
CITY/STATE/ZIP: Cedar City, UT
PHONE #: FAX:
CONTACT: Kirk Nicholes PROJECT:
EMAIL: Knicholes@altoncoal.com

BILLING ADDRESS: North Lease Baseline
BILLING CITY/STATE/ZIP:
PURCHASE ORDER #:

CHEMTECH-FORD

TURNAROUND REQUIRED:*
* Expedited turnaround subject to additional charge

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX: DW = Drinking Water, WW = Wastewater, W = Water, S = Soil, SO = Solid, SL = Sludge, O = Other

Bacteriological: R = Routine, I = Investigative, TG = Trigger Source, CO = Confirmation

REPEAT: OR = Original Location, UP = Upstream, DN = Downstream

Lab ID # F0483		SAMPLE NAME	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	MATRIX	ALTON BGW	ANALYTICAL TESTS REQUESTED	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	WW: Total Coliform + Fecal Coliform		Repeat (Fail #)	SYSTEM #
-01	1.	CN 2-70	6 Jun 16	20:50			X										
-02	2.	CN 4-49	6 Jun 16	21:30													
-03	3.	CN 7-70	6 Jun 16	22:10				See Attached									
-04	4.	CN 5-58	7 Jun 16	9:00													
-05	5.	CN 3-98	7 Jun 16	9:40													
-06	6.	CN 1-58	7 Jun 16	10:50													
-07	7.	CN 1-43	7 Jun 16	11:30													
-08	8.	CN 0-60	7 Jun 16	12:20													
	9.																
	10.																

Sampled by: [print] Erik Petersen | Sampled by: [signature] | ON ICE | NOT ON ICE | 0.0°

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
	8 June 2016 13:30		8 June 2016 13:30
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
	8 June 2016 14:11		6/8/16 1411
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD 6100 South Stratler Street (380 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-7378 www.chemtechford.com

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agrees to pay collection costs and attorney's fees.

Alton Coal Development samples for 6/8/2016 drop off

	Sample ID	Date	Time	Parameter list requested	DOGM site code	Billing project
	SP-4	5-Jun-16	9:30	Alton Qtr GW	2	Quarterly Monitoring (North and Old)
	SP-8	5-Jun-16	10:50	Alton Qtr GW	5	Quarterly Monitoring (North and Old)
	LR-45	5-Jun-16	11:15	Alton Qtr GW	75	Quarterly Monitoring (North and Old)
	UR-70	5-Jun-16	13:45	Alton Qtr GW	82	Quarterly Monitoring (North and Old)
	Y-61	5-Jun-16	18:00	Alton Qtr GW	55	Quarterly Monitoring (North and Old)
	SP-20	5-Jun-16	18:25	Alton Qtr GW	12	Quarterly Monitoring (North and Old)
	SP-14	5-Jun-16	19:20	Alton Qtr GW	6	Quarterly Monitoring (North and Old)
	SP-33	6-Jun-16	10:25	Alton Qtr GW	25	Quarterly Monitoring (North and Old)
	LS-28	6-Jun-16	11:30	Alton Qtr GW	76	Quarterly Monitoring (North and Old)
	LS-85	6-Jun-16	11:45	Alton Qtr GW	78	Quarterly Monitoring (North and Old)
	SS-30	6-Jun-16	13:00	Alton Qtr GW	80	Quarterly Monitoring (North and Old)
	NLP-13	6-Jun-16	16:00	Alton Qtr GW	249	Quarterly Monitoring (North and Old)
	Pond Spring	6-Jun-16	18:20	Alton Qtr GW	208	Quarterly Monitoring (North and Old)
	NLP-4	6-Jun-16	19:45	Alton Qtr GW	234	Quarterly Monitoring (North and Old)
	NLP-5	6-Jun-16	20:20	Alton Qtr GW	235	Quarterly Monitoring (North and Old)
	Y-103	7-Jun-16	10:15	Alton Qtr GW	204	Quarterly Monitoring (North and Old)
	SW-2	4-Jun-16	18:00	Alton Qtr SW	29	Quarterly Monitoring (North and Old)
	SW-3	4-Jun-16	19:15	Alton Qtr SW	30	Quarterly Monitoring (North and Old)
	Kanab at C.R.	4-Jun-16	20:00	Alton Qtr SW	202	Quarterly Monitoring (North and Old)
	SW-1M	4-Jun-16	20:45	Alton Qtr SW	268	Quarterly Monitoring (North and Old)
	SW-1	4-Jun-16	21:45	Alton Qtr SW	28	Quarterly Monitoring (North and Old)
	BLM-1	5-Jun-16	10:30	Alton Qtr SW	57	Quarterly Monitoring (North and Old)
	SW-6	6-Jun-16	12:20	Alton Qtr SW	33	Quarterly Monitoring (North and Old)
F0483						
-01	CN2-70	6-Jun-16	20:50	Alton BGW	260	North Lease Baseline
-02	CN4-49	6-Jun-16	21:30	Alton BGW	261	North Lease Baseline
-03	CN7-70	6-Jun-16	22:10	Alton BGW	262	North Lease Baseline
-04	CN5-58	7-Jun-16	9:00	Alton BGW	263	North Lease Baseline
-05	CN3-98	7-Jun-16	9:40	Alton BGW	264	North Lease Baseline
-06	CN1-58	7-Jun-16	10:50	Alton BGW	265	North Lease Baseline
-07	CN1-43	7-Jun-16	11:30	Alton BGW	266	North Lease Baseline
-08	CN0-60	7-Jun-16	12:20	Alton BGW	267	North Lease Baseline

CHEMTECH FORD LABORATORIES

Sample Receipt

CHEMTECH-FORD LABORATORIES

Work Order # F0483

Delivery Method:

- ☐ UPS
- ☐ USPS
- ☐ FedEx
- ☐ Chemtech Courier
- ☒ Walk-in
- ☐ Customer Courier

Receiving Temperature 0.0 °C

Sample #	Container	Chemtech Lot # or Preservative	Number of Subsamples	Preserved by Client/Third Party	Preserved in Receiving/Laboratory	Filtered in Field by Client	Misc Volume (oz/mL)	Comments
-01	AQ		2					
	M	ILLEGIBLE						
	N	669						
-02, -03	AQ		2					
	M	ILLEGIBLE						
	N	669						
-04	AQ		2					
	M	537						
	N	669						
-05	AQ		2					
	M	ILLEGIBLE						
	N	669						
-06	AQ		2					
	M	516						
	N	ILLEGIBLE						
-07	AQ		2					
	N	669						
	M	ILLEGIBLE						
-08	AQ		2					
	M	516						
	N	669						

Sample Condition (check if yes)

- ☐ Custody Seals
- ☒ Containers Intact
- ☒ COC/Labels Agree
- ☒ Preservation Confirmed
- ☒ Received on Ice
- ☒ Correct Containers(s)
- ☒ Sufficent Sample Volume
- ☐ Headspace Present (VOC)
- ☐ Temperature Blank
- ☒ Received within Holding Time

Plastic Containers

A- Plastic Unpreserved
B- Miscellaneous Plastic
C- Cyanide Qt (NaOH)
E- Coliform/Ecoli/HPC
F- Sulfide Qt (Zn Acetate)
L- Mercury 1631
M- Metals Pint (HNO3)
N- Nutrient Pint (H2SO4)
R- Radiological (HNO3)
S- Sludge Cups/Tubs
Q- Plastic Bag

Glass Containers

D- 625 (Na2S2O3)
G- Glass Unpreserved
H- HAAs (NH4Cl)
J- 508/515/525 (Na2SO3)
K- 515.3 Herbicides
O- Oil & Grease (HCl)
P- Phenols (H2SO4)
T- TOC/TOX (H3PO4)
U- 531 (MCAA, Na2S2O3)
V- 524/THMs (Ascorbic Acid)
W- 8260 VOC (1:1 HCl)
X- Vial Unpreserved
Y- 624/504 (Na2S2O3)
Z- Miscellaneous Glass

Report Footnotes

Abbreviations

ND = Not detected at the corresponding Minimum Reporting Limit.
1 mg/L = one milligram per liter or 1 mg/Kg = one milligram per kilogram = 1 part per million.
1 ug/L = one microgram per liter or 1 ug/Kg = one microgram per kilogram = 1 part per billion.
1 ng/L = one nanogram per liter or 1 ng/Kg = one nanogram per kilogram = 1 part per trillion.

Flag Descriptions

Additional Report Information

The analyses presented on this report were performed in accordance with the National Environmental Laboratory Accreditation Program (NELAP) unless noted in the comments, flags or case narrative. If the report is to be used for regulatory compliance, it should be presented in its entirety, and not be altered.

Chemtech-Ford Contact Information

Labortory Director	Dave Gayer	dgayer@chemtechford.com	801.262.7299 (Main)	801.639.1172 (Direct)
QA Officer	Ron Fuller	rfuller@chemtechford.com	801.262.7299 (Main)	801.693.1171 (Direct)

Attachment F

THWELLS Modeling data

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↑
********************** THWELLS - version 4.01 **********************  PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

--------------------------------------------------------------------------------
TRUE
--------------------------------------------------------------------------------


********************************* INPUT DATA *********************************

              LEAKY CONFINED AQUIFER - HANTUSH-JACOB'S EQUATION

                                    TRANSMISSIVITY  =  4990 [gpd/ft]

                               STORAGE COEFFICIENT  =  .0001599

                            REGIONAL FLOW GRADIENT
        (positive--downwards--in flow direction)  =  .004

                           REGIONAL FLOW DIRECTION
                      (horizontal angle in degrees
         counter-clockwise from positive x-axis)  =  22.5

                     REGIONAL FLOW OFFSET AT ORIGIN
                (positive in downwards direction)  =  0 [ft]

        HYDRAULIC CONDUCTIVITY OF CONFINING LAYER =  .0831 [gpd/sq.ft]

                      THICKNESS OF CONFINING LAYER  =  20 [ft]

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↑
*********************************************************** THWELLS - PAGE 2


                         PUMPING/INJECTION WELL DATA


     WELL NO. 1

                               X-COORDINATE  =  0 [ft]
                               Y-COORDINATE  =  500 [ft]
```

```
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]


 WELL NO. 2

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  400 [ft]
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]


 WELL NO. 3

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  300 [ft]
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]


 WELL NO. 4

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  200 [ft]
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]


 WELL NO. 5

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  100 [ft]
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]


 WELL NO. 6

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  0 [ft]
               PUMPING/INJECTION RATE  =  43200 [gpd]
   TIME SINCE START PUMPING/INJECTION  =  10 [day]

--------------------------------------------------------------------------------

************************************************************ THWELLS - PAGE 3
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```
WELL NO. 7

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -100 [ft]
              PUMPING/INJECTION RATE  =  43200 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 8

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -200 [ft]
              PUMPING/INJECTION RATE  =  43200 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 9

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -300 [ft]
              PUMPING/INJECTION RATE  =  43200 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 10

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -400 [ft]
              PUMPING/INJECTION RATE  =  43200 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 11

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -500 [ft]
              PUMPING/INJECTION RATE  =  43200 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]

--------------------------------------------------------------------------------
********************************* RESULTS ******************* THWELLS - PAGE 4


------------------------------- Drawdown in [ft] -------------------------------
```

Y [ft]	-1000	-900	-800	-700	-600	-500
-1000.00	2.182	2.966	3.776	4.607	5.450	6.294
-900.00	2.379	3.225	4.108	5.024	5.966	6.924
-800.00	2.577	3.490	4.452	5.465	6.523	7.618
-700.00	2.770	3.751	4.799	5.915	7.103	8.360
-600.00	2.946	3.997	5.131	6.356	7.682	9.117
-500.00	3.096	4.213	5.430	6.762	8.226	9.841
-400.00	3.208	4.386	5.680	7.109	8.699	10.481
-300.00	3.274	4.502	5.860	7.372	9.069	10.989
-200.00	3.284	4.550	5.956	7.531	9.307	11.328
-100.00	3.231	4.521	5.958	7.571	9.396	11.478
0.00	3.112	4.410	5.857	7.483	9.325	11.427
100.00	2.925	4.215	5.652	7.265	9.090	11.172
200.00	2.671	3.938	5.344	6.919	8.695	10.716
300.00	2.355	3.583	4.941	6.454	8.150	10.070
400.00	1.984	3.161	4.455	5.885	7.475	9.256
500.00	1.565	2.682	3.900	5.232	6.695	8.310
600.00	1.109	2.160	3.294	4.519	5.845	7.280
700.00	0.627	1.608	2.656	3.772	4.960	6.217
800.00	0.128	1.041	2.003	3.015	4.074	5.169
900.00	-0.377	0.470	1.352	2.268	3.211	4.168

<- X [ft] ->

Y [ft]	-400	-300	-200	-100	0	100
-1000.00	7.120	7.901	8.605	9.196	9.643	9.935
-900.00	7.875	8.790	9.619	10.304	10.787	11.044
-800.00	8.733	9.832	10.853	11.698	12.247	12.437
-700.00	9.676	11.025	12.344	13.489	14.182	14.228
-600.00	10.666	12.328	14.083	15.830	16.990	16.569
-500.00	11.633	13.635	15.902	18.572	27.600	19.311
-400.00	12.495	14.801	17.497	20.764	30.257	21.503
-300.00	13.182	15.718	18.695	22.251	31.886	22.990
-200.00	13.648	16.336	19.479	23.178	32.872	23.917
-100.00	13.872	16.645	19.874	23.641	33.361	24.380
0.00	13.846	16.646	19.901	23.688	33.416	24.427
100.00	13.566	16.339	19.568	23.335	33.055	24.074
200.00	13.036	15.724	18.867	22.566	32.260	23.305
300.00	12.263	14.799	17.776	21.333	30.967	22.072
400.00	11.271	13.577	16.272	19.540	29.033	20.279
500.00	10.102	12.104	14.372	17.041	26.069	17.781
600.00	8.829	10.492	12.246	13.993	15.154	14.733
700.00	7.533	8.882	10.201	11.346	12.039	12.085
800.00	6.284	7.383	8.404	9.249	9.797	9.988

Y [ft]	-400	-300	-200	-100	0	100
900.00	5.120	6.034	6.864	7.549	8.032	8.288

Y [ft]	200	300	400	500	600	700
-1000.00	10.083	10.118	10.076	9.990	9.885	9.781
-900.00	11.098	11.007	10.832	10.619	10.401	10.197
-800.00	12.331	12.049	11.689	11.314	10.957	10.638
-700.00	13.823	13.243	12.633	12.056	11.538	11.089
-600.00	15.561	14.546	13.622	12.812	12.116	11.530
-500.00	17.381	15.852	14.589	13.537	12.661	11.936
-400.00	18.975	17.019	15.452	14.177	13.134	12.283
-300.00	20.173	17.935	16.138	14.684	13.504	12.546
-200.00	20.957	18.554	16.605	15.024	13.742	12.705
-100.00	21.352	18.863	16.829	15.174	13.831	12.745
0.00	21.379	18.863	16.802	15.123	13.759	12.657
100.00	21.046	18.556	16.523	14.867	13.524	12.438
200.00	20.345	17.941	15.992	14.411	13.130	12.092
300.00	19.255	17.017	15.220	13.766	12.585	11.627
400.00	17.750	15.794	14.227	12.952	11.910	11.058
500.00	15.850	14.322	13.059	12.006	11.130	10.405
600.00	13.725	12.709	11.785	10.975	10.280	9.693
700.00	11.680	11.100	10.490	9.913	9.395	8.946
800.00	9.882	9.600	9.240	8.865	8.508	8.189
900.00	8.342	8.252	8.077	7.864	7.646	7.442

Y [ft]	800	900
-1000.00	9.689	9.618
-900.00	10.021	9.877
-800.00	10.365	10.142
-700.00	10.711	10.403
-600.00	11.043	10.649
-500.00	11.343	10.865
-400.00	11.592	11.038
-300.00	11.773	11.154
-200.00	11.869	11.202
-100.00	11.871	11.173

```
     0.00        11.770     11.062
   100.00        11.565     10.867
   200.00        11.257     10.589
   300.00        10.854     10.235
   400.00        10.368      9.813
   500.00         9.813      9.334
   600.00         9.206      8.812
   700.00         8.568      8.260
   800.00         7.916      7.693
```

```
*********************** THWELLS - version 4.01 ***********************  PAGE 6


  Y [ft]                          <- X [ft] ->
--------------------------------------------------------------------------------
              800         900
   900.00         7.265      7.122

--------------------------------------------------------------------------------
```

```
↑
********************** THWELLS - version 4.01 **********************  PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

--------------------------------------------------------------------------------
Scenario 2
--------------------------------------------------------------------------------


********************************* INPUT DATA *********************************

              LEAKY CONFINED AQUIFER - HANTUSH-JACOB'S EQUATION

                                  TRANSMISSIVITY  =  4990 [gpd/ft]

                             STORAGE COEFFICIENT  =  .0001599

                          REGIONAL FLOW GRADIENT
        (positive--downwards--in flow direction)  =  .004

                         REGIONAL FLOW DIRECTION
                    (horizontal angle in degrees
         counter-clockwise from positive x-axis)  =  22.5

                  REGIONAL FLOW OFFSET AT ORIGIN
               (positive in downwards direction)  =  0 [ft]

        HYDRAULIC CONDUCTIVITY OF CONFINING LAYER =  .0831 [gpd/sq.ft]

                    THICKNESS OF CONFINING LAYER  =  20 [ft]

--------------------------------------------------------------------------------

↑
*********************************************************** THWELLS - PAGE 2


                         PUMPING/INJECTION WELL DATA


     WELL NO. 1

                             X-COORDINATE  =  0 [ft]
                             Y-COORDINATE  =  500 [ft]
```

```
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 2

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  =  400 [ft]
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 3

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  =  300 [ft]
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 4

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  =  200 [ft]
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 5

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  =  100 [ft]
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 6

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  =  0 [ft]
               PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


--------------------------------------------------------------------------------

************************************************************ THWELLS - PAGE 3
```

```
WELL NO. 7

                       X-COORDINATE  =  0 [ft]
                       Y-COORDINATE  = -100 [ft]
             PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 8

                       X-COORDINATE  =  0 [ft]
                       Y-COORDINATE  = -200 [ft]
             PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 9

                       X-COORDINATE  =  0 [ft]
                       Y-COORDINATE  = -300 [ft]
             PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 10

                       X-COORDINATE  =  0 [ft]
                       Y-COORDINATE  = -400 [ft]
             PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 11

                       X-COORDINATE  =  0 [ft]
                       Y-COORDINATE  = -500 [ft]
             PUMPING/INJECTION RATE  =  72000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]

--------------------------------------------------------------------------------
↑
********************************* RESULTS ******************* THWELLS - PAGE 4


------------------------------- Drawdown in [ft] -------------------------------
```

Y [ft]	<- X [ft] ->					
	-1000	-900	-800	-700	-600	-500
-1000.00	5.079	6.141	7.244	8.382	9.542	10.701
-900.00	5.510	6.674	7.899	9.179	10.504	11.853
-800.00	5.943	7.218	8.575	10.016	11.533	13.113
-700.00	6.365	7.755	9.254	10.869	12.603	14.451
-600.00	6.761	8.266	9.910	11.705	13.669	15.814
-500.00	7.113	8.729	10.511	12.485	14.678	17.123
-400.00	7.403	9.119	11.029	13.165	15.569	18.292
-300.00	7.614	9.414	11.431	13.705	16.287	19.240
-200.00	7.732	9.596	11.694	14.072	16.786	19.908
-100.00	7.747	9.650	11.799	14.241	17.036	20.260
0.00	7.650	9.567	11.733	14.196	17.019	20.277
100.00	7.441	9.344	11.492	13.934	16.730	19.954
200.00	7.120	8.984	11.082	13.460	16.174	19.296
300.00	6.696	8.496	10.513	12.787	15.368	18.321
400.00	6.178	7.894	9.804	11.941	14.345	17.067
500.00	5.582	7.198	8.981	10.954	13.147	15.593
600.00	4.924	6.430	8.073	9.868	11.832	13.977
700.00	4.222	5.612	7.111	8.726	10.459	12.308
800.00	3.494	4.768	6.126	7.567	9.084	10.664
900.00	2.754	3.919	5.143	6.424	7.748	9.098

Y [ft]	<- X [ft] ->					
	-400	-300	-200	-100	0	100
-1000.00	11.831	12.887	13.814	14.553	15.052	15.292
-900.00	13.193	14.470	15.607	16.502	17.061	17.241
-800.00	14.724	16.309	17.765	18.927	19.595	19.666
-700.00	16.399	18.400	20.352	22.013	22.923	22.752
-600.00	18.150	20.674	23.353	26.018	27.705	26.757
-500.00	19.864	22.954	26.486	30.690	45.490	31.429
-400.00	21.403	25.000	29.246	34.445	50.021	35.184
-300.00	22.649	26.629	31.345	37.026	52.837	37.765
-200.00	23.528	27.762	32.753	38.673	54.583	39.412
-100.00	24.004	28.379	33.513	39.546	55.500	40.285
0.00	24.062	28.482	33.661	39.727	55.694	40.466
100.00	23.698	28.073	33.207	39.240	55.194	39.979
200.00	22.916	27.150	32.141	38.060	53.970	38.800
300.00	21.731	25.711	30.426	36.107	51.918	36.846
400.00	20.178	23.775	28.021	33.221	48.796	33.960
500.00	18.333	21.423	24.956	29.159	43.959	29.898
600.00	16.313	18.837	21.516	24.181	25.868	24.920
700.00	14.256	16.257	18.209	19.870	20.780	20.609
800.00	12.275	13.860	15.316	16.478	17.145	17.217

Y [ft]	-400	-300	-200	-100	0	100
900.00	10.438	11.715	12.851	13.747	14.305	14.486

Y [ft]	200	300	400	500	600	700
-1000.00	15.292	15.104	14.787	14.397	13.976	13.556
-900.00	17.085	16.688	16.149	15.548	14.938	14.353
-800.00	19.243	18.526	17.680	16.808	15.968	15.190
-700.00	21.831	20.618	19.355	18.147	17.037	16.043
-600.00	24.831	22.892	21.106	19.509	18.104	16.879
-500.00	27.965	25.171	22.820	20.819	19.112	17.659
-400.00	30.724	27.217	24.359	21.988	20.004	18.339
-300.00	32.823	28.847	25.605	22.935	20.722	18.879
-200.00	34.232	29.979	26.485	23.604	21.221	19.246
-100.00	34.992	30.596	26.960	23.955	21.471	19.414
0.00	35.139	30.699	27.018	23.972	21.454	19.370
100.00	34.686	30.290	26.654	23.649	21.165	19.108
200.00	33.619	29.367	25.872	22.991	20.608	18.633
300.00	31.904	27.928	24.687	22.017	19.803	17.961
400.00	29.499	25.993	23.134	20.763	18.779	17.114
500.00	26.434	23.641	21.289	19.288	17.582	16.128
600.00	22.994	21.055	19.269	17.673	16.267	15.042
700.00	19.688	18.475	17.212	16.004	14.894	13.900
800.00	16.794	16.077	15.231	14.359	13.519	12.740
900.00	14.330	13.932	13.394	12.793	12.183	11.597

Y [ft]	800	900
-1000.00	13.157	12.793
-900.00	13.811	13.326
-800.00	14.488	13.869
-700.00	15.167	14.407
-600.00	15.822	14.918
-500.00	16.424	15.381
-400.00	16.941	15.771
-300.00	17.344	16.066
-200.00	17.607	16.248
-100.00	17.711	16.302

```
    0.00       17.645     16.219
  100.00       17.405     15.996
  200.00       16.995     15.636
  300.00       16.426     15.148
  400.00       15.717     14.546
  500.00       14.894     13.850
  600.00       13.985     13.082
  700.00       13.024     12.264
  800.00       12.039     11.420
```

```
*********************** THWELLS - version 4.01 ***********************  PAGE 6


  Y [ft]                          <- X [ft] ->
--------------------------------------------------------------------------------
              800        900
  900.00       11.056     10.570

--------------------------------------------------------------------------------
```

```
↑
********************** THWELLS - version 4.01 **********************  PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

--------------------------------------------------------------------------------
Scenario 2
--------------------------------------------------------------------------------


********************************* INPUT DATA *********************************

              LEAKY CONFINED AQUIFER - HANTUSH-JACOB'S EQUATION

                                  TRANSMISSIVITY  =  4990 [gpd/ft]

                             STORAGE COEFFICIENT  =  .0001599

                          REGIONAL FLOW GRADIENT
        (positive--downwards--in flow direction)  =  .004

                         REGIONAL FLOW DIRECTION
                   (horizontal angle in degrees
         counter-clockwise from positive x-axis)  =  22.5

                  REGIONAL FLOW OFFSET AT ORIGIN
              (positive in downwards direction)  =  0 [ft]

        HYDRAULIC CONDUCTIVITY OF CONFINING LAYER =  .0831 [gpd/sq.ft]

                    THICKNESS OF CONFINING LAYER  =  20 [ft]

--------------------------------------------------------------------------------

↑
*********************************************************** THWELLS - PAGE 2


                         PUMPING/INJECTION WELL DATA


     WELL NO. 1

                              X-COORDINATE  =  0 [ft]
                              Y-COORDINATE  =  500 [ft]
```

```
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]


   WELL NO. 2

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  400 [ft]
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]


   WELL NO. 3

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  300 [ft]
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]


   WELL NO. 4

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  200 [ft]
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]


   WELL NO. 5

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  100 [ft]
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]


   WELL NO. 6

                         X-COORDINATE  =  0 [ft]
                         Y-COORDINATE  =  0 [ft]
               PUMPING/INJECTION RATE  =  108000 [gpd]
     TIME SINCE START PUMPING/INJECTION  =  10 [day]

--------------------------------------------------------------------------------

************************************************************ THWELLS - PAGE 3
```

```
WELL NO. 7

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -100 [ft]
              PUMPING/INJECTION RATE  =  108000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 8

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -200 [ft]
              PUMPING/INJECTION RATE  =  108000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 9

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -300 [ft]
              PUMPING/INJECTION RATE  =  108000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 10

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -400 [ft]
              PUMPING/INJECTION RATE  =  108000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]


WELL NO. 11

                        X-COORDINATE  =  0 [ft]
                        Y-COORDINATE  = -500 [ft]
              PUMPING/INJECTION RATE  =  108000 [gpd]
  TIME SINCE START PUMPING/INJECTION  =  10 [day]

--------------------------------------------------------------------------------

********************************* RESULTS ******************* THWELLS - PAGE 4


------------------------------- Drawdown in [ft] -------------------------------
```

Y [ft]	-1000	-900	-800	-700	-600	-500
-1000.00	8.701	10.109	11.579	13.102	14.656	16.211
-900.00	9.423	10.985	12.637	14.373	16.175	18.014
-800.00	10.150	11.877	13.729	15.705	17.796	19.981
-700.00	10.860	12.760	14.824	17.061	19.477	22.065
-600.00	11.530	13.603	15.883	18.392	21.153	24.186
-500.00	12.135	14.374	16.863	19.638	22.743	26.226
-400.00	12.646	15.035	17.715	20.735	24.156	28.056
-300.00	13.039	15.555	18.396	21.622	25.309	29.554
-200.00	13.293	15.904	18.867	22.248	26.135	30.633
-100.00	13.391	16.062	19.100	22.578	26.586	31.237
0.00	13.323	16.014	19.077	22.588	26.637	31.339
100.00	13.085	15.756	18.793	22.272	26.280	30.931
200.00	12.681	15.292	18.254	21.636	25.523	30.021
300.00	12.121	14.636	17.477	20.703	24.391	28.636
400.00	11.421	13.810	16.490	19.510	22.932	26.831
500.00	10.604	12.843	15.332	18.108	21.212	24.696
600.00	9.694	11.767	14.046	16.555	19.316	22.349
700.00	8.717	10.617	12.681	14.918	17.334	19.922
800.00	7.701	9.428	11.280	13.256	15.347	17.532
900.00	6.668	8.230	9.882	11.618	13.420	15.259

<- X [ft] ->

Y [ft]	-400	-300	-200	-100	0	100
-1000.00	17.720	19.119	20.326	21.249	21.813	21.988
-900.00	19.840	21.571	23.091	24.249	24.902	24.988
-800.00	22.213	24.405	26.405	27.963	28.780	28.702
-700.00	24.801	27.619	30.362	32.669	33.848	33.408
-600.00	27.505	31.107	34.939	38.752	41.099	39.492
-500.00	30.152	34.603	39.717	45.837	67.852	46.576
-400.00	32.537	37.748	43.932	51.547	74.725	52.286
-300.00	34.483	40.269	47.157	55.494	79.026	56.233
-200.00	35.878	42.045	49.346	58.041	81.721	58.780
-100.00	36.668	43.047	50.563	59.427	83.174	60.166
0.00	36.831	43.277	50.860	59.775	83.540	60.514
100.00	36.362	42.740	50.257	59.121	82.867	59.860
200.00	35.266	41.432	48.734	57.428	81.109	58.168
300.00	33.565	39.350	46.238	54.575	78.107	55.314
400.00	31.312	36.523	42.707	50.322	73.500	51.061
500.00	28.621	33.072	38.186	44.306	66.322	45.045
600.00	25.668	29.270	33.102	36.916	39.262	37.655
700.00	22.658	25.476	28.219	30.526	31.705	31.265
800.00	19.764	21.956	23.956	25.514	26.331	26.253

Y [ft] <- X [ft] ->

Y [ft]	-400	-300	-200	-100	0	100
900.00	17.084	18.816	20.335	21.494	22.147	22.233

Y [ft] <- X [ft] ->

Y [ft]	200	300	400	500	600	700
-1000.00	21.804	21.336	20.676	19.906	19.091	18.276
-900.00	24.569	23.788	22.796	21.710	20.610	19.547
-800.00	27.883	26.623	25.169	23.676	22.231	20.879
-700.00	31.841	29.836	27.758	25.761	23.911	22.235
-600.00	36.417	33.324	30.461	27.881	25.587	23.566
-500.00	41.195	36.820	33.108	29.922	27.177	24.812
-400.00	45.410	39.965	35.493	31.751	28.591	25.909
-300.00	48.635	42.486	37.439	33.250	29.744	26.796
-200.00	50.825	44.262	38.835	34.328	30.569	27.422
-100.00	52.041	45.264	39.625	34.933	31.021	27.751
0.00	52.339	45.495	39.788	35.035	31.072	27.762
100.00	51.735	44.958	39.319	34.627	30.715	27.445
200.00	50.212	43.650	38.223	33.716	29.957	26.810
300.00	47.716	41.568	36.521	32.331	28.826	25.877
400.00	44.186	38.741	34.269	30.527	27.366	24.684
500.00	39.664	35.289	31.577	28.391	25.647	23.281
600.00	34.580	31.487	28.624	26.044	23.751	21.729
700.00	29.697	27.693	25.615	23.618	21.768	20.092
800.00	25.434	24.174	22.720	21.227	19.782	18.429
900.00	21.814	21.033	20.041	18.954	17.855	16.791

Y [ft] <- X [ft] ->

Y [ft]	800	900
-1000.00	17.492	16.761
-900.00	18.550	17.637
-800.00	19.642	18.529
-700.00	20.737	19.412
-600.00	21.796	20.255
-500.00	22.775	21.025
-400.00	23.628	21.687
-300.00	24.308	22.207
-200.00	24.779	22.556
-100.00	25.012	22.714

```
   0.00       24.990     22.666
 100.00       24.706     22.407
 200.00       24.167     21.944
 300.00       23.390     21.288
 400.00       22.403     20.462
 500.00       21.245     19.495
 600.00       19.959     18.419
 700.00       18.594     17.269
 800.00       17.193     16.080
```



```
  Y [ft]                        <- X [ft] ->
--------------------------------------------------------------------------------
             800         900
 900.00       15.795     14.882

--------------------------------------------------------------------------------
```

Appendix 7-19

Investigation of Alluvial Groundwater near
Kanab Creek at the Southern Permit Boundary of the
North Private Lease, Coal Hollow Mine;
Kane County, Utah

Petersen Hydrologic, LLC
12 May 2017

Investigation of Alluvial Groundwater Near Kanab Creek at the Southern Permit Boundary of the North Private Lease, Coal Hollow Mine; Kane County, Utah

12 May 2017

Alton Coal Development, LLC
Coal Hollow Mine
Cedar City Utah

Petersen Hydrologic
Consultants in Hydrogeology

Investigation of Alluvial Groundwater Near Kanab Creek at the Southern Permit Boundary of the North Private Lease, Coal Hollow Mine; Kane County, Utah

12 May 2017

Alton Coal Development, LLC
Coal Hollow Mine
Cedar City, Utah

Prepared by:

LICENSED PROFESSIONAL GEOLOGIST
ERIK CARL PETERSEN
No. 5373615-2250
STATE OF UTAH

Erik C. Petersen, P.G.

PETERSEN HYDROLOGIC
CONSULTANTS IN HYDROGEOLOGY

2695 N. 600 E.
LEHI, UTAH 84043
(801) 766-4006

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1.0 Introduction

The Coal Hollow Mine is owned and operated by Alton Coal Development, LLC (ACD). The mine is located south of the town of Alton, Utah (Figure 1). Alton Coal Development proposes to expand its existing coal mining operations into Areas two and three at the North Private Lease. In conjunction with permitting of this proposed action, the Division of Oil, Gas and Mining (UDOGM) has requested that ACD determine the quantity of groundwater that may be flowing through the alluvial groundwater system beneath the Kanab Creek stream channel at the southern permit boundary of the North Private Lease. The purpose of this document is to present the findings of an investigation performed by Petersen Hydrologic, LLC in this regard.

2.0 Methods of Study and Calculations

The methods of study utilized in this investigation of alluvial groundwaters near Kanab Creek are described below.

Monitoring Well Construction

Four groundwater monitoring wells were installed in the alluvial groundwater system along the banks of Kanab Creek near the southern lease boundary of the North Private Lease (Figures 1, 2, and 3). The wells are identified as CLEM-1, CLEM-2, CLEM-3 and CLEM-4. The monitoring well locations were chosen based on direction provided by UDOGM personnel.

The wells were installed by Clement Drilling and Geophysical, Inc. of Cedar Hills, Utah on 14-15 March 2016 using direct-push drilling methods. By using the direct-push drilling technique there is typically little disturbance to the aquifer. The 2.375-inch stainless steel drilling rods are advanced by applying percussive pressure to the rods from the surface. There are no drilling fluids involved nor is there rotation of the drilling rods during the drilling. The boreholes could be advanced through the alluvial sediments to a depth of about 30 to a maximum of 40 feet before drilling refusal occurred.

The direct-push drill rig is mounted on a small tractor with wide rubber tires. Consequently, it was possible to access, drill, and construct the wells in the sensitive environment near Kanab Creek with little or no disturbance to the sensitive riparian environment adjacent to Kanab Creek. No access road was required as would have been the circumstance had a larger truck-mounted drilling rig been used in the steep terrain of the well site.

The monitoring wells were constructed by installing 1-inch I.D. pvc into the drilled borehole with a 20-foot slotted interval. A gravel pack zone consisting of 10-20 silica sand was emplaced in the annular space between the pvc casing and the borehole wall in the slotted intervals. The annulus in the intervals from near the top of the gravel pack/screened zone to the land surface was plugged and sealed using bentonite chips. Surface well protectors were installed using 4-inch acrylonitrile butadiene styrene (ABS plastic) materials. Completion information for the four monitoring wells is presented in Table 1.

Project Survey

The land coordinates and monitoring well casing elevations were surveyed by qualified Alton Coal Development, LLC personnel using survey grade GPS techniques. The land coordinates were determined relative to the Coal Hollow Mine grid. Elevations were also determined for the monitoring reference points on the well casings in feet above sea level. Additionally, approximate land coordinates for the wells were determined in UTM NAD27 coordinates using a hand-held Garmin GPS.

The elevation of the water surface of Kanab Creek adjacent to the CLEM-3 and CLEM-4 monitoring wells was determined using a laser level. The surveyed stream water elevations were referenced to the nearby surveyed monitoring well top-of-casing elevations. The Kanab Creek water surface elevation was measured by Petersen Hydrologic personnel on 4 May 2017. The elevation of the Kanab Creek water surface measured adjacent to the upper wells (CLEM-3 and CLEM-2) was 6825.27 feet. The Kanab Creek water surface adjacent to the upper wells (CLEM-1 and CLEM-4) was 6826.46 feet.

The surveyed locations of CLEM-1, CLEM-2, CLEM-3, and CLEM-4 are plotted on Figure 3. It is noted that the plotted position of Kanab Creek on Figure 3 is approximate.

Geologic Logging of Boreholes

In conjunction with the direct-push drilling activities, samples of minimally disturbed sediments are extracted from the drilling rods in clear plastic tubes. The tubes are subsequently cut open for inspection and geologic logging. The results of the geologic logging of the core samples obtained during the drilling of the CLEM-1, CLEM-2, CLEM-3, and CLEM-4 boreholes are presented in Table 3. It is apparent in Table 3 that the alluvial sediments encountered during the drilling of the well boreholes consist predominantly of silty sediments. It is also apparent that the alluvial sediments in the vicinity of the wells are heterogeneous and anisotopropic.

Water Level Monitoring

Water levels in the four monitoring wells were monitored periodically during the period from their construction in March 2016 through May 2017 using a Waterline Envirotech, Ltd. Model 150 well sounder. Water level measurement data from these activities are presented in Table 2. A plot of historic water levels measured ad CLEM-1, CLEM-2, CLEM-3, and CLEM-4 is presented in Figure 4. The elevations of Kanab Creek near the upper and lower monitoring well locations as measured on 4 May 2017 is also plotted on Figure 4.

It is notable from Figure 4 that during the May 2017 monitoring events, the water levels in each of the four monitoring wells was below the elevation of Kanab Creek adjacent to the wells. During low-flow periods, the water levels in all monitoring wells were substantially lower than the adjacent level of Kanab Creek.

Aquifer Pump Testing

A multi-well pumping test was performed at the Kanab Creek alluvial groundwater monitoring wells on 9 May 2017 by Petersen Hydrologic personnel. The test was performed by pumping well CLEM-4 for a period of two hours (126 minutes) using a battery-powered peristaltic pump at a discharge rate that ranged from 0.395 gpm to 0.0.337 gpm, which was equal to the approximate maximum capacity of the well pump. The well pump was then shut off and water levels were monitored during the two hour (137 minute) recovery period of the test. During the pumping portion of the test, water levels were monitored in wells CLEM-1, CLEM-2, and CLEM-3. Water levels in CLEM-1 were monitored using an electronic down-hole water pressure/data logger device. Water levels in CLEM-2 and CLEM-3 were monitoring using the Model 150 well sounder. There were no measureable water level declines observed in wells CLEM-1, CLEM-2, or CLEM-3 during the pumping test.

For the pumping test, a Geopump Peristaltic Pump Series II pump supplied by Geotech Environmental Equipment, Inc. of Denver, Colorado was utilized. Water level measurements at the pumping well (CLEM-4) and observation well CLEM-1 were taken and recorded using AquiStar PT2X Submersible Pressure/Temperature Smart Sensors, also provided by Geotech Environmental Equipment, Inc. Other water level measurements were performed using a Waterline Envirotech, Ltd. Model 150 well sounder.

Stream Discharge Monitoring

Discharge and field water quality parameters were measured on the day of the aquifer pumping test at monitoring station Kanab Creek @ C.R., which is located at the alluvial groundwater monitoring wells location (Figure 2). Discharge and field water quality parameters were also measured at monitoring station SW-3, which is located on Kanab Creek about 0.5 miles below the Kanab Creek @ C.R. monitoring station (Figure 1). Temperature measurements were performed using a Taylor brand electronic thermometer. The pH values were determined using a calibrated Hanna Brand Model HI 98128 pH meter with automatic temperature compensation. Specific conductance values (corrected to 25 °C) were measured using a calibrated Hanna Brand Model HI 98311 meter. Dissolved oxygen concentrations were measured using a calibrated YSI Brand Model 55 meter. The results of these measurements are presented below:

Site	Date/Time	Flow (gpm)	Temp. (°C)	pH	Specific cond. (µS/cm)	Dissolved ox. (mg/L)
CLEM-4	9 May 2017 17:15	---	8.7	7.56	1,115	---
Kanab Creek @ C.R.	9 May 2017 16:20	330	14.7	8.45	1,342	8.59
SW-3	9 May 2017 12:30	316	13.6	8.40	1,344	8.08

It is apparent from this information that the discharge in Kanab Creek did not increase measurably between the upstream Kanab Creek @ C.R. monitoring station and the downstream monitoring station SW-3. It is also apparent that the field water quality parameters at both of these sites were similar. It is also notable that the quality of the water measured from CLEM-4 is not the same as that measured at Kanab Creek. CLEM-4 is located less than 8 feet laterally from the flowing surface of Kanab Creek (suggesting a lack of strong hydraulic communication and groundwater/surface-water interactions there).

Pump Test Analysis

The geologic information, well completion information, and information collected during the 9 May 2017 pump test were compiled into electronic format for analysis. The data for the pumping test was analyzed using the widely accepted computer program AQTESOLV version 4.50 software from HydroSOLVE, Inc. The AQTESOLV pump test analysis implemented the Hantush (1960) method that accounts for partial penetration, variable pumping rates, and analysis of recovery data. The raw data files and the results of the analysis are presented in Attachment 1.

As is common during pumping tests, the highest quality data from the CLEM-4 pumping test was from the well recovery period. Drawdown data from the pumping phase of the test was generally similar to that obtained during the recovery portion of the test, although the curve was not as smooth as it was for the recovery period. Consequently, the recovery portion of the aquifer pumping test data was utilized for this analysis. A plot of these data is provided in Figure 5.

It should be noted that a slight perturbation (2-minute water level spike in the measured water levels) occurred during the recovery period of the test for CLEM-4 (see Attachment 1). The anomalous data points occurred shortly after the well pump was turned off after the end of the pumping period of the test. Field observations at that time indicated that a small amount of water that remained in the discharge tubing when the pump was turned off siphoned back into the well casing at that time. For the pumping test analysis, these anomalous data points were omitted from the analysis. It is our professional opinion that this small disturbance did not significantly affect the results of the pumping test analysis.

For the performance of the pump test, it was assumed that the bottom of the alluvial groundwater system at the CLEM-1, CLEM-2, CLEM-3, and CLEM-4 was at an elevation of 6,790, which corresponds to the deepest depth to which drilling could be advanced (to refusal) in the vicinity of the wells.

The results of the pump test analysis show that the aquifer response to the groundwater pumping (as reflected by curve matching) fits with good agreement with the time drawdown curves for a semi-confined system using the Hantush 1960 method for a semi-confined (leaky) groundwater system. It is noted that semi-confined (leaky) groundwater conditions were identified in the Kanab Creek alluvial groundwater system further north in the North Private Lease aquifer testing of April 2016 (Petersen Hydrologic, 2016).

3.0 Results and Discussion

As requested by the Division of Oil, Gas and Mining, the information provided in this investigation can be used to estimate the quantity of water flowing beneath the Kanab Creek stream channel near the southern boundary of the North Private Lease (Figure 1).

This can be accomplished using Darcy's Law, which may be expressed as:

$$Q=KIA$$

Where K = hydraulic conductivity

I = hydraulic gradient

A = cross-sectional area of saturated sediments.

Thus, using the value of hydraulic conductivity determined from the alluvial groundwater pumping test, the hydraulic gradient determined from water elevations measured from the four alluvial groundwater monitoring wells, and determinations of the alluvial groundwater system geometry obtained from the drilling activities at the site, the flow may be calculated.

Hydraulic Conductivity

The results of the aquifer testing at the Kanab Creek alluvial groundwater system indicates a value of hydraulic conductivity of 8.515×10^{-4} cm/sec, or 2.794×10^{-5} ft/sec (see Attachment A). It is noteworthy that this value is consistent with published ranges of values for a silty sand (middle of the range), or at the upper end of the published range for a clean sand (Freeze and Cherry, 1979). Thus, the value for hydraulic conductivity measured during the pumping test is generally consistent with the types of materials (mostly mixtures of silt) encountered during the well drilling activities at the Kanab Creek alluvial groundwater monitoring wells (Table 3).

Hydraulic Gradient

The hydraulic gradient at the well site is not uniform. Typically, the hydraulic gradient on the west side of the creek is greater than the hydraulic gradient on the east side of the creek. Therefore, an average hydraulic gradient from both sides of the creek is utilized in this calculation. The hydraulic gradient is determined by dividing the change in water level (in feet) by the distance between the wells (in feet), resulting in a gradient with dimensionless units. The average of the gradients measured on 9 May 2017 for wells CLEM-1 and CLEM-2 (east side of the creek), and for wells CLEM-4 and CLEM-3 (west side of the creek) is 0.057.

Cross-sectional area of saturated alluvium

For the purposes of this investigation, a width of 160 feet (measured from crest to crest of the alluvial channel near well locations) was used. It is noted that this value appreciably exceeds the much narrower valley bottom, which on the order of 30 to 35 feet. A value for the depth of saturated alluvium of 50 feet was used. It is noted that value is considered conservative, since this value exceeds the depths encountered during drilling. Thus, the cross-sectional area of saturated alluvium is:

160 feet x 50 feet = 8,000 square feet.

Using these values with Darcy's Law, the flow of alluvial groundwater beneath the Kanab Creek stream channel is:

$$Q = (2.794 \times 10^{-5} \text{ ft/sec}) \times (0.046) \times (8{,}000 \text{ ft}^2)$$
$$= 0.01028 \text{ ft}^3\text{/sec}$$
$$= 4.6 \text{ gpm}$$

The modest amount of groundwater flow calculated here is consistent with years of field observations made in the region. No springs or seeps with appreciable groundwater flow rates have been identified near the Kanab Creek stream channel between the locations of monitoring stations Kanab Creek @ C.R. and SW-3. Similarly, the lack of appreciable gains in the discharge rate in Kanab Creek below station Kanab Creek @ C.R. measured at the time of this survey further suggests that there is likely not a large quantity of discharge from alluvial groundwater systems in this reach of the Kanab Creek drainage.

4.0 References Cited

Freeze, R.A, and Cherry, J.C., 1979, Groundwater, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 604 p.

HydroSOLVE, Inc., 2007, AQTESOLV for Windows, developed by Glenn M. Duffield, registered trademark of ARCADOS Geraghty & Miller, Inc.

Petersen Hydrologic, 2016, Characterization of alluvial groundwater systems in the North Private Lease area at the Alton Coal Development, LLC Coal Hollow Mine, Unpublished consulting report for Alton Coal Development, LLC, Cedar City, Utah.

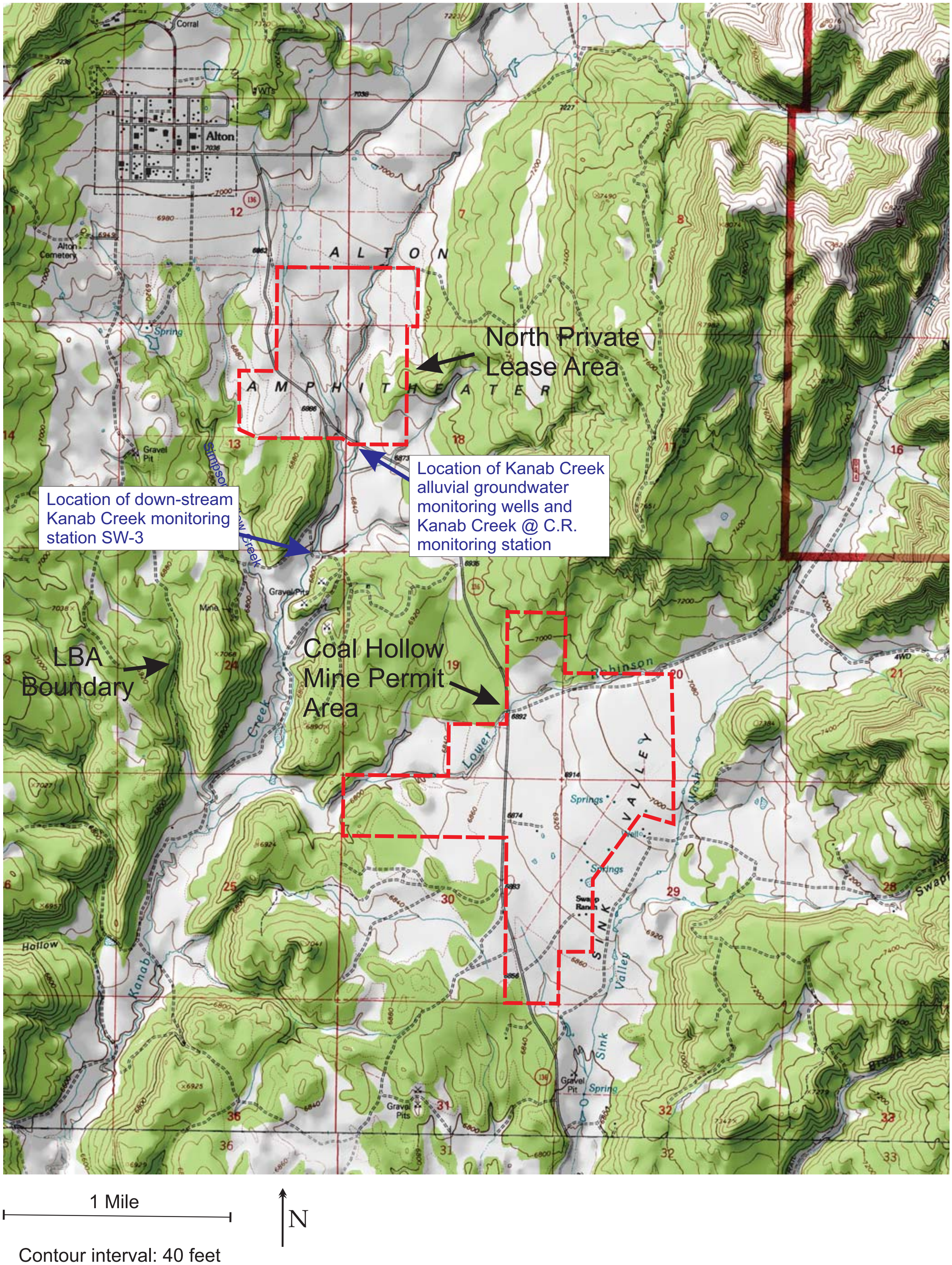

Figure 1 Locations of the North Private Lease and the Kanab Creek alluvial groundwater monitoring wells at the Coal Hollow Mine.

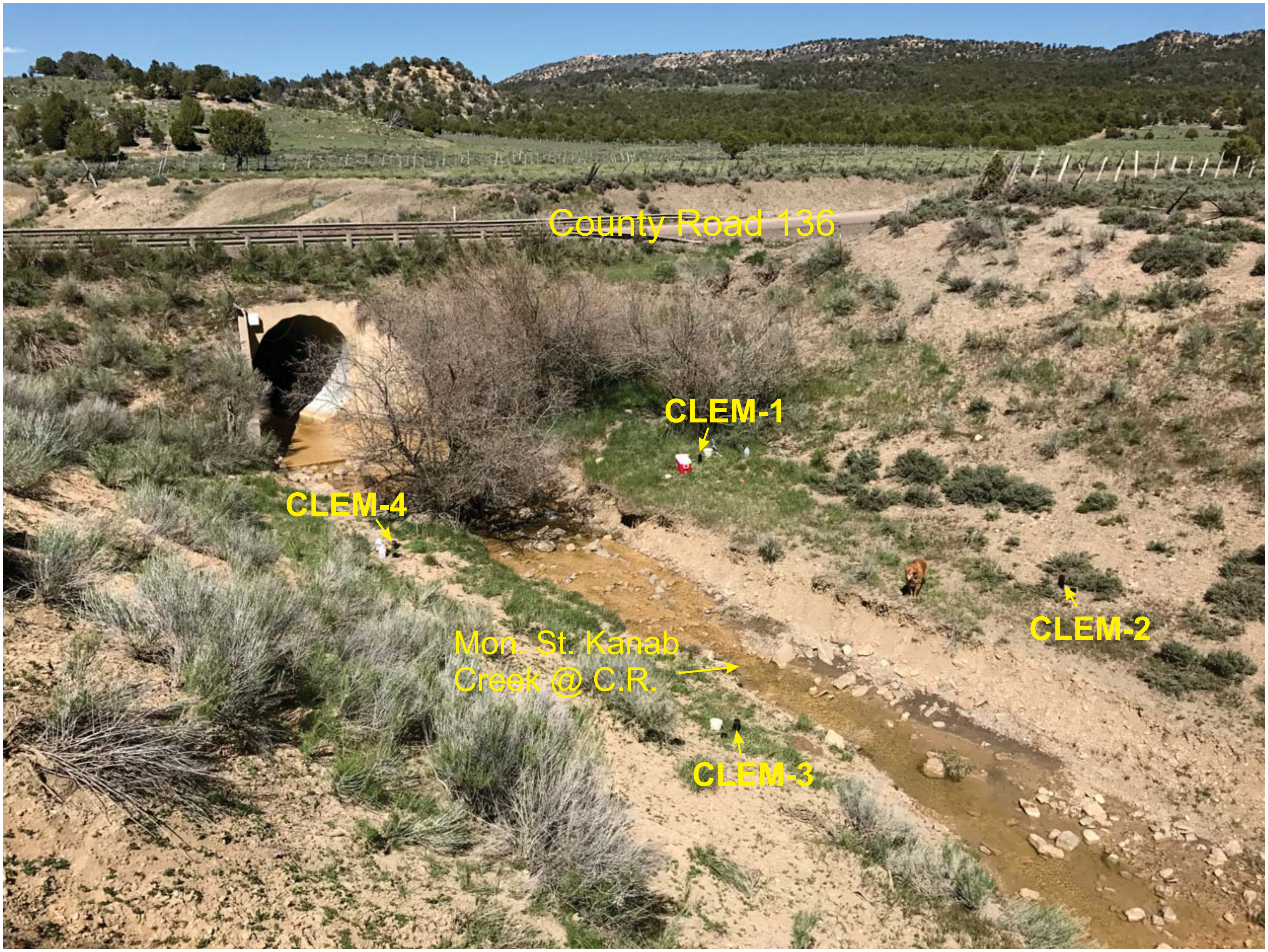

Figure 2 Locations of Kanab Creek alluvial groundwater monitoring wells and monitoring station Kanab Creek @ C.R.

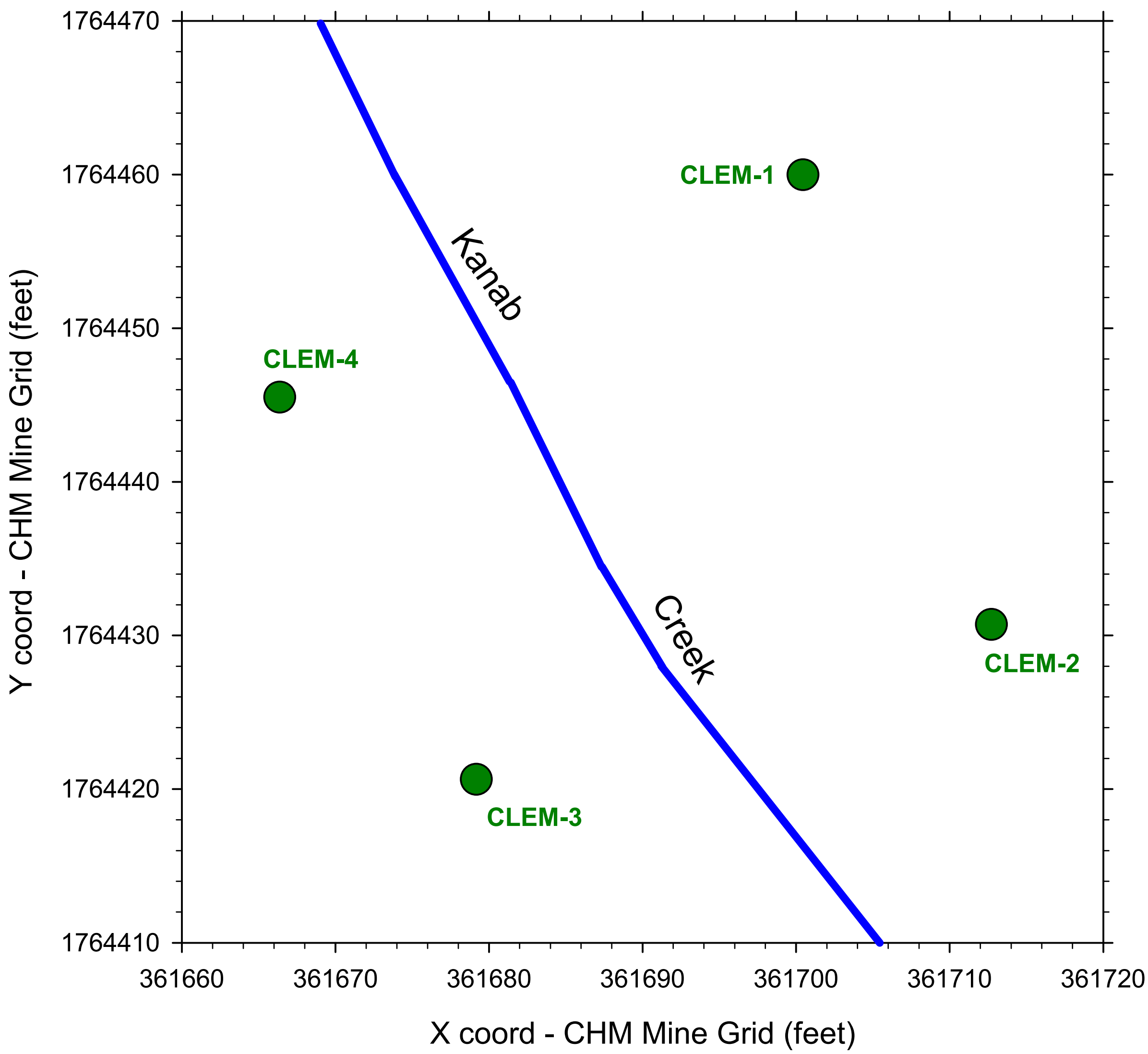

Figure 3 Kanab Creek alluvial groundwater monitoring well locations.

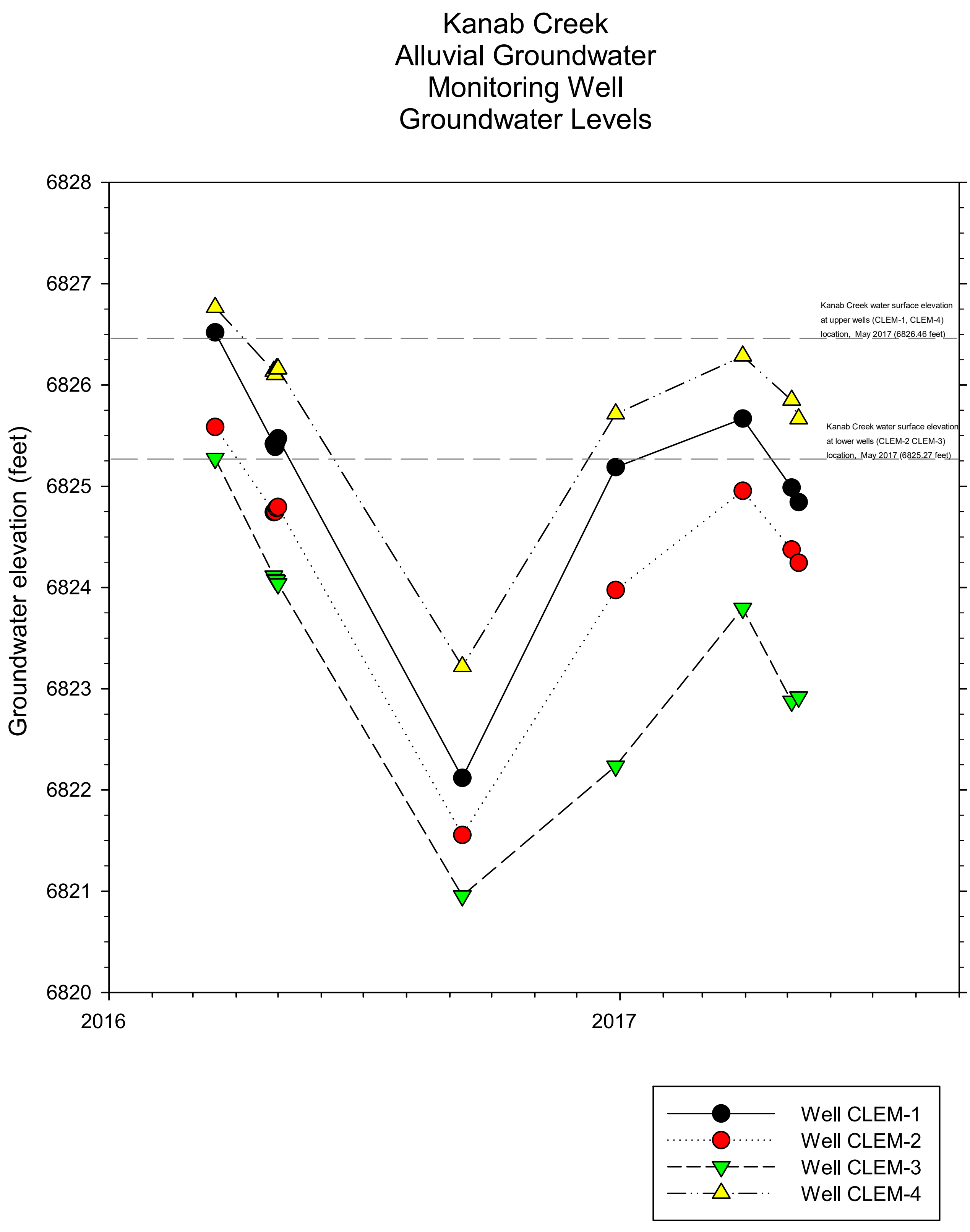

Figure 4 Water level hydrographs for Kanab Creek alluvial monitoring wells.

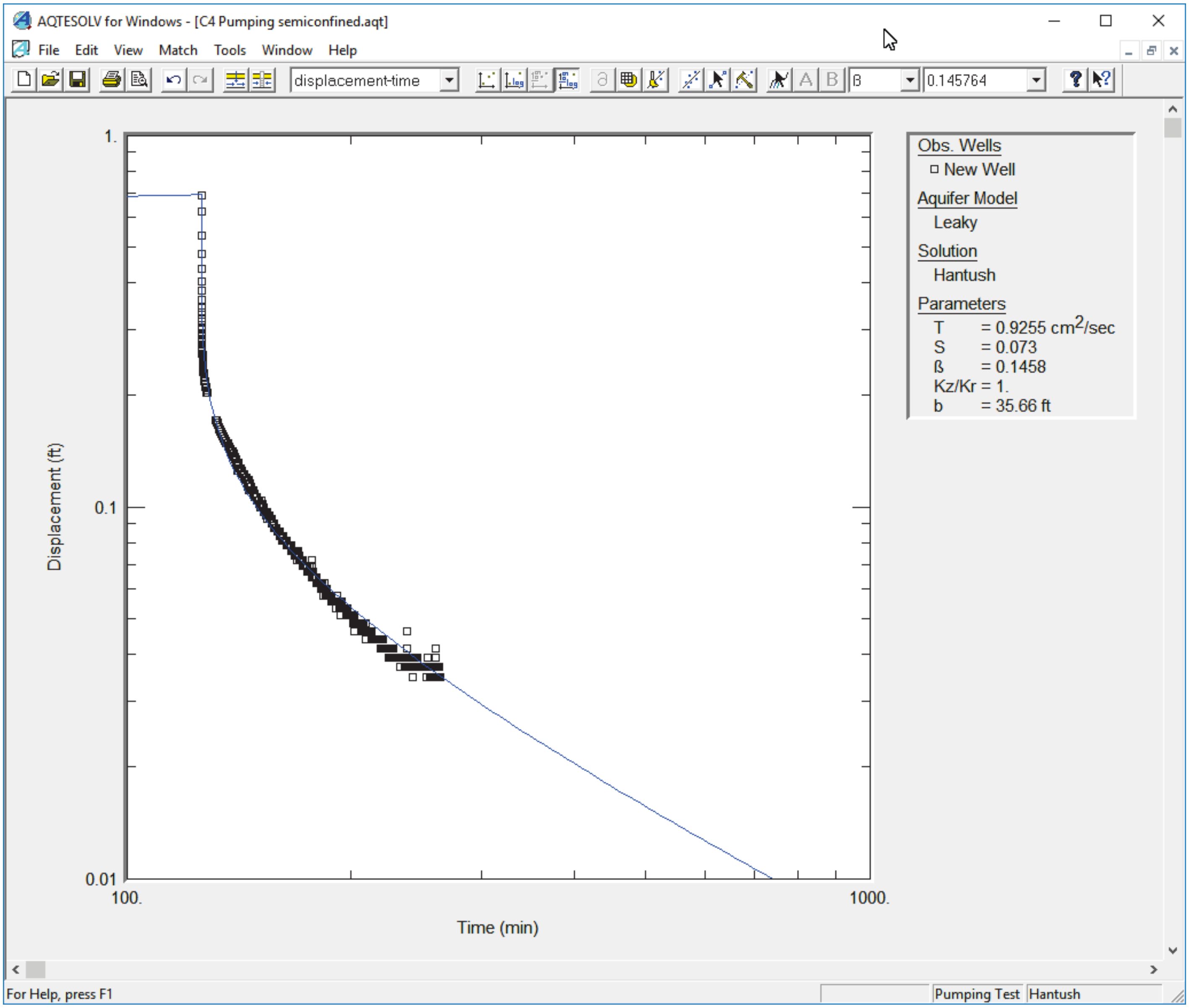

Figure 5 Aqtesolv single-well pumping test recovery plot for well CLEM-4.

Table 1 Construction details for Kanab Creek alluvial monitoring wells.

Well ID	Loc. UTM NAD 27 (Hand held GPS)		Location (feet) (CHM Mine Grid)		Elevation (top of casing ft.)	Stick-up height (ft)	Borehole diameter	Drilling type	Total borehole depth (ft.)	Casing type
CLEM-1	370214	4142181	361700.44	1764459.98	6831.75	0.79	2.375-inch	Direct push	32	1-inch pvc
CLEM-2	370208	4142171	361666.36	1764445.51	6830.56	0.79	2.375-inch	Direct push	28	1-inch pvc
CLEM-3	370200	4142177	361679.17	1764420.63	6827.97	0.71	2.375-inch	Direct push	28	1-inch pvc
CLEM-4	370202	4142185	361712.72	1764430.71	6829.31	0.29	2.375-inch	Direct push	28	1-inch pvc

Well ID	Screen type	Screen len. (ft.)	Screen dia. (ft)	Screen bot. (ft.)	Screen top (ft.)	Gravel pack type	Gravel bottom (ft.)	Gravel top (ft.)	Plug bottom (ft.)	Plug top (ft.)
CLEM-1	10-slot pvc	20	1-inch	28	8	10-20 Sil. sand	28	6	6	0
CLEM-2	10-slot pvc	20	1-inch	28	8	10-20 Sil. sand	28	5	5	0
CLEM-3	10-slot pvc	20	1-inch	27	7	10-20 Sil. sand	27	5	5	0
CLEM-4	10-slot pvc	20	1-inch	27.5	7.5	10-20 Sil. sand	27.5	5	5	0

Table 2 Potentiometric levels in Kanab Creek alluvial monitoring wells.

Well ID	Date	Depth (ft.)	Well Elevation	Water Elevation
CLEM-1	3/17/2016	5.23	6831.7486	6826.52
CLEM-1	4/28/2016	6.33	6831.7486	6825.42
CLEM-1	4/29/2016	6.36	6831.7486	6825.39
CLEM-1	4/30/2016	6.30	6831.7486	6825.45
CLEM-1	5/1/2016	6.28	6831.7486	6825.47
CLEM-1	9/10/2016	9.63	6831.7486	6822.12
CLEM-1	12/29/2016	6.56	6831.7486	6825.19
CLEM-1	3/30/2017	6.08	6831.7486	6825.67
CLEM-1	5/4/2017	6.76	6831.7486	6824.99
CLEM-1	5/9/2017	6.91	6831.7486	6824.84
CLEM-2	3/17/2016	4.97	6830.555	6825.59
CLEM-2	4/28/2016	5.81	6830.555	6824.75
CLEM-2	4/29/2016	5.81	6830.555	6824.75
CLEM-2	4/30/2016	5.77	6830.555	6824.79
CLEM-2	5/1/2016	5.76	6830.555	6824.80
CLEM-2	9/10/2016	9.00	6830.555	6821.56
CLEM-2	12/29/2016	6.58	6830.555	6823.98
CLEM-2	3/30/2017	5.60	6830.555	6824.96
CLEM-2	5/4/2017	6.18	6830.555	6824.38
CLEM-2	5/9/2017	6.31	6830.555	6824.25
CLEM-3	3/17/2016	2.70	6827.9745	6825.27
CLEM-3	4/28/2016	3.86	6827.9745	6824.11
CLEM-3	4/29/2016	3.90	6827.9745	6824.08
CLEM-3	4/30/2016	3.91	6827.9745	6824.07
CLEM-3	5/1/2016	3.94	6827.9745	6824.04
CLEM-3	9/10/2016	7.02	6827.9745	6820.95
CLEM-3	12/29/2016	5.74	6827.9745	6822.23
CLEM-3	3/30/2017	4.18	6827.9745	6823.79
CLEM-3	5/4/2017	5.10	6827.9745	6822.88
CLEM-3	5/9/2017	5.06	6827.9745	6822.92
CLEM-4	3/17/2016	2.55	6829.3149	6826.76
CLEM-4	4/28/2016	3.18	6829.3149	6826.13
CLEM-4	4/29/2016	3.21	6829.3149	6826.10
CLEM-4	4/30/2016	3.16	6829.3149	6826.16
CLEM-4	5/1/2016	3.16	6829.3149	6826.16
CLEM-4	9/10/2016	6.10	6829.3149	6823.22
CLEM-4	12/29/2016	3.60	6829.3149	6825.71
CLEM-4	3/30/2017	3.03	6829.3149	6826.28
CLEM-4	5/4/2017	3.47	6829.3149	6825.85
CLEM-4	5/9/2017	3.65	6829.3149	6825.66

Table 3 Geologic logs of Kanab Creek alluvial groundwater monitoring well boreholes.

CLEM-1	Description
0-4 ft	Silty clay, brown
4-8 ft	Silty clay and gravel, silty sand, brown
8-12 ft	Silty sand and silty gravel, tan
12-16 ft	Silty sand, silty gravel, tan
	Clay, dense, waxy, gray, possible perching layer
16-20 ft	Silty fine-grained sand, brown and gray
	Gravelly silty sand, tan, gravel is ~0.5 inch
	Silty fine-grained sand, brown and tan
20-24 ft	Medium- and fine-grained sand, brown and gray
	Gravelly silt, brown and gray
24-36 ft	Gravelly silt with fine-grained sand, brown, gray, red
	Medium-grained sand, brayish brown

CLEM-2	Description
0-4 ft	Clay with rocks/gravel, broken rocks, brown, tan, red
	Silty gravel, broken rocks, yellow-orange and gray
	Medium-gray sand, gray
	Gravelly silt with sand, broken rock fragments, red, brown gray
4-8 ft	Gravelly silt, tan, wet
	Gravelly silt with broken rock fragments, red, white, gray, tight, mostly dry
8-12 ft	Silty gravel and broken rock, minor sand, tan, red, brown, gray
12-16 ft	Silty gravel with broken rock fragments, tan, red, brown, gray
	Clay, dense, dark gray
	Sandy clay, gray
	Silty fine-grained sand, brownish gray and medium gray
	Clay, dense, dark gray
16-20 ft	Clay, dense, dark gray
	Fine-grained sand, brownish gray
	Gravelly silt, gray, brown, red
	Silty fine-grained sand, brownish gray
20-24 ft	Silty fine- to medium-grained sand, gray and brown
24-28 ft	Silty medium-grained sand, gray
	Silty gravel and fine-grained sand
28-32 ft	Silt with fine-grained sand, brownish gray, loose, runny
	Gravelly silt with rock fragments
32-36 ft	Broken rock, silty gravel, likely presence of flowing silt (not recovered)
36-40 ft	Silt and gravelly silt, hard, brown, likely presence of flowing silt (not recovered)
40 ft	Rock, hard, dry, white, red, Bedrock?

CLEM-3	Description
0-4 ft	Silty clay, brown
	Rock, black, hard
	Silty clay, brown
	Silty fine-grained sand, medium grayish brown
4-8 ft	Silty fine-grained sand, medium grayish brown
	Clay, dense, gray and tan
	Silty gravel and rock fragments, orange, gray, and brown
8-12 ft	Silty gravel, loose, 0.25 to 1.0-inch
	Clay, dense, medium gray
	Clayey silt, medium gray
12-16 ft	Clayey silt, medium gray
	Clay, dense, medium gray
	Silty fine-grained sand, tan and brown
16-20 ft	Silty gravel and rock fragments, tight, predom. 0.75-inch, red, black, tan, white
	Sandy clay, silty, gray
	Silty sand, brownish gray
	Silty gravel, tightly packed, gray, red, brown, tan
20-24 ft	Sandy, silty, clayey gravel and rock fragments, red, white,gray, brown, tan
24-28 ft	Silty, sandy rock fragments and gravel, tightly packed in matrix, pink, tan, gray, brown

CKEM-4	Description
0-4 ft	Clayey silt, brown
	Silty gravel and rock fragments, pink, brown, gray, tan
4-8 ft	Silty, sandy gravel, tightly packed, tan, brown, red, gray, black
8-12 ft	Silty, sandy gravel, tightly packed, tan, brown, red, gray, black
	Silty, fine gravel with clay, gray
	Silty clay, medium and dark gray
12-16 ft	Silty clay, dark gray
	Silty fine-grained sand, grayish brown
16-20 ft	Silty fine-grained sand, dark brownish gray
	Silty, sandy gravel and rock fragments, tightly packed, tan, pink, gray, brown
20-24 ft	Silty fine-grained sand, dark grayish brown
	Silty sandy gravel and rock fragments and silty sand, tightly packed, pink, gray, tan, brown
24-28 ft	Silt and very-fine-grained sand, runny, brownish gray
	Rock/gravel, brown and gray

Attachment 1

AQTESOLV printout of CLEM-4 pump test calculations and results.

Printout of time displacement data for CLEM-4 recovery period.

Plot of raw data from CLEM-4 pumping and recovery test.

Data Set: C:\Users\Erik\Documents\AAA PH LLC\Coal Hollow\AAA North Lease Permitting\Kanab Creek Well Clus
Date: 05/11/17
Time: 23:22:14

PROJECT INFORMATION

Company: Petersen Hydrologic, LLC
Client: ACD
Test Date: 9 May 2017
Test Well: CLEM-4 Pumping

AQUIFER DATA

Saturated Thickness: 35.66 ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 1. ft
Aquitard Thickness (b"): 1. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: New Well

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.042 ft
Well Radius: 0.042 ft

Partially Penetrating Well
Depth to Top of Screen: 4.14 ft
Depth to Bottom of Screen: 24.14 ft

No. of pumping periods: 5

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	0.395	86.	0.337
14.75	0.395	126.	0.
30.	0.366		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: New Well

X Location: 0. ft
Y Location: 0. ft

Radial distance from New Well: 0. ft

Partially Penetrating Well
Depth to Top of Screen: 4.14 ft
Depth to Bottom of Screen: 24.14 ft

No. of Observations: 8076

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
126.	0.6908	196.6	0.05323
126.	0.6215	196.6	0.05323
126.	0.5383	196.6	0.05323
126.1	0.4783	196.6	0.05323
126.1	0.4367	196.6	0.05323
126.1	0.4043	196.6	0.05323

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
126.1	0.3812	196.7	0.05323
126.1	0.3605	196.7	0.05323
126.1	0.3443	196.7	0.05323
126.2	0.3327	196.7	0.05323
126.2	0.3212	196.7	0.05323
126.2	0.3143	196.7	0.05323
126.2	0.305	196.8	0.05323
126.2	0.3004	196.8	0.05323
126.2	0.2935	196.8	0.05323
126.3	0.2889	196.8	0.05323
126.3	0.2842	196.8	0.05323
126.3	0.2796	196.8	0.05323
126.3	0.2773	196.8	0.05323
126.3	0.2727	196.9	0.05323
126.3	0.2704	196.9	0.05323
126.3	0.2681	196.9	0.05323
126.4	0.2657	196.9	0.05323
126.4	0.2634	196.9	0.05323
126.4	0.2611	196.9	0.05323
126.4	0.2588	197.	0.05323
126.4	0.2565	197.	0.05323
126.5	0.2542	197.	0.05323
126.5	0.2542	197.	0.05323
126.5	0.2519	197.	0.05323
126.5	0.2496	197.1	0.05323
126.5	0.2496	197.1	0.05323
126.5	0.2473	197.1	0.05323
126.6	0.2473	197.1	0.05323
126.6	0.245	197.1	0.05323
126.6	0.245	197.1	0.05323
126.6	0.2427	197.2	0.05323
126.6	0.2427	197.2	0.05323
126.6	0.2403	197.2	0.05323
126.7	0.2403	197.2	0.05323
126.7	0.238	197.2	0.05323
126.7	0.238	197.2	0.05323
126.7	0.238	197.3	0.05323
126.7	0.2357	197.3	0.05323
126.7	0.2357	197.3	0.05323
126.8	0.2357	197.3	0.05323
126.8	0.2334	197.3	0.05092
126.8	0.2334	197.3	0.05092
126.8	0.2334	197.3	0.05092
126.8	0.2311	197.4	0.05092
126.8	0.2311	197.4	0.05323
126.8	0.2311	197.4	0.05323
126.9	0.2311	197.4	0.05323
126.9	0.2288	197.4	0.05323
126.9	0.2288	197.4	0.05323
126.9	0.2288	197.5	0.05092
126.9	0.2265	197.5	0.05092
127.	0.2265	197.5	0.05092
127.	0.2265	197.5	0.05092
127.	0.2265	197.5	0.05323
127.	0.2265	197.6	0.05323
127.	0.2265	197.6	0.05323
127.	0.2242	197.6	0.05323
127.1	0.2242	197.6	0.05323
127.1	0.2242	197.6	0.05092
127.1	0.2242	197.6	0.05092
127.1	0.2242	197.7	0.05092
127.1	0.2219	197.7	0.05092
127.1	0.2219	197.7	0.05092
127.2	0.2219	197.7	0.05092
127.2	0.2219	197.7	0.05092
127.2	0.2196	197.7	0.05092

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
127.2	0.2196	197.8	0.05323
127.2	0.2196	197.8	0.05092
127.2	0.2196	197.8	0.05092
127.3	0.2196	197.8	0.05092
127.3	0.2196	197.8	0.05092
127.3	0.2196	197.8	0.05323
127.3	0.2172	197.8	0.05092
127.3	0.2172	197.9	0.05092
127.3	0.2172	197.9	0.05092
127.3	0.2172	197.9	0.05092
127.4	0.2172	197.9	0.05092
127.4	0.2172	197.9	0.05092
127.4	0.2172	197.9	0.05092
127.4	0.2172	198.	0.05092
127.4	0.2149	198.	0.05092
127.5	0.2149	198.	0.05092
127.5	0.2149	198.	0.05092
127.5	0.2149	198.	0.05092
127.5	0.2149	198.1	0.05092
127.5	0.2149	198.1	0.05092
127.5	0.2149	198.1	0.05092
127.6	0.2149	198.1	0.05092
127.6	0.2149	198.1	0.05092
127.6	0.2149	198.1	0.05092
127.6	0.2149	198.2	0.05092
127.6	0.2149	198.2	0.05092
127.6	0.2126	198.2	0.05092
127.7	0.2126	198.2	0.05092
127.7	0.2126	198.2	0.05092
127.7	0.2126	198.2	0.05092
127.7	0.2126	198.3	0.05092
127.7	0.2126	198.3	0.05092
127.7	0.2126	198.3	0.05092
127.8	0.2103	198.3	0.05092
127.8	0.2103	198.3	0.05092
127.8	0.2103	198.3	0.05092
127.8	0.2103	198.3	0.05092
127.8	0.2103	198.4	0.05092
127.8	0.2103	198.4	0.05092
127.8	0.2103	198.4	0.05092
127.9	0.208	198.4	0.05092
127.9	0.208	198.4	0.05092
127.9	0.208	198.4	0.05092
127.9	0.208	198.5	0.05092
127.9	0.208	198.5	0.05092
128.	0.208	198.5	0.05092
128.	0.208	198.5	0.05092
128.	0.208	198.5	0.05092
128.	0.208	198.6	0.05092
128.	0.208	198.6	0.05092
128.	0.2057	198.6	0.05092
128.1	0.2057	198.6	0.05092
128.1	0.2057	198.6	0.05092
128.1	0.2057	198.6	0.05092
128.1	0.2057	198.7	0.05092
128.1	0.2057	198.7	0.05092
128.1	0.2057	198.7	0.05092
128.2	0.2057	198.7	0.05092
128.2	0.2057	198.7	0.05092
128.2	0.2034	198.7	0.05092
128.2	0.2034	198.8	0.05092
128.2	0.2034	198.8	0.05092
128.2	0.2034	198.8	0.05092
128.3	0.2034	198.8	0.05092
131.5	0.171	198.8	0.05092
131.5	0.171	198.8	0.05092

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
131.6	0.171	198.8	0.05092
131.6	0.171	198.9	0.05092
131.6	0.171	198.9	0.05092
131.6	0.171	198.9	0.05092
131.6	0.171	198.9	0.05092
131.6	0.171	198.9	0.05092
131.7	0.171	198.9	0.05092
131.7	0.171	199.	0.05092
131.7	0.171	199.	0.05092
131.7	0.171	199.	0.05092
131.7	0.171	199.	0.05092
131.7	0.171	199.	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.1	0.05092
131.8	0.171	199.2	0.05092
131.9	0.171	199.2	0.05092
131.9	0.171	199.2	0.05092
131.9	0.171	199.2	0.05092
131.9	0.171	199.2	0.05092
131.9	0.171	199.2	0.05092
131.9	0.171	199.3	0.05092
132.	0.171	199.3	0.05092
132.	0.171	199.3	0.05092
132.	0.171	199.3	0.05092
132.	0.1687	199.3	0.05092
132.	0.1687	199.3	0.05092
132.1	0.1687	199.3	0.05092
132.1	0.1687	199.4	0.05092
132.1	0.1687	199.4	0.05092
132.1	0.1687	199.4	0.05092
132.1	0.1687	199.4	0.05092
132.1	0.1687	199.4	0.05092
132.2	0.1687	199.4	0.05092
132.2	0.1687	199.5	0.05092
132.2	0.1687	199.5	0.05092
132.2	0.1687	199.5	0.05092
132.2	0.1687	199.5	0.05092
132.2	0.1687	199.5	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.6	0.05092
132.3	0.1687	199.7	0.05092
132.4	0.1687	199.7	0.05092
132.4	0.1687	199.7	0.05092
132.4	0.1687	199.7	0.05092
132.4	0.1687	199.7	0.05092
132.4	0.1687	199.7	0.05092
132.4	0.1687	199.8	0.05092
132.5	0.1664	199.8	0.05092
132.5	0.1664	199.8	0.05092
132.5	0.1664	199.8	0.05092
132.5	0.1664	199.8	0.05092
132.5	0.1664	199.8	0.05092
132.6	0.1664	199.8	0.05092
132.6	0.1664	199.9	0.05092
132.6	0.1664	199.9	0.05092
132.6	0.1664	199.9	0.05092
132.6	0.1664	199.9	0.05092
132.6	0.1664	199.9	0.05092

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
132.7	0.1664	199.9	0.05092
132.7	0.1664	200.	0.05092
132.7	0.1664	200.	0.05092
132.7	0.1664	200.	0.05092
132.7	0.1664	200.	0.05092
132.7	0.1664	200.	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.1	0.05092
132.8	0.1664	200.2	0.05092
132.9	0.1664	200.2	0.05092
132.9	0.1641	200.2	0.05092
132.9	0.1641	200.2	0.05092
132.9	0.1641	200.2	0.05092
132.9	0.1641	200.2	0.05092
132.9	0.1641	200.3	0.05092
133.	0.1641	200.3	0.05092
133.	0.1641	200.3	0.05092
133.	0.1641	200.3	0.05092
133.	0.1641	200.3	0.05092
133.	0.1641	200.3	0.05092
133.1	0.1641	200.4	0.05092
133.1	0.1641	200.4	0.05092
133.1	0.1641	200.4	0.05092
133.1	0.1641	200.4	0.05092
133.1	0.1641	200.4	0.05092
133.1	0.1641	200.4	0.05092
133.2	0.1641	200.5	0.05092
133.2	0.1641	200.5	0.05092
133.2	0.1641	200.5	0.05092
133.2	0.1641	200.5	0.05092
133.2	0.1641	200.5	0.05092
133.2	0.1641	200.5	0.05092
133.3	0.1641	200.6	0.05092
133.3	0.1641	200.6	0.05092
133.3	0.1641	200.6	0.05092
133.3	0.1641	200.6	0.05092
133.3	0.1641	200.6	0.05092
133.3	0.1618	200.6	0.05092
133.3	0.1618	200.7	0.05092
133.4	0.1618	200.7	0.05092
133.4	0.1618	200.7	0.05092
133.4	0.1618	200.7	0.05092
133.4	0.1618	200.7	0.05092
133.4	0.1618	200.7	0.05092
133.4	0.1618	200.8	0.05092
133.5	0.1618	200.8	0.05092
133.5	0.1618	200.8	0.05092
133.5	0.1618	200.8	0.05092
133.5	0.1618	200.8	0.05092
133.5	0.1618	200.8	0.05092
133.6	0.1618	200.8	0.05092
133.6	0.1618	200.9	0.05092
133.6	0.1618	200.9	0.05092
133.6	0.1618	200.9	0.05092
133.6	0.1618	200.9	0.05092
133.6	0.1618	200.9	0.05092
133.7	0.1618	200.9	0.05092
133.7	0.1618	201.	0.05092
133.7	0.1618	201.	0.05092
133.7	0.1618	201.	0.05092
133.7	0.1618	201.	0.05092
133.7	0.1618	201.	0.05092

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
133.8	0.1618	201.1	0.05092
133.8	0.1595	201.1	0.05092
133.8	0.1595	201.1	0.05092
133.8	0.1595	201.1	0.05092
133.8	0.1595	201.1	0.05092
133.8	0.1595	201.1	0.05092
133.8	0.1595	201.2	0.05092
133.9	0.1595	201.2	0.05092
133.9	0.1595	201.2	0.05092
133.9	0.1595	201.2	0.05092
133.9	0.1595	201.2	0.05092
133.9	0.1595	201.2	0.05092
133.9	0.1595	201.3	0.05092
134.	0.1595	201.3	0.05092
134.	0.1595	201.3	0.05092
134.	0.1595	201.3	0.05092
134.	0.1595	201.3	0.05092
134.	0.1595	201.3	0.05092
134.1	0.1595	201.3	0.05092
134.1	0.1595	201.4	0.05092
134.1	0.1595	201.4	0.05092
134.1	0.1595	201.4	0.05092
134.1	0.1595	201.4	0.05092
134.1	0.1595	201.4	0.05092
134.2	0.1595	201.4	0.05092
134.2	0.1572	201.5	0.05092
134.2	0.1572	201.5	0.05092
134.2	0.1572	201.5	0.05092
134.2	0.1572	201.5	0.05092
134.2	0.1572	201.5	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.6	0.05092
134.3	0.1572	201.7	0.05092
134.4	0.1572	201.7	0.05092
134.4	0.1572	201.7	0.05092
134.4	0.1572	201.7	0.05092
134.4	0.1572	201.7	0.05092
134.4	0.1572	201.7	0.05092
134.4	0.1572	201.8	0.05092
134.5	0.1572	201.8	0.05092
134.5	0.1572	201.8	0.05092
134.5	0.1572	201.8	0.05092
134.5	0.1572	201.8	0.05092
134.5	0.1572	201.8	0.05092
134.6	0.1572	201.8	0.05092
134.6	0.1572	201.9	0.05092
134.6	0.1572	201.9	0.05092
134.6	0.1572	201.9	0.05092
134.6	0.1549	201.9	0.05092
134.6	0.1549	201.9	0.05092
134.7	0.1549	201.9	0.04861
134.7	0.1549	202.	0.04861
134.7	0.1549	202.	0.04861
134.7	0.1549	202.	0.05092
134.7	0.1549	202.	0.04861
134.7	0.1549	202.	0.04861
134.8	0.1549	202.1	0.04861
134.8	0.1549	202.1	0.04861
134.8	0.1549	202.1	0.04861
134.8	0.1549	202.1	0.05092
134.8	0.1549	202.1	0.04861
134.8	0.1549	202.1	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
134.8	0.1549	202.2	0.04861
134.9	0.1549	202.2	0.04861
134.9	0.1549	202.2	0.04861
134.9	0.1549	202.2	0.04861
134.9	0.1549	202.2	0.05092
134.9	0.1549	202.2	0.05092
134.9	0.1549	202.3	0.04861
135.	0.1549	202.3	0.04861
135.	0.1549	202.3	0.04861
135.	0.1549	202.3	0.04861
135.	0.1549	202.3	0.04861
135.	0.1549	202.3	0.04861
135.1	0.1549	202.3	0.04861
135.1	0.1526	202.4	0.04861
135.1	0.1526	202.4	0.04861
135.1	0.1526	202.4	0.04861
135.1	0.1526	202.4	0.04861
135.1	0.1526	202.4	0.04861
135.2	0.1526	202.4	0.0463
135.2	0.1526	202.5	0.0463
135.2	0.1526	202.5	0.04861
135.2	0.1526	202.5	0.04861
135.2	0.1526	202.5	0.04861
135.2	0.1526	202.5	0.04861
135.3	0.1526	202.6	0.05092
135.3	0.1526	202.6	0.05092
135.3	0.1526	202.6	0.05092
135.3	0.1526	202.6	0.04861
135.3	0.1526	202.6	0.05092
135.3	0.1526	202.6	0.05092
135.3	0.1526	202.7	0.05092
135.4	0.1526	202.7	0.05092
135.4	0.1526	202.7	0.04861
135.4	0.1526	202.7	0.04861
135.4	0.1526	202.7	0.05092
135.4	0.1502	202.7	0.05092
135.4	0.1502	202.8	0.04861
135.5	0.1502	202.8	0.04861
135.5	0.1502	202.8	0.04861
135.5	0.1502	202.8	0.04861
135.5	0.1502	202.8	0.04861
135.5	0.1502	202.8	0.04861
135.6	0.1502	202.8	0.04861
135.6	0.1502	202.9	0.04861
135.6	0.1502	202.9	0.04861
135.6	0.1502	202.9	0.04861
135.6	0.1502	202.9	0.04861
135.6	0.1502	202.9	0.04861
135.7	0.1502	202.9	0.04861
135.7	0.1502	203.	0.04861
135.7	0.1502	203.	0.04861
135.7	0.1502	203.	0.04861
135.7	0.1502	203.	0.04861
135.7	0.1502	203.	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.1	0.04861
135.8	0.1502	203.2	0.04861
135.9	0.1502	203.2	0.04861
135.9	0.1502	203.2	0.04861
135.9	0.1502	203.2	0.04861
135.9	0.1502	203.2	0.04861
135.9	0.1502	203.2	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
135.9	0.1502	203.3	0.04861
136.	0.1502	203.3	0.04861
136.	0.1502	203.3	0.04861
136.	0.1502	203.3	0.04861
136.	0.1502	203.3	0.04861
136.	0.1502	203.3	0.04861
136.1	0.1502	203.3	0.04861
136.1	0.1502	203.4	0.04861
136.1	0.1502	203.4	0.04861
136.1	0.1502	203.4	0.04861
136.1	0.1502	203.4	0.04861
136.1	0.1502	203.4	0.04861
136.2	0.1502	203.4	0.04861
136.2	0.1502	203.5	0.04861
136.2	0.1502	203.5	0.04861
136.2	0.1502	203.5	0.04861
136.2	0.1479	203.5	0.04861
136.2	0.1479	203.5	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.6	0.04861
136.3	0.1479	203.7	0.04861
136.4	0.1479	203.7	0.04861
136.4	0.1479	203.7	0.04861
136.4	0.1479	203.7	0.04861
136.4	0.1479	203.7	0.04861
136.4	0.1479	203.7	0.04861
136.4	0.1479	203.8	0.04861
136.5	0.1479	203.8	0.04861
136.5	0.1479	203.8	0.04861
136.5	0.1479	203.8	0.04861
136.5	0.1479	203.8	0.04861
136.5	0.1479	203.8	0.04861
136.6	0.1479	203.8	0.04861
136.6	0.1479	203.9	0.04861
136.6	0.1479	203.9	0.04861
136.6	0.1479	203.9	0.04861
136.6	0.1479	203.9	0.04861
136.6	0.1479	203.9	0.04861
136.7	0.1479	203.9	0.04861
136.7	0.1479	204.	0.04861
136.7	0.1479	204.	0.04861
136.7	0.1479	204.	0.04861
136.7	0.1479	204.	0.04861
136.7	0.1479	204.	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.1	0.04861
136.8	0.1479	204.2	0.04861
136.9	0.1479	204.2	0.04861
136.9	0.1479	204.2	0.04861
136.9	0.1479	204.2	0.04861
136.9	0.1479	204.2	0.04861
136.9	0.1479	204.2	0.04861
136.9	0.1479	204.3	0.04861
137.	0.1479	204.3	0.04861
137.	0.1479	204.3	0.04861
137.	0.1479	204.3	0.04861
137.	0.1456	204.3	0.04861
137.	0.1456	204.3	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
137.1	0.1456	204.3	0.04861
137.1	0.1456	204.4	0.04861
137.1	0.1456	204.4	0.04861
137.1	0.1456	204.4	0.04861
137.1	0.1456	204.4	0.04861
137.1	0.1456	204.4	0.04861
137.2	0.1456	204.4	0.04861
137.2	0.1456	204.5	0.04861
137.2	0.1456	204.5	0.04861
137.2	0.1456	204.5	0.04861
137.2	0.1456	204.5	0.04861
137.2	0.1456	204.5	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.6	0.04861
137.3	0.1456	204.7	0.04861
137.4	0.1456	204.7	0.04861
137.4	0.1456	204.7	0.04861
137.4	0.1456	204.7	0.04861
137.4	0.1456	204.7	0.04861
137.4	0.1456	204.7	0.04861
137.4	0.1456	204.8	0.04861
137.5	0.1456	204.8	0.04861
137.5	0.1456	204.8	0.04861
137.5	0.1433	204.8	0.04861
137.5	0.1433	204.8	0.04861
137.5	0.1433	204.8	0.04861
137.6	0.1433	204.8	0.04861
137.6	0.1433	204.9	0.04861
137.6	0.1433	204.9	0.04861
137.6	0.1433	204.9	0.04861
137.6	0.1433	204.9	0.04861
137.6	0.1433	204.9	0.04861
137.7	0.1433	204.9	0.04861
137.7	0.1433	205.	0.04861
137.7	0.1433	205.	0.04861
137.7	0.1433	205.	0.04861
137.7	0.1433	205.	0.04861
137.7	0.1433	205.	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.1	0.04861
137.8	0.1433	205.2	0.04861
137.9	0.1433	205.2	0.04861
137.9	0.1433	205.2	0.04861
137.9	0.1433	205.2	0.04861
137.9	0.1433	205.2	0.04861
137.9	0.1433	205.2	0.04861
137.9	0.1433	205.3	0.04861
138.	0.141	205.3	0.04861
138.	0.141	205.3	0.04861
138.	0.141	205.3	0.04861
138.	0.141	205.3	0.04861
138.	0.141	205.3	0.04861
138.1	0.141	205.3	0.04861
138.1	0.141	205.4	0.04861
138.1	0.141	205.4	0.04861
138.1	0.141	205.4	0.04861
138.1	0.141	205.4	0.04861
138.1	0.141	205.4	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
138.2	0.141	205.4	0.04861
138.2	0.141	205.5	0.04861
138.2	0.141	205.5	0.04861
138.2	0.141	205.5	0.04861
138.2	0.141	205.5	0.04861
138.2	0.141	205.5	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.6	0.04861
138.3	0.141	205.7	0.04861
138.4	0.141	205.7	0.04861
138.4	0.141	205.7	0.04861
138.4	0.141	205.7	0.04861
138.4	0.141	205.7	0.04861
138.4	0.141	205.7	0.04861
138.4	0.141	205.8	0.04861
138.5	0.141	205.8	0.04861
138.5	0.141	205.8	0.04861
138.5	0.141	205.8	0.04861
138.5	0.141	205.8	0.04861
138.5	0.141	205.8	0.04861
138.6	0.141	205.8	0.04861
138.6	0.1387	205.9	0.04861
138.6	0.1387	205.9	0.04861
138.6	0.1387	205.9	0.04861
138.6	0.1387	205.9	0.04861
138.6	0.1387	205.9	0.04861
138.7	0.1387	205.9	0.04861
138.7	0.1387	206.	0.04861
138.7	0.1387	206.	0.04861
138.7	0.1364	206.	0.04861
138.7	0.1364	206.	0.04861
138.7	0.1387	206.	0.04861
138.8	0.1387	206.1	0.04861
138.8	0.1387	206.1	0.04861
138.8	0.141	206.1	0.04861
138.8	0.1387	206.1	0.04861
138.8	0.1387	206.1	0.04861
138.8	0.1387	206.1	0.04861
138.8	0.1387	206.2	0.04861
138.9	0.1387	206.2	0.04861
138.9	0.1387	206.2	0.04861
138.9	0.1387	206.2	0.04861
138.9	0.1387	206.2	0.04861
138.9	0.1387	206.2	0.04861
138.9	0.1387	206.3	0.04861
139.	0.1387	206.3	0.04861
139.	0.1387	206.3	0.04861
139.	0.1387	206.3	0.04861
139.	0.1387	206.3	0.04861
139.	0.1387	206.3	0.04861
139.1	0.1387	206.3	0.04861
139.1	0.1387	206.4	0.04861
139.1	0.1387	206.4	0.04861
139.1	0.1387	206.4	0.04861
139.1	0.1387	206.4	0.04861
139.1	0.1387	206.4	0.04861
139.2	0.1387	206.4	0.04861
139.2	0.1387	206.5	0.04861
139.2	0.1387	206.5	0.04861
139.2	0.1364	206.5	0.04861
139.2	0.1364	206.5	0.04861
139.2	0.1364	206.5	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.6	0.04861
139.3	0.1364	206.7	0.04861
139.4	0.1364	206.7	0.04861
139.4	0.1364	206.7	0.04861
139.4	0.1364	206.7	0.04861
139.4	0.1364	206.7	0.04861
139.4	0.1364	206.7	0.04861
139.4	0.1364	206.8	0.04861
139.5	0.1364	206.8	0.04861
139.5	0.1364	206.8	0.04861
139.5	0.1364	206.8	0.04861
139.5	0.1364	206.8	0.04861
139.5	0.1364	206.8	0.04861
139.6	0.1364	206.8	0.04861
139.6	0.1364	206.9	0.04861
139.6	0.1364	206.9	0.04861
139.6	0.1364	206.9	0.04861
139.6	0.1364	206.9	0.04861
139.6	0.1364	206.9	0.04861
139.7	0.1364	206.9	0.04861
139.7	0.1364	207.	0.04861
139.7	0.1364	207.	0.04861
139.7	0.1364	207.	0.04861
139.7	0.1364	207.	0.04861
139.7	0.1364	207.	0.04861
139.8	0.1364	207.1	0.04861
139.8	0.1364	207.1	0.04861
139.8	0.1364	207.1	0.04861
139.8	0.1341	207.1	0.04861
139.8	0.1341	207.1	0.04861
139.8	0.1341	207.1	0.04861
139.8	0.1341	207.2	0.04861
139.9	0.1341	207.2	0.04861
139.9	0.1341	207.2	0.04861
139.9	0.1341	207.2	0.04861
139.9	0.1341	207.2	0.04861
139.9	0.1341	207.2	0.04861
139.9	0.1341	207.3	0.04861
140.	0.1341	207.3	0.04861
140.	0.1341	207.3	0.04861
140.	0.1341	207.3	0.04861
140.	0.1341	207.3	0.04861
140.	0.1341	207.3	0.04861
140.1	0.1341	207.3	0.04861
140.1	0.1341	207.4	0.04861
140.1	0.1341	207.4	0.04861
140.1	0.1341	207.4	0.04861
140.1	0.1341	207.4	0.04861
140.1	0.1341	207.4	0.04861
140.2	0.1341	207.4	0.04861
140.2	0.1341	207.5	0.04861
140.2	0.1341	207.5	0.04861
140.2	0.1341	207.5	0.04861
140.2	0.1341	207.5	0.04861
140.2	0.1341	207.5	0.04861
140.3	0.1341	207.6	0.04861
140.3	0.1341	207.6	0.04861
140.3	0.1341	207.6	0.04861
140.3	0.1341	207.6	0.04861
140.3	0.1341	207.6	0.04861
140.3	0.1341	207.6	0.04861

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
140.3	0.1341	207.7	0.04861
140.4	0.1341	207.7	0.04861
140.4	0.1341	207.7	0.04861
140.4	0.1341	207.7	0.0463
140.4	0.1318	207.7	0.0463
140.4	0.1318	207.7	0.04861
140.4	0.1318	207.8	0.0463
140.5	0.1318	207.8	0.0463
140.5	0.1318	207.8	0.0463
140.5	0.1318	207.8	0.0463
140.5	0.1318	207.8	0.0463
140.5	0.1318	207.8	0.04861
140.6	0.1318	207.8	0.04861
140.6	0.1318	207.9	0.04861
140.6	0.1318	207.9	0.0463
140.6	0.1318	207.9	0.0463
140.6	0.1318	207.9	0.0463
140.6	0.1318	207.9	0.0463
140.7	0.1318	207.9	0.0463
140.7	0.1318	208.	0.0463
140.7	0.1318	208.	0.0463
140.7	0.1318	208.	0.0463
140.7	0.1295	208.	0.0463
140.7	0.1295	208.	0.0463
140.8	0.1295	208.1	0.0463
140.8	0.1295	208.1	0.04861
140.8	0.1295	208.1	0.0463
140.8	0.1295	208.1	0.0463
140.8	0.1272	208.1	0.0463
140.8	0.1272	208.1	0.0463
140.8	0.1248	208.2	0.0463
140.9	0.1248	208.2	0.0463
140.9	0.1248	208.2	0.0463
140.9	0.1248	208.2	0.0463
140.9	0.1272	208.2	0.0463
140.9	0.1272	208.2	0.0463
140.9	0.1272	208.3	0.0463
141.	0.1295	208.3	0.0463
141.	0.1318	208.3	0.0463
141.	0.1318	208.3	0.0463
141.	0.1318	208.3	0.0463
141.	0.1295	208.3	0.0463
141.1	0.1295	208.3	0.0463
141.1	0.1295	208.4	0.0463
141.1	0.1295	208.4	0.04861
141.1	0.1295	208.4	0.0463
141.1	0.1295	208.4	0.0463
141.1	0.1272	208.4	0.0463
141.2	0.1295	208.4	0.0463
141.2	0.1295	208.5	0.0463
141.2	0.1272	208.5	0.0463
141.2	0.1295	208.5	0.0463
141.2	0.1318	208.5	0.0463
141.2	0.1295	208.5	0.0463
141.3	0.1318	208.6	0.0463
141.3	0.1295	208.6	0.0463
141.3	0.1295	208.6	0.0463
141.3	0.1295	208.6	0.0463
141.3	0.1295	208.6	0.0463
141.3	0.1295	208.6	0.0463
141.3	0.1295	208.7	0.0463
141.4	0.1295	208.7	0.0463
141.4	0.1295	208.7	0.0463
141.4	0.1295	208.7	0.0463
141.4	0.1295	208.7	0.0463
141.4	0.1295	208.7	0.0463

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
141.4	0.1295	208.8	0.0463
141.5	0.1295	208.8	0.0463
141.5	0.1295	208.8	0.0463
141.5	0.1295	208.8	0.0463
141.5	0.1295	208.8	0.0463
141.5	0.1295	208.8	0.0463
141.6	0.1295	208.8	0.0463
141.6	0.1295	208.9	0.0463
141.6	0.1295	208.9	0.0463
141.6	0.1295	208.9	0.0463
141.6	0.1295	208.9	0.0463
141.6	0.1295	208.9	0.0463
141.7	0.1272	208.9	0.0463
141.7	0.1272	209.	0.0463
141.7	0.1272	209.	0.0463
141.7	0.1272	209.	0.0463
141.7	0.1272	209.	0.0463
141.7	0.1272	209.	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.1	0.0463
141.8	0.1272	209.2	0.0463
141.9	0.1272	209.2	0.0463
141.9	0.1272	209.2	0.0463
141.9	0.1272	209.2	0.0463
141.9	0.1272	209.2	0.0463
141.9	0.1272	209.2	0.0463
141.9	0.1272	209.3	0.0463
142.	0.1272	209.3	0.0463
142.	0.1272	209.3	0.0463
142.	0.1272	209.3	0.0463
142.	0.1272	209.3	0.0463
142.	0.1272	209.3	0.0463
142.1	0.1272	209.3	0.0463
142.1	0.1272	209.4	0.0463
142.1	0.1272	209.4	0.0463
142.1	0.1272	209.4	0.0463
142.1	0.1272	209.4	0.0463
142.1	0.1272	209.4	0.0463
142.2	0.1272	209.4	0.0463
142.2	0.1272	209.5	0.0463
142.2	0.1272	209.5	0.0463
142.2	0.1272	209.5	0.0463
142.2	0.1272	209.5	0.04399
142.2	0.1272	209.5	0.04399
142.3	0.1272	209.6	0.04399
142.3	0.1272	209.6	0.04399
142.3	0.1272	209.6	0.0463
142.3	0.1272	209.6	0.0463
142.3	0.1272	209.6	0.0463
142.3	0.1272	209.6	0.0463
142.3	0.1272	209.7	0.0463
142.4	0.1272	209.7	0.0463
142.4	0.1272	209.7	0.0463
142.4	0.1272	209.7	0.0463
142.4	0.1272	209.7	0.04861
142.4	0.1272	209.7	0.0463
142.4	0.1248	209.8	0.0463
142.5	0.1248	209.8	0.0463
142.5	0.1248	209.8	0.0463
142.5	0.1248	209.8	0.0463
142.5	0.1248	209.8	0.0463
142.5	0.1248	209.8	0.0463

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
142.6	0.1248	209.8	0.0463
142.6	0.1248	209.9	0.0463
142.6	0.1248	209.9	0.0463
142.6	0.1248	209.9	0.0463
142.6	0.1248	209.9	0.0463
142.6	0.1248	209.9	0.0463
142.7	0.1248	209.9	0.0463
142.7	0.1248	210.	0.0463
142.7	0.1248	210.	0.0463
142.7	0.1248	210.	0.0463
142.7	0.1248	210.	0.0463
142.7	0.1248	210.	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.1	0.0463
142.8	0.1248	210.2	0.0463
142.9	0.1248	210.2	0.0463
142.9	0.1248	210.2	0.0463
142.9	0.1248	210.2	0.0463
142.9	0.1248	210.2	0.0463
142.9	0.1248	210.2	0.0463
142.9	0.1248	210.3	0.0463
143.	0.1248	210.3	0.0463
143.	0.1248	210.3	0.0463
143.	0.1248	210.3	0.0463
143.	0.1248	210.3	0.0463
143.	0.1248	210.3	0.0463
143.1	0.1248	210.3	0.0463
143.1	0.1248	210.4	0.0463
143.1	0.1248	210.4	0.0463
143.1	0.1248	210.4	0.0463
143.1	0.1225	210.4	0.0463
143.1	0.1225	210.4	0.0463
143.2	0.1225	210.4	0.0463
143.2	0.1225	210.5	0.0463
143.2	0.1225	210.5	0.0463
143.2	0.1225	210.5	0.0463
143.2	0.1225	210.5	0.0463
143.2	0.1225	210.5	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.6	0.0463
143.3	0.1225	210.7	0.0463
143.4	0.1225	210.7	0.0463
143.4	0.1225	210.7	0.0463
143.4	0.1225	210.7	0.0463
143.4	0.1225	210.7	0.0463
143.4	0.1225	210.7	0.0463
143.4	0.1225	210.8	0.0463
143.5	0.1225	210.8	0.0463
143.5	0.1225	210.8	0.0463
143.5	0.1225	210.8	0.0463
143.5	0.1225	210.8	0.0463
143.5	0.1225	210.8	0.0463
143.6	0.1225	210.8	0.0463
143.6	0.1225	210.9	0.0463
143.6	0.1225	210.9	0.0463
143.6	0.1225	210.9	0.0463
143.6	0.1225	210.9	0.0463
143.6	0.1225	210.9	0.0463

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
143.7	0.1225	210.9	0.0463
143.7	0.1225	211.	0.0463
143.7	0.1225	211.	0.0463
143.7	0.1225	211.	0.0463
143.7	0.1225	211.	0.0463
143.7	0.1202	211.	0.0463
143.8	0.1202	211.1	0.0463
143.8	0.1225	211.1	0.0463
143.8	0.1202	211.1	0.0463
143.8	0.1202	211.1	0.0463
143.8	0.1202	211.1	0.0463
143.8	0.1202	211.1	0.0463
143.8	0.1225	211.2	0.0463
143.9	0.1202	211.2	0.0463
143.9	0.1202	211.2	0.0463
143.9	0.1225	211.2	0.0463
143.9	0.1225	211.2	0.0463
143.9	0.1225	211.2	0.0463
143.9	0.1225	211.3	0.0463
144.	0.1225	211.3	0.0463
144.	0.1225	211.3	0.0463
144.	0.1225	211.3	0.0463
144.	0.1225	211.3	0.0463
144.	0.1225	211.3	0.0463
144.1	0.1225	211.3	0.0463
144.1	0.1225	211.4	0.0463
144.1	0.1225	211.4	0.0463
144.1	0.1225	211.4	0.0463
144.1	0.1225	211.4	0.0463
144.1	0.1225	211.4	0.0463
144.2	0.1202	211.4	0.0463
144.2	0.1202	211.5	0.0463
144.2	0.1202	211.5	0.0463
144.2	0.1202	211.5	0.0463
144.2	0.1202	211.5	0.0463
144.2	0.1202	211.5	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.6	0.0463
144.3	0.1202	211.7	0.0463
144.4	0.1202	211.7	0.0463
144.4	0.1202	211.7	0.0463
144.4	0.1202	211.7	0.0463
144.4	0.1202	211.7	0.0463
144.4	0.1202	211.7	0.0463
144.4	0.1202	211.8	0.0463
144.5	0.1202	211.8	0.0463
144.5	0.1202	211.8	0.0463
144.5	0.1202	211.8	0.0463
144.5	0.1202	211.8	0.0463
144.5	0.1202	211.8	0.0463
144.6	0.1202	211.8	0.0463
144.6	0.1202	211.9	0.0463
144.6	0.1202	211.9	0.0463
144.6	0.1202	211.9	0.0463
144.6	0.1202	211.9	0.0463
144.6	0.1202	211.9	0.0463
144.7	0.1202	211.9	0.0463
144.7	0.1202	212.	0.0463
144.7	0.1202	212.	0.0463
144.7	0.1179	212.	0.0463
144.7	0.1179	212.	0.0463
144.7	0.1202	212.	0.0463

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.1	0.0463
144.8	0.1179	212.2	0.0463
144.9	0.1179	212.2	0.0463
144.9	0.1179	212.2	0.0463
144.9	0.1179	212.2	0.0463
144.9	0.1179	212.2	0.0463
144.9	0.1179	212.2	0.0463
144.9	0.1179	212.3	0.0463
145.	0.1179	212.3	0.0463
145.	0.1179	212.3	0.0463
145.	0.1179	212.3	0.0463
145.	0.1179	212.3	0.0463
145.	0.1179	212.3	0.0463
145.1	0.1179	212.3	0.0463
145.1	0.1179	212.4	0.0463
145.1	0.1179	212.4	0.0463
145.1	0.1179	212.4	0.0463
145.1	0.1179	212.4	0.0463
145.1	0.1179	212.4	0.0463
145.2	0.1179	212.4	0.0463
145.2	0.1179	212.5	0.0463
145.2	0.1179	212.5	0.0463
145.2	0.1179	212.5	0.0463
145.2	0.1179	212.5	0.0463
145.2	0.1179	212.5	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.6	0.0463
145.3	0.1179	212.7	0.0463
145.4	0.1179	212.7	0.0463
145.4	0.1179	212.7	0.0463
145.4	0.1179	212.7	0.0463
145.4	0.1179	212.7	0.0463
145.4	0.1179	212.7	0.0463
145.4	0.1179	212.8	0.0463
145.5	0.1179	212.8	0.0463
145.5	0.1179	212.8	0.0463
145.5	0.1179	212.8	0.0463
145.5	0.1179	212.8	0.0463
145.5	0.1179	212.8	0.0463
145.6	0.1179	212.8	0.0463
145.6	0.1156	212.9	0.0463
145.6	0.1156	212.9	0.0463
145.6	0.1156	212.9	0.0463
145.6	0.1156	212.9	0.0463
145.6	0.1179	212.9	0.0463
145.7	0.1156	212.9	0.0463
145.7	0.1156	213.	0.0463
145.7	0.1156	213.	0.0463
145.7	0.1133	213.	0.0463
145.7	0.1156	213.	0.0463
145.7	0.1133	213.	0.0463
145.8	0.1156	213.1	0.0463
145.8	0.1156	213.1	0.0463
145.8	0.1156	213.1	0.0463
145.8	0.1156	213.1	0.0463
145.8	0.1156	213.1	0.0463
145.8	0.1179	213.1	0.0463

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
145.8	0.1156	213.2	0.0463
145.9	0.1156	213.2	0.0463
145.9	0.1156	213.2	0.0463
145.9	0.1156	213.2	0.0463
145.9	0.1156	213.2	0.0463
145.9	0.1156	213.2	0.0463
145.9	0.1156	213.3	0.0463
146.	0.1156	213.3	0.0463
146.	0.1156	213.3	0.0463
146.	0.1156	213.3	0.0463
146.	0.1156	213.3	0.0463
146.	0.1156	213.3	0.0463
146.1	0.1156	213.3	0.0463
146.1	0.1156	213.4	0.0463
146.1	0.1156	213.4	0.0463
146.1	0.1156	213.4	0.0463
146.1	0.1156	213.4	0.0463
146.1	0.1133	213.4	0.0463
146.2	0.1133	213.4	0.0463
146.2	0.1156	213.5	0.0463
146.2	0.1133	213.5	0.0463
146.2	0.1133	213.5	0.0463
146.2	0.111	213.5	0.0463
146.2	0.1133	213.5	0.0463
146.3	0.1133	213.6	0.0463
146.3	0.111	213.6	0.04399
146.3	0.111	213.6	0.04399
146.3	0.111	213.6	0.0463
146.3	0.1133	213.6	0.0463
146.3	0.1156	213.6	0.0463
146.3	0.1156	213.7	0.0463
146.4	0.1156	213.7	0.04399
146.4	0.1156	213.7	0.04399
146.4	0.1156	213.7	0.04399
146.4	0.1156	213.7	0.04399
146.4	0.1133	213.7	0.04399
146.4	0.1156	213.8	0.04399
146.5	0.1156	213.8	0.04399
146.5	0.1156	213.8	0.04399
146.5	0.1156	213.8	0.04399
146.5	0.1133	213.8	0.04399
146.5	0.1133	213.8	0.04399
146.6	0.1133	213.8	0.04399
146.6	0.1133	213.9	0.04399
146.6	0.1133	213.9	0.04399
146.6	0.1133	213.9	0.0463
146.6	0.1133	213.9	0.0463
146.6	0.1133	213.9	0.04399
146.7	0.1133	213.9	0.04399
146.7	0.1133	214.	0.04399
146.7	0.1133	214.	0.04399
146.7	0.1133	214.	0.04399
146.7	0.1133	214.	0.04399
146.7	0.1133	214.	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.1	0.04399
146.8	0.1133	214.2	0.04399
146.9	0.1133	214.2	0.04399
146.9	0.1133	214.2	0.04399
146.9	0.1133	214.2	0.04399
146.9	0.1133	214.2	0.04399
146.9	0.1133	214.2	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
146.9	0.1133	214.3	0.04399
147.	0.1133	214.3	0.04399
147.	0.1133	214.3	0.04399
147.	0.1133	214.3	0.04399
147.	0.1133	214.3	0.04399
147.	0.1133	214.3	0.04399
147.1	0.1133	214.3	0.04399
147.1	0.1133	214.4	0.04399
147.1	0.1133	214.4	0.04399
147.1	0.1133	214.4	0.04399
147.1	0.1133	214.4	0.04399
147.1	0.1133	214.4	0.04399
147.2	0.1133	214.4	0.04399
147.2	0.1133	214.5	0.04399
147.2	0.1133	214.5	0.04399
147.2	0.111	214.5	0.04399
147.2	0.111	214.5	0.04399
147.2	0.111	214.5	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.6	0.04399
147.3	0.111	214.7	0.04399
147.4	0.111	214.7	0.04399
147.4	0.111	214.7	0.04399
147.4	0.111	214.7	0.04399
147.4	0.111	214.7	0.04399
147.4	0.111	214.7	0.04399
147.4	0.111	214.8	0.04399
147.5	0.111	214.8	0.04399
147.5	0.111	214.8	0.04399
147.5	0.111	214.8	0.04399
147.5	0.111	214.8	0.04399
147.5	0.111	214.8	0.04399
147.6	0.111	214.8	0.04399
147.6	0.111	214.9	0.04399
147.6	0.111	214.9	0.04399
147.6	0.111	214.9	0.04399
147.6	0.111	214.9	0.04399
147.6	0.111	214.9	0.04399
147.7	0.111	214.9	0.04399
147.7	0.111	215.	0.04399
147.7	0.111	215.	0.04399
147.7	0.111	215.	0.04399
147.7	0.111	215.	0.04399
147.7	0.111	215.	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.1	0.04399
147.8	0.111	215.2	0.04399
147.9	0.111	215.2	0.04399
147.9	0.111	215.2	0.04399
147.9	0.111	215.2	0.04399
147.9	0.111	215.2	0.04399
147.9	0.111	215.2	0.04399
147.9	0.111	215.3	0.04399
148.	0.111	215.3	0.04399
148.	0.111	215.3	0.04399
148.	0.111	215.3	0.04399
148.	0.1087	215.3	0.04399
148.	0.1087	215.3	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
148.1	0.1087	215.3	0.04399
148.1	0.1087	215.4	0.04399
148.1	0.1087	215.4	0.04399
148.1	0.111	215.4	0.04399
148.1	0.1087	215.4	0.04399
148.1	0.1087	215.4	0.04399
148.2	0.1087	215.4	0.04399
148.2	0.1087	215.5	0.04399
148.2	0.1087	215.5	0.04399
148.2	0.1087	215.5	0.04399
148.2	0.1087	215.5	0.04399
148.2	0.1087	215.5	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.6	0.04399
148.3	0.1087	215.7	0.04399
148.4	0.1087	215.7	0.04399
148.4	0.1087	215.7	0.04399
148.4	0.1087	215.7	0.04399
148.4	0.1087	215.7	0.04399
148.4	0.1087	215.7	0.04399
148.4	0.1087	215.8	0.04399
148.5	0.1087	215.8	0.04399
148.5	0.1087	215.8	0.04399
148.5	0.1064	215.8	0.04399
148.5	0.1064	215.8	0.04399
148.5	0.1064	215.8	0.04399
148.6	0.1064	215.8	0.04399
148.6	0.1064	215.9	0.04399
148.6	0.1064	215.9	0.04399
148.6	0.1064	215.9	0.04399
148.6	0.1064	215.9	0.04399
148.6	0.1064	215.9	0.04399
148.7	0.1064	215.9	0.04399
148.7	0.1064	216.	0.04399
148.7	0.1064	216.	0.04399
148.7	0.1064	216.	0.04399
148.7	0.1064	216.	0.04399
148.7	0.1064	216.	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.1	0.04399
148.8	0.1064	216.2	0.04399
148.9	0.1064	216.2	0.04399
148.9	0.1064	216.2	0.04399
148.9	0.1064	216.2	0.04399
148.9	0.1064	216.2	0.04399
148.9	0.1064	216.2	0.04399
148.9	0.1064	216.3	0.04399
149.	0.1064	216.3	0.04399
149.	0.1064	216.3	0.04399
149.	0.1064	216.3	0.04399
149.	0.1064	216.3	0.04399
149.	0.1064	216.3	0.04399
149.1	0.1064	216.3	0.04399
149.1	0.1064	216.4	0.04399
149.1	0.1064	216.4	0.04399
149.1	0.1064	216.4	0.04399
149.1	0.1064	216.4	0.04399
149.1	0.1064	216.4	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
149.2	0.1064	216.4	0.04399
149.2	0.1064	216.5	0.04399
149.2	0.1064	216.5	0.04399
149.2	0.1064	216.5	0.04399
149.2	0.1064	216.5	0.04399
149.2	0.1064	216.5	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.6	0.04399
149.3	0.1064	216.7	0.04399
149.4	0.1064	216.7	0.04399
149.4	0.1064	216.7	0.04399
149.4	0.1064	216.7	0.04399
149.4	0.1064	216.7	0.04399
149.4	0.1064	216.7	0.04399
149.4	0.1064	216.8	0.04399
149.5	0.1064	216.8	0.04399
149.5	0.1064	216.8	0.04399
149.5	0.1041	216.8	0.04399
149.5	0.1041	216.8	0.04399
149.5	0.1041	216.8	0.04399
149.6	0.1041	216.8	0.04399
149.6	0.1041	216.9	0.04399
149.6	0.1041	216.9	0.04399
149.6	0.1041	216.9	0.04399
149.6	0.1041	216.9	0.04399
149.6	0.1064	216.9	0.04399
149.7	0.1041	216.9	0.04399
149.7	0.1064	217.	0.04399
149.7	0.1041	217.	0.04399
149.7	0.1041	217.	0.04399
149.7	0.1041	217.	0.04399
149.7	0.1041	217.	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.1	0.04399
149.8	0.1041	217.2	0.04399
149.9	0.1041	217.2	0.04399
149.9	0.1041	217.2	0.04399
149.9	0.1041	217.2	0.04399
149.9	0.1041	217.2	0.04399
149.9	0.1041	217.2	0.04399
149.9	0.1041	217.3	0.04399
150.	0.1041	217.3	0.04399
150.	0.1041	217.3	0.04399
150.	0.1041	217.3	0.04399
150.	0.1041	217.3	0.04399
150.	0.1041	217.3	0.04399
150.1	0.1041	217.3	0.04399
150.1	0.1041	217.4	0.04399
150.1	0.1041	217.4	0.04399
150.1	0.1041	217.4	0.04399
150.1	0.1041	217.4	0.04399
150.1	0.1041	217.4	0.04399
150.2	0.1041	217.4	0.04399
150.2	0.1041	217.5	0.04399
150.2	0.1041	217.5	0.04399
150.2	0.1041	217.5	0.04399
150.2	0.1041	217.5	0.04399
150.2	0.1041	217.5	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.6	0.04399
150.3	0.1041	217.7	0.04399
150.4	0.1041	217.7	0.04399
150.4	0.1041	217.7	0.04399
150.4	0.1041	217.7	0.04399
150.4	0.1041	217.7	0.04399
150.4	0.1041	217.7	0.04399
150.4	0.1041	217.8	0.04399
150.5	0.1041	217.8	0.04399
150.5	0.1041	217.8	0.04399
150.5	0.1041	217.8	0.04399
150.5	0.1041	217.8	0.04399
150.5	0.1041	217.8	0.04399
150.6	0.1041	217.8	0.04399
150.6	0.1041	217.9	0.04399
150.6	0.1041	217.9	0.04399
150.6	0.1041	217.9	0.04399
150.6	0.1041	217.9	0.04399
150.6	0.1041	217.9	0.04399
150.7	0.1017	217.9	0.04399
150.7	0.1017	218.	0.04399
150.7	0.1017	218.	0.04399
150.7	0.1017	218.	0.04399
150.7	0.1017	218.	0.04399
150.7	0.1017	218.	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.1	0.04399
150.8	0.1017	218.2	0.04399
150.9	0.1017	218.2	0.04399
150.9	0.1017	218.2	0.04399
150.9	0.1017	218.2	0.04399
150.9	0.1017	218.2	0.04399
150.9	0.1017	218.2	0.04399
150.9	0.1017	218.3	0.04399
151.	0.1017	218.3	0.04399
151.	0.1017	218.3	0.04399
151.	0.1017	218.3	0.04399
151.	0.1017	218.3	0.04399
151.	0.1017	218.3	0.04399
151.1	0.1017	218.3	0.04399
151.1	0.1017	218.4	0.04399
151.1	0.09943	218.4	0.04399
151.1	0.1017	218.4	0.04399
151.1	0.1017	218.4	0.04399
151.1	0.1017	218.4	0.04399
151.2	0.1017	218.4	0.04399
151.2	0.1017	218.5	0.04399
151.2	0.1017	218.5	0.04399
151.2	0.1017	218.5	0.04399
151.2	0.1017	218.5	0.04399
151.2	0.1017	218.5	0.04399
151.3	0.1017	218.6	0.04399
151.3	0.1017	218.6	0.04399
151.3	0.1017	218.6	0.04399
151.3	0.1017	218.6	0.04399
151.3	0.09943	218.6	0.04399
151.3	0.1017	218.6	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
151.3	0.1017	218.7	0.04399
151.4	0.1017	218.7	0.04399
151.4	0.1017	218.7	0.04399
151.4	0.1017	218.7	0.04399
151.4	0.1017	218.7	0.04399
151.4	0.1017	218.7	0.04399
151.4	0.1017	218.8	0.04399
151.5	0.09943	218.8	0.04399
151.5	0.09943	218.8	0.04399
151.5	0.09943	218.8	0.04399
151.5	0.09943	218.8	0.04399
151.5	0.1017	218.8	0.04399
151.6	0.1017	218.8	0.04399
151.6	0.1017	218.9	0.04399
151.6	0.1017	218.9	0.04399
151.6	0.1017	218.9	0.04399
151.6	0.1017	218.9	0.04399
151.6	0.1017	218.9	0.04399
151.7	0.1017	218.9	0.04399
151.7	0.1017	219.	0.04399
151.7	0.1017	219.	0.04399
151.7	0.1017	219.	0.04399
151.7	0.1017	219.	0.04399
151.7	0.1017	219.	0.04399
151.8	0.1017	219.1	0.04399
151.8	0.1017	219.1	0.04399
151.8	0.1041	219.1	0.04399
151.8	0.09943	219.1	0.04399
151.8	0.1017	219.1	0.04399
151.8	0.1017	219.1	0.04399
151.8	0.09943	219.2	0.04399
151.9	0.1017	219.2	0.04399
151.9	0.09943	219.2	0.04399
151.9	0.09943	219.2	0.04399
151.9	0.09943	219.2	0.04399
151.9	0.09943	219.2	0.04399
151.9	0.09943	219.3	0.04399
152.	0.1017	219.3	0.04399
152.	0.1017	219.3	0.04399
152.	0.1017	219.3	0.04399
152.	0.09943	219.3	0.04399
152.	0.09943	219.3	0.04399
152.1	0.09943	219.3	0.04399
152.1	0.1017	219.4	0.04399
152.1	0.1017	219.4	0.04399
152.1	0.09943	219.4	0.04399
152.1	0.09943	219.4	0.04399
152.1	0.09943	219.4	0.04399
152.2	0.1017	219.4	0.04399
152.2	0.09943	219.5	0.04399
152.2	0.09943	219.5	0.04399
152.2	0.09943	219.5	0.04399
152.2	0.09943	219.5	0.04399
152.2	0.09943	219.5	0.04168
152.3	0.09943	219.6	0.04168
152.3	0.09943	219.6	0.04168
152.3	0.09943	219.6	0.04168
152.3	0.09943	219.6	0.04168
152.3	0.09943	219.6	0.04399
152.3	0.09943	219.6	0.04399
152.3	0.09943	219.7	0.04168
152.4	0.09943	219.7	0.04168
152.4	0.09943	219.7	0.04399
152.4	0.09943	219.7	0.04399
152.4	0.09943	219.7	0.04399
152.4	0.09943	219.7	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
152.4	0.09943	219.8	0.04399
152.5	0.09943	219.8	0.04399
152.5	0.09943	219.8	0.04399
152.5	0.09943	219.8	0.04399
152.5	0.09943	219.8	0.04399
152.5	0.09943	219.8	0.04399
152.6	0.09943	219.8	0.04399
152.6	0.09943	219.9	0.04399
152.6	0.09943	219.9	0.04399
152.6	0.09943	219.9	0.04399
152.6	0.09943	219.9	0.04399
152.6	0.09943	219.9	0.04399
152.7	0.09943	219.9	0.04399
152.7	0.09943	220.	0.04399
152.7	0.09943	220.	0.04399
152.7	0.09943	220.	0.04399
152.7	0.09943	220.	0.04399
152.7	0.09943	220.	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.1	0.04399
152.8	0.09943	220.2	0.04399
152.9	0.09943	220.2	0.04399
152.9	0.09943	220.2	0.04399
152.9	0.09943	220.2	0.04399
152.9	0.09712	220.2	0.04399
152.9	0.09712	220.2	0.04399
152.9	0.09712	220.3	0.04399
153.	0.09943	220.3	0.04399
153.	0.09712	220.3	0.04399
153.	0.09712	220.3	0.04399
153.	0.09943	220.3	0.04399
153.	0.09712	220.3	0.04168
153.1	0.09712	220.3	0.04399
153.1	0.09712	220.4	0.04168
153.1	0.09712	220.4	0.04168
153.1	0.09712	220.4	0.04168
153.1	0.09712	220.4	0.04168
153.1	0.09712	220.4	0.04168
153.2	0.09712	220.4	0.04399
153.2	0.09712	220.5	0.04399
153.2	0.09712	220.5	0.04399
153.2	0.09712	220.5	0.04168
153.2	0.09712	220.5	0.04399
153.2	0.09712	220.5	0.04399
153.3	0.09712	220.6	0.04399
153.3	0.09712	220.6	0.04399
153.3	0.09712	220.6	0.04399
153.3	0.09712	220.6	0.04399
153.3	0.09712	220.6	0.04399
153.3	0.09712	220.6	0.04168
153.3	0.09712	220.7	0.04168
153.4	0.09712	220.7	0.04168
153.4	0.09712	220.7	0.04168
153.4	0.09712	220.7	0.04168
153.4	0.09712	220.7	0.04399
153.4	0.09712	220.7	0.04399
153.4	0.09712	220.8	0.04168
153.5	0.09712	220.8	0.04399
153.5	0.09712	220.8	0.04168
153.5	0.09712	220.8	0.04168
153.5	0.09712	220.8	0.04168
153.5	0.09712	220.8	0.04399

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
153.6	0.09712	220.8	0.04168
153.6	0.09712	220.9	0.04168
153.6	0.09712	220.9	0.04168
153.6	0.09712	220.9	0.04168
153.6	0.09712	220.9	0.04168
153.6	0.09712	220.9	0.04168
153.7	0.09712	220.9	0.04168
153.7	0.09712	221.	0.04168
153.7	0.09712	221.	0.04168
153.7	0.09712	221.	0.04168
153.7	0.09712	221.	0.04168
153.7	0.09712	221.	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.1	0.04168
153.8	0.09712	221.2	0.04168
153.9	0.09712	221.2	0.04168
153.9	0.09712	221.2	0.04168
153.9	0.09712	221.2	0.04168
153.9	0.09712	221.2	0.04168
153.9	0.09712	221.2	0.04168
153.9	0.09712	221.3	0.04168
154.	0.09712	221.3	0.04168
154.	0.09712	221.3	0.04399
154.	0.09712	221.3	0.04168
154.	0.09712	221.3	0.04168
154.	0.09712	221.3	0.04168
154.1	0.09712	221.3	0.04168
154.1	0.09712	221.4	0.04168
154.1	0.09712	221.4	0.04168
154.1	0.09712	221.4	0.04168
154.1	0.09712	221.4	0.04168
154.1	0.09712	221.4	0.04168
154.2	0.09481	221.4	0.04168
154.2	0.09712	221.5	0.04168
154.2	0.09712	221.5	0.04168
154.2	0.09481	221.5	0.04168
154.2	0.09481	221.5	0.04168
154.2	0.09481	221.5	0.04168
154.3	0.09481	221.6	0.04168
154.3	0.09481	221.6	0.04168
154.3	0.0925	221.6	0.04168
154.3	0.09481	221.6	0.04168
154.3	0.09481	221.6	0.04168
154.3	0.09712	221.6	0.04168
154.3	0.09481	221.7	0.04168
154.4	0.09712	221.7	0.04168
154.4	0.09481	221.7	0.04168
154.4	0.09481	221.7	0.04168
154.4	0.09712	221.7	0.04168
154.4	0.09481	221.7	0.04168
154.4	0.09481	221.8	0.04168
154.5	0.09481	221.8	0.04168
154.5	0.09481	221.8	0.04168
154.5	0.09712	221.8	0.04168
154.5	0.09481	221.8	0.04168
154.5	0.09481	221.8	0.04168
154.6	0.09481	221.8	0.04168
154.6	0.09481	221.9	0.04168
154.6	0.09481	221.9	0.04168
154.6	0.09481	221.9	0.04168
154.6	0.09481	221.9	0.04168
154.6	0.09481	221.9	0.04168

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
154.7	0.09481	221.9	0.04168
154.7	0.09481	222.	0.04168
154.7	0.09481	222.	0.04168
154.7	0.09481	222.	0.04168
154.7	0.09481	222.	0.04168
154.7	0.09481	222.	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.1	0.04168
154.8	0.09481	222.2	0.04168
154.9	0.09481	222.2	0.04168
154.9	0.09481	222.2	0.04168
154.9	0.09481	222.2	0.04168
154.9	0.09481	222.2	0.04168
154.9	0.09481	222.2	0.04168
154.9	0.09481	222.3	0.04168
155.	0.09481	222.3	0.04168
155.	0.09481	222.3	0.04168
155.	0.09481	222.3	0.04168
155.	0.09481	222.3	0.04168
155.	0.09481	222.3	0.04168
155.1	0.09481	222.3	0.04168
155.1	0.09481	222.4	0.04168
155.1	0.09481	222.4	0.04168
155.1	0.09481	222.4	0.04168
155.1	0.09481	222.4	0.04168
155.1	0.09481	222.4	0.04168
155.2	0.09481	222.4	0.04168
155.2	0.09481	222.5	0.04168
155.2	0.09481	222.5	0.04168
155.2	0.09481	222.5	0.04168
155.2	0.09481	222.5	0.04168
155.2	0.09481	222.5	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.6	0.04168
155.3	0.09481	222.7	0.04168
155.4	0.09481	222.7	0.04168
155.4	0.09481	222.7	0.04168
155.4	0.09481	222.7	0.04168
155.4	0.09481	222.7	0.04168
155.4	0.09481	222.7	0.04168
155.4	0.09481	222.8	0.04168
155.5	0.09481	222.8	0.04168
155.5	0.09481	222.8	0.04168
155.5	0.09481	222.8	0.04168
155.5	0.09481	222.8	0.04168
155.5	0.09481	222.8	0.04168
155.6	0.09481	222.8	0.04168
155.6	0.09481	222.9	0.04168
155.6	0.09481	222.9	0.04168
155.6	0.0925	222.9	0.04168
155.6	0.0925	222.9	0.04168
155.6	0.0925	222.9	0.04168
155.7	0.0925	222.9	0.04168
155.7	0.0925	223.	0.04168
155.7	0.0925	223.	0.04168
155.7	0.0925	223.	0.04168
155.7	0.0925	223.	0.04168
155.7	0.0925	223.	0.04168

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.1	0.04168
155.8	0.0925	223.2	0.04168
155.9	0.0925	223.2	0.04168
155.9	0.0925	223.2	0.04168
155.9	0.0925	223.2	0.04168
155.9	0.0925	223.2	0.04168
155.9	0.0925	223.2	0.04168
155.9	0.0925	223.3	0.04168
156.	0.0925	223.3	0.04168
156.	0.0925	223.3	0.04168
156.	0.0925	223.3	0.04168
156.	0.0925	223.3	0.04168
156.	0.0925	223.3	0.04168
156.1	0.0925	223.3	0.04168
156.1	0.0925	223.4	0.04168
156.1	0.0925	223.4	0.04168
156.1	0.0925	223.4	0.04168
156.1	0.0925	223.4	0.04168
156.1	0.0925	223.4	0.04168
156.2	0.0925	223.4	0.04168
156.2	0.0925	223.5	0.04168
156.2	0.0925	223.5	0.04168
156.2	0.0925	223.5	0.04168
156.2	0.0925	223.5	0.04168
156.2	0.0925	223.5	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.6	0.04168
156.3	0.0925	223.7	0.04168
156.4	0.0925	223.7	0.04168
156.4	0.0925	223.7	0.04168
156.4	0.0925	223.7	0.04168
156.4	0.0925	223.7	0.04168
156.4	0.0925	223.7	0.04168
156.4	0.0925	223.8	0.04168
156.5	0.0925	223.8	0.04168
156.5	0.0925	223.8	0.04168
156.5	0.0925	223.8	0.04168
156.5	0.0925	223.8	0.04168
156.5	0.0925	223.8	0.04168
156.6	0.0925	223.8	0.04168
156.6	0.0925	223.9	0.04168
156.6	0.0925	223.9	0.04168
156.6	0.0925	223.9	0.04168
156.6	0.0925	223.9	0.04168
156.6	0.0925	223.9	0.04168
156.7	0.0925	223.9	0.04168
156.7	0.0925	224.	0.04168
156.7	0.0925	224.	0.04168
156.7	0.0925	224.	0.04168
156.7	0.0925	224.	0.04168
156.7	0.0925	224.	0.04168
156.8	0.0925	224.1	0.04168
156.8	0.0925	224.1	0.04168
156.8	0.0925	224.1	0.04168
156.8	0.0925	224.1	0.04168
156.8	0.0925	224.1	0.04168
156.8	0.0925	224.1	0.04168

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
156.8	0.0925	224.2	0.04168
156.9	0.0925	224.2	0.04168
156.9	0.0925	224.2	0.04168
156.9	0.0925	224.2	0.04168
156.9	0.09019	224.2	0.04168
156.9	0.09019	224.2	0.04168
156.9	0.09019	224.3	0.04168
157.	0.09019	224.3	0.04168
157.	0.09019	224.3	0.04168
157.	0.09019	224.3	0.04168
157.	0.09019	224.3	0.04168
157.	0.09019	224.3	0.04168
157.1	0.09019	224.3	0.04168
157.1	0.09019	224.4	0.04168
157.1	0.09019	224.4	0.04168
157.1	0.09019	224.4	0.04168
157.1	0.09019	224.4	0.04168
157.1	0.09019	224.4	0.04168
157.2	0.09019	224.4	0.04168
157.2	0.09019	224.5	0.04168
157.2	0.09019	224.5	0.04168
157.2	0.09019	224.5	0.04168
157.2	0.09019	224.5	0.04168
157.2	0.09019	224.5	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.6	0.04168
157.3	0.09019	224.7	0.04168
157.4	0.09019	224.7	0.04168
157.4	0.09019	224.7	0.04168
157.4	0.09019	224.7	0.04168
157.4	0.09019	224.7	0.04168
157.4	0.09019	224.7	0.04168
157.4	0.09019	224.8	0.04168
157.5	0.09019	224.8	0.04168
157.5	0.09019	224.8	0.04168
157.5	0.09019	224.8	0.04168
157.5	0.09019	224.8	0.04168
157.5	0.09019	224.8	0.04168
157.6	0.09019	224.8	0.04168
157.6	0.09019	224.9	0.04168
157.6	0.09019	224.9	0.04168
157.6	0.09019	224.9	0.04168
157.6	0.09019	224.9	0.04168
157.6	0.09019	224.9	0.04168
157.7	0.09019	224.9	0.04168
157.7	0.09019	225.	0.04168
157.7	0.09019	225.	0.04168
157.7	0.09019	225.	0.04168
157.7	0.09019	225.	0.04168
157.7	0.09019	225.	0.04168
157.8	0.09019	225.1	0.04168
157.8	0.09019	225.1	0.04168
157.8	0.09019	225.1	0.04168
157.8	0.09019	225.1	0.04168
157.8	0.09019	225.1	0.04168
157.8	0.09019	225.1	0.03937
157.8	0.09019	225.2	0.04168
157.9	0.09019	225.2	0.04168
157.9	0.09019	225.2	0.03937
157.9	0.09019	225.2	0.04168
157.9	0.09019	225.2	0.04168
157.9	0.09019	225.2	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
157.9	0.09019	225.3	0.03937
158.	0.09019	225.3	0.04168
158.	0.09019	225.3	0.04168
158.	0.09019	225.3	0.03937
158.	0.08788	225.3	0.03937
158.	0.09019	225.3	0.03937
158.1	0.08788	225.3	0.04168
158.1	0.09019	225.4	0.04168
158.1	0.08788	225.4	0.04168
158.1	0.08788	225.4	0.03937
158.1	0.08788	225.4	0.03937
158.1	0.08788	225.4	0.04168
158.2	0.08788	225.4	0.03937
158.2	0.08788	225.5	0.03937
158.2	0.08788	225.5	0.03937
158.2	0.08788	225.5	0.03937
158.2	0.08788	225.5	0.03937
158.2	0.08788	225.5	0.04168
158.3	0.08788	225.6	0.04168
158.3	0.08788	225.6	0.03937
158.3	0.08788	225.6	0.03937
158.3	0.08788	225.6	0.03937
158.3	0.08788	225.6	0.04168
158.3	0.08788	225.6	0.04168
158.3	0.08788	225.7	0.04168
158.4	0.08788	225.7	0.03937
158.4	0.08788	225.7	0.04168
158.4	0.08788	225.7	0.03937
158.4	0.08788	225.7	0.03937
158.4	0.08788	225.7	0.03937
158.4	0.08788	225.8	0.04168
158.5	0.08788	225.8	0.03937
158.5	0.08788	225.8	0.04168
158.5	0.08788	225.8	0.03937
158.5	0.08788	225.8	0.03937
158.5	0.08788	225.8	0.04168
158.6	0.08788	225.8	0.03937
158.6	0.08788	225.9	0.03937
158.6	0.08788	225.9	0.04168
158.6	0.08788	225.9	0.03937
158.6	0.08788	225.9	0.03937
158.6	0.08788	225.9	0.03937
158.7	0.08788	225.9	0.03937
158.7	0.08788	226.	0.04168
158.7	0.08788	226.	0.03937
158.7	0.08788	226.	0.03937
158.7	0.08788	226.	0.03937
158.7	0.08788	226.	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.1	0.03937
158.8	0.08788	226.2	0.04168
158.9	0.08788	226.2	0.03937
158.9	0.08788	226.2	0.03937
158.9	0.08788	226.2	0.03937
158.9	0.08788	226.2	0.03937
158.9	0.08788	226.2	0.03937
158.9	0.08788	226.3	0.03937
159.	0.08788	226.3	0.03937
159.	0.08788	226.3	0.03937
159.	0.08788	226.3	0.04168
159.	0.08788	226.3	0.04168
159.	0.08788	226.3	0.04168

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
159.1	0.08788	226.3	0.04168
159.1	0.08788	226.4	0.04168
159.1	0.08788	226.4	0.04168
159.1	0.08788	226.4	0.04168
159.1	0.08788	226.4	0.04168
159.1	0.08788	226.4	0.03937
159.2	0.08788	226.4	0.04168
159.2	0.08788	226.5	0.03937
159.2	0.08788	226.5	0.03937
159.2	0.08788	226.5	0.03937
159.2	0.08788	226.5	0.03937
159.2	0.08788	226.5	0.03937
159.3	0.08788	226.6	0.03937
159.3	0.08788	226.6	0.03937
159.3	0.08557	226.6	0.03937
159.3	0.08557	226.6	0.03937
159.3	0.08557	226.6	0.03937
159.3	0.08557	226.6	0.03937
159.3	0.08557	226.7	0.03937
159.4	0.08557	226.7	0.03937
159.4	0.08557	226.7	0.03937
159.4	0.08557	226.7	0.03937
159.4	0.08557	226.7	0.03937
159.4	0.08557	226.7	0.03937
159.4	0.08557	226.8	0.03937
159.5	0.08557	226.8	0.03937
159.5	0.08557	226.8	0.03937
159.5	0.08557	226.8	0.03937
159.5	0.08557	226.8	0.03937
159.5	0.08557	226.8	0.03937
159.6	0.08557	226.8	0.03937
159.6	0.08557	226.9	0.03937
159.6	0.08557	226.9	0.03937
159.6	0.08557	226.9	0.03937
159.6	0.08557	226.9	0.03937
159.6	0.08557	226.9	0.03937
159.7	0.08557	226.9	0.03937
159.7	0.08557	227.	0.03937
159.7	0.08557	227.	0.03937
159.7	0.08557	227.	0.03937
159.7	0.08557	227.	0.03937
159.7	0.08557	227.	0.03937
159.8	0.08557	227.1	0.03937
159.8	0.08557	227.1	0.03937
159.8	0.08557	227.1	0.03937
159.8	0.08557	227.1	0.03937
159.8	0.08557	227.1	0.03937
159.8	0.08557	227.1	0.04168
159.8	0.08557	227.2	0.03937
159.9	0.08557	227.2	0.03937
159.9	0.08557	227.2	0.03937
159.9	0.08557	227.2	0.03937
159.9	0.08557	227.2	0.03937
159.9	0.08557	227.2	0.04168
159.9	0.08557	227.3	0.04168
160.	0.08557	227.3	0.03937
160.	0.08557	227.3	0.03937
160.	0.08557	227.3	0.03937
160.	0.08557	227.3	0.03937
160.	0.08557	227.3	0.04168
160.1	0.08557	227.3	0.04168
160.1	0.08557	227.4	0.04168
160.1	0.08557	227.4	0.04168
160.1	0.08557	227.4	0.04168
160.1	0.08557	227.4	0.03937
160.1	0.08557	227.4	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
160.2	0.08557	227.4	0.03937
160.2	0.08557	227.5	0.03937
160.2	0.08557	227.5	0.04168
160.2	0.08557	227.5	0.03937
160.2	0.08557	227.5	0.03937
160.2	0.08557	227.5	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.6	0.03937
160.3	0.08557	227.7	0.04168
160.4	0.08557	227.7	0.03937
160.4	0.08557	227.7	0.04168
160.4	0.08557	227.7	0.03937
160.4	0.08557	227.7	0.03937
160.4	0.08557	227.7	0.03937
160.4	0.08557	227.8	0.04168
160.5	0.08557	227.8	0.03937
160.5	0.08557	227.8	0.03937
160.5	0.08557	227.8	0.03937
160.5	0.08557	227.8	0.03937
160.5	0.08557	227.8	0.03937
160.6	0.08557	227.8	0.03937
160.6	0.08326	227.9	0.03937
160.6	0.08557	227.9	0.03937
160.6	0.08557	227.9	0.03937
160.6	0.08557	227.9	0.03937
160.6	0.08326	227.9	0.03937
160.7	0.08326	227.9	0.03937
160.7	0.08326	228.	0.03937
160.7	0.08326	228.	0.03937
160.7	0.08326	228.	0.03937
160.7	0.08326	228.	0.03937
160.7	0.08326	228.	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.1	0.03937
160.8	0.08326	228.2	0.04168
160.9	0.08326	228.2	0.03937
160.9	0.08326	228.2	0.03937
160.9	0.08326	228.2	0.03937
160.9	0.08326	228.2	0.03937
160.9	0.08326	228.2	0.03937
160.9	0.08326	228.3	0.03937
161.	0.08326	228.3	0.03937
161.	0.08326	228.3	0.03937
161.	0.08326	228.3	0.03937
161.	0.08326	228.3	0.03937
161.	0.08326	228.3	0.03937
161.1	0.08326	228.3	0.03937
161.1	0.08326	228.4	0.03937
161.1	0.08326	228.4	0.03937
161.1	0.08326	228.4	0.03937
161.1	0.08326	228.4	0.03937
161.1	0.08326	228.4	0.03937
161.2	0.08326	228.4	0.03937
161.2	0.08326	228.5	0.03937
161.2	0.08326	228.5	0.03937
161.2	0.08326	228.5	0.03937
161.2	0.08326	228.5	0.03937
161.2	0.08326	228.5	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.6	0.03937
161.3	0.08326	228.7	0.03937
161.4	0.08326	228.7	0.03937
161.4	0.08326	228.7	0.03937
161.4	0.08326	228.7	0.03937
161.4	0.08326	228.7	0.03937
161.4	0.08326	228.7	0.03937
161.4	0.08326	228.8	0.03937
161.5	0.08326	228.8	0.03937
161.5	0.08326	228.8	0.03937
161.5	0.08326	228.8	0.03937
161.5	0.08326	228.8	0.03937
161.5	0.08326	228.8	0.03937
161.6	0.08326	228.8	0.03937
161.6	0.08326	228.9	0.03937
161.6	0.08326	228.9	0.03937
161.6	0.08326	228.9	0.03937
161.6	0.08326	228.9	0.03937
161.6	0.08326	228.9	0.03937
161.7	0.08326	228.9	0.03937
161.7	0.08326	229.	0.03937
161.7	0.08326	229.	0.03937
161.7	0.08326	229.	0.03937
161.7	0.08326	229.	0.03937
161.7	0.08326	229.	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.1	0.03937
161.8	0.08326	229.2	0.03937
161.9	0.08326	229.2	0.03937
161.9	0.08326	229.2	0.03937
161.9	0.08326	229.2	0.03937
161.9	0.08326	229.2	0.03937
161.9	0.08326	229.2	0.03937
161.9	0.08326	229.3	0.03937
162.	0.08326	229.3	0.03937
162.	0.08326	229.3	0.03937
162.	0.08326	229.3	0.03937
162.	0.08326	229.3	0.03937
162.	0.08326	229.3	0.03937
162.1	0.08326	229.3	0.03937
162.1	0.08326	229.4	0.03937
162.1	0.08095	229.4	0.03937
162.1	0.08095	229.4	0.03937
162.1	0.08095	229.4	0.03937
162.1	0.08326	229.4	0.03937
162.2	0.08326	229.4	0.03937
162.2	0.08326	229.5	0.03937
162.2	0.08326	229.5	0.03937
162.2	0.08326	229.5	0.03937
162.2	0.08326	229.5	0.03937
162.2	0.08326	229.5	0.03937
162.3	0.08326	229.6	0.03937
162.3	0.08326	229.6	0.03937
162.3	0.08326	229.6	0.03937
162.3	0.08326	229.6	0.03937
162.3	0.08326	229.6	0.03937
162.3	0.08326	229.6	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
162.3	0.08326	229.7	0.03937
162.4	0.08326	229.7	0.03937
162.4	0.08326	229.7	0.03937
162.4	0.08326	229.7	0.03937
162.4	0.08326	229.7	0.03937
162.4	0.08326	229.7	0.03937
162.4	0.08326	229.8	0.03937
162.5	0.08326	229.8	0.03937
162.5	0.08326	229.8	0.03937
162.5	0.08326	229.8	0.03937
162.5	0.08095	229.8	0.03937
162.5	0.08095	229.8	0.03937
162.6	0.08095	229.8	0.03937
162.6	0.08326	229.9	0.03937
162.6	0.08095	229.9	0.03937
162.6	0.08095	229.9	0.03937
162.6	0.08095	229.9	0.03937
162.6	0.08095	229.9	0.03937
162.7	0.08095	229.9	0.03937
162.7	0.08095	230.	0.03937
162.7	0.08095	230.	0.03937
162.7	0.08095	230.	0.03937
162.7	0.08095	230.	0.03937
162.7	0.08095	230.	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.1	0.03937
162.8	0.08095	230.2	0.03937
162.9	0.08095	230.2	0.03937
162.9	0.08095	230.2	0.03937
162.9	0.08095	230.2	0.03937
162.9	0.08095	230.2	0.03937
162.9	0.08095	230.2	0.03937
162.9	0.08095	230.3	0.03937
163.	0.08095	230.3	0.03937
163.	0.08095	230.3	0.03937
163.	0.08095	230.3	0.03937
163.	0.08095	230.3	0.03937
163.	0.08095	230.3	0.03937
163.1	0.08095	230.3	0.03937
163.1	0.08095	230.4	0.03937
163.1	0.08095	230.4	0.03937
163.1	0.08095	230.4	0.03937
163.1	0.08095	230.4	0.03937
163.1	0.08095	230.4	0.03937
163.2	0.08095	230.4	0.03937
163.2	0.08095	230.5	0.03937
163.2	0.08095	230.5	0.03937
163.2	0.08095	230.5	0.03937
163.2	0.08095	230.5	0.03937
163.2	0.08095	230.5	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.6	0.03937
163.3	0.08095	230.7	0.03937
163.4	0.08095	230.7	0.03937
163.4	0.08095	230.7	0.03937
163.4	0.08095	230.7	0.03937
163.4	0.08095	230.7	0.03937
163.4	0.08095	230.7	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
163.4	0.08095	230.8	0.03937
163.5	0.08095	230.8	0.03937
163.5	0.08095	230.8	0.03937
163.5	0.08095	230.8	0.03937
163.5	0.08095	230.8	0.03937
163.5	0.08095	230.8	0.03937
163.6	0.08095	230.8	0.03937
163.6	0.08095	230.9	0.03937
163.6	0.08095	230.9	0.03937
163.6	0.08095	230.9	0.03937
163.6	0.08095	230.9	0.03937
163.6	0.08095	230.9	0.03937
163.7	0.08095	230.9	0.03937
163.7	0.08095	231.	0.03937
163.7	0.08095	231.	0.03937
163.7	0.08095	231.	0.03937
163.7	0.08095	231.	0.03937
163.7	0.08095	231.	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.1	0.03937
163.8	0.08095	231.2	0.03937
163.9	0.08095	231.2	0.03937
163.9	0.08095	231.2	0.03937
163.9	0.08095	231.2	0.03937
163.9	0.08095	231.2	0.03937
163.9	0.08095	231.2	0.03937
163.9	0.07864	231.3	0.03937
164.	0.07864	231.3	0.03937
164.	0.07864	231.3	0.03937
164.	0.07864	231.3	0.03937
164.	0.07864	231.3	0.03937
164.	0.07864	231.3	0.03937
164.1	0.07864	231.3	0.03937
164.1	0.07864	231.4	0.03937
164.1	0.08095	231.4	0.03937
164.1	0.08095	231.4	0.03937
164.1	0.08095	231.4	0.03937
164.1	0.08095	231.4	0.03937
164.2	0.08095	231.4	0.03937
164.2	0.08095	231.5	0.03937
164.2	0.08095	231.5	0.03937
164.2	0.08095	231.5	0.03937
164.2	0.08095	231.5	0.03937
164.2	0.08095	231.5	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.6	0.03937
164.3	0.08095	231.7	0.03937
164.4	0.08095	231.7	0.03937
164.4	0.08095	231.7	0.03937
164.4	0.08095	231.7	0.03937
164.4	0.08095	231.7	0.03937
164.4	0.08095	231.7	0.03937
164.4	0.08095	231.8	0.03937
164.5	0.07864	231.8	0.03937
164.5	0.07864	231.8	0.03937
164.5	0.07864	231.8	0.03937
164.5	0.07864	231.8	0.03937
164.5	0.07864	231.8	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
164.6	0.07864	231.8	0.03937
164.6	0.07864	231.9	0.03937
164.6	0.07864	231.9	0.03937
164.6	0.07864	231.9	0.03937
164.6	0.07864	231.9	0.03937
164.6	0.07864	231.9	0.03937
164.7	0.07864	231.9	0.03937
164.7	0.07864	232.	0.03937
164.7	0.07864	232.	0.03937
164.7	0.07864	232.	0.03937
164.7	0.07864	232.	0.03937
164.7	0.07864	232.	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.1	0.03937
164.8	0.07864	232.2	0.03937
164.9	0.07864	232.2	0.03937
164.9	0.07864	232.2	0.03937
164.9	0.07864	232.2	0.03937
164.9	0.07864	232.2	0.03937
164.9	0.07864	232.2	0.03937
164.9	0.07864	232.3	0.03937
165.	0.07864	232.3	0.03937
165.	0.07864	232.3	0.03937
165.	0.07864	232.3	0.03937
165.	0.07864	232.3	0.03937
165.	0.07864	232.3	0.03937
165.1	0.07864	232.3	0.03937
165.1	0.07864	232.4	0.03937
165.1	0.07864	232.4	0.03937
165.1	0.07864	232.4	0.03937
165.1	0.07864	232.4	0.03937
165.1	0.07864	232.4	0.03937
165.2	0.07864	232.4	0.03937
165.2	0.07864	232.5	0.03937
165.2	0.07864	232.5	0.03937
165.2	0.07864	232.5	0.03937
165.2	0.07864	232.5	0.03937
165.2	0.07864	232.5	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.6	0.03937
165.3	0.07864	232.7	0.03937
165.4	0.07864	232.7	0.03937
165.4	0.07864	232.7	0.03937
165.4	0.07864	232.7	0.03937
165.4	0.07864	232.7	0.03937
165.4	0.07864	232.7	0.03937
165.4	0.07864	232.8	0.03937
165.5	0.07864	232.8	0.03937
165.5	0.07864	232.8	0.03937
165.5	0.07864	232.8	0.03937
165.5	0.07864	232.8	0.03937
165.5	0.07864	232.8	0.03937
165.6	0.07864	232.8	0.03937
165.6	0.07864	232.9	0.03937
165.6	0.07864	232.9	0.03937
165.6	0.07864	232.9	0.03937
165.6	0.07864	232.9	0.03937
165.6	0.07864	232.9	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
165.7	0.07864	232.9	0.03937
165.7	0.07864	233.	0.03937
165.7	0.07864	233.	0.03937
165.7	0.07864	233.	0.03937
165.7	0.07864	233.	0.03937
165.7	0.07864	233.	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.1	0.03937
165.8	0.07864	233.2	0.03937
165.9	0.07864	233.2	0.03937
165.9	0.07864	233.2	0.03937
165.9	0.07864	233.2	0.03937
165.9	0.07864	233.2	0.03937
165.9	0.07864	233.2	0.03937
165.9	0.07864	233.3	0.03937
166.	0.07864	233.3	0.03937
166.	0.07864	233.3	0.03937
166.	0.07864	233.3	0.03937
166.	0.07864	233.3	0.03937
166.	0.07864	233.3	0.03937
166.1	0.07864	233.3	0.03937
166.1	0.07864	233.4	0.03937
166.1	0.07864	233.4	0.03937
166.1	0.07864	233.4	0.03937
166.1	0.07864	233.4	0.03937
166.1	0.07864	233.4	0.03937
166.2	0.07864	233.4	0.03937
166.2	0.07864	233.5	0.03937
166.2	0.07864	233.5	0.03937
166.2	0.07864	233.5	0.03937
166.2	0.07864	233.5	0.03706
166.2	0.07864	233.5	0.03706
166.3	0.07864	233.6	0.03937
166.3	0.07864	233.6	0.03937
166.3	0.07864	233.6	0.03706
166.3	0.07864	233.6	0.03937
166.3	0.07864	233.6	0.03937
166.3	0.07864	233.6	0.03937
166.3	0.07864	233.7	0.03937
166.4	0.07864	233.7	0.03937
166.4	0.07864	233.7	0.03937
166.4	0.07864	233.7	0.03937
166.4	0.07864	233.7	0.03937
166.4	0.07864	233.7	0.03937
166.4	0.07864	233.8	0.03937
166.5	0.07864	233.8	0.03937
166.5	0.07864	233.8	0.03937
166.5	0.07864	233.8	0.03937
166.5	0.07864	233.8	0.03937
166.5	0.07864	233.8	0.03937
166.6	0.07864	233.8	0.03937
166.6	0.07633	233.9	0.03937
166.6	0.07633	233.9	0.03937
166.6	0.07633	233.9	0.03937
166.6	0.07633	233.9	0.03937
166.6	0.07633	233.9	0.03937
166.7	0.07633	233.9	0.03937
166.7	0.07633	234.	0.03937
166.7	0.07633	234.	0.03937
166.7	0.07633	234.	0.03937
166.7	0.07633	234.	0.03937
166.7	0.07633	234.	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.1	0.03937
166.8	0.07633	234.2	0.03937
166.9	0.07633	234.2	0.03937
166.9	0.07633	234.2	0.03937
166.9	0.07633	234.2	0.03937
166.9	0.07633	234.2	0.03937
166.9	0.07633	234.2	0.03937
166.9	0.07633	234.3	0.03937
167.	0.07633	234.3	0.03937
167.	0.07633	234.3	0.03937
167.	0.07633	234.3	0.03937
167.	0.07633	234.3	0.03937
167.	0.07633	234.3	0.03937
167.1	0.07633	234.3	0.03937
167.1	0.07633	234.4	0.03937
167.1	0.07633	234.4	0.03937
167.1	0.07633	234.4	0.03937
167.1	0.07633	234.4	0.03937
167.1	0.07633	234.4	0.03937
167.2	0.07633	234.4	0.03937
167.2	0.07633	234.5	0.03937
167.2	0.07633	234.5	0.03937
167.2	0.07633	234.5	0.03937
167.2	0.07633	234.5	0.03937
167.2	0.07633	234.5	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.6	0.03937
167.3	0.07633	234.7	0.03937
167.4	0.07633	234.7	0.03937
167.4	0.07633	234.7	0.03937
167.4	0.07633	234.7	0.03937
167.4	0.07633	234.7	0.03937
167.4	0.07633	234.7	0.03937
167.4	0.07633	234.8	0.03937
167.5	0.07633	234.8	0.03937
167.5	0.07633	234.8	0.03937
167.5	0.07633	234.8	0.03937
167.5	0.07633	234.8	0.03937
167.5	0.07633	234.8	0.03937
167.6	0.07633	234.8	0.03937
167.6	0.07633	234.9	0.03937
167.6	0.07633	234.9	0.03937
167.6	0.07633	234.9	0.03937
167.6	0.07633	234.9	0.03937
167.6	0.07633	234.9	0.03937
167.7	0.07633	234.9	0.03937
167.7	0.07633	235.	0.03937
167.7	0.07633	235.	0.03937
167.7	0.07633	235.	0.03937
167.7	0.07633	235.	0.03937
167.7	0.07633	235.	0.03937
167.8	0.07633	235.1	0.03937
167.8	0.07633	235.1	0.03937
167.8	0.07633	235.1	0.03937
167.8	0.07633	235.1	0.03937
167.8	0.07633	235.1	0.03937
167.8	0.07633	235.1	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
167.8	0.07633	235.2	0.03937
167.9	0.07633	235.2	0.03937
167.9	0.07633	235.2	0.03937
167.9	0.07633	235.2	0.03937
167.9	0.07633	235.2	0.03937
167.9	0.07633	235.2	0.03937
167.9	0.07633	235.3	0.03937
168.	0.07633	235.3	0.03937
168.	0.07633	235.3	0.03937
168.	0.07633	235.3	0.03937
168.	0.07633	235.3	0.03937
168.	0.07633	235.3	0.03937
168.1	0.07633	235.3	0.03937
168.1	0.07633	235.4	0.03937
168.1	0.07633	235.4	0.03937
168.1	0.07633	235.4	0.03937
168.1	0.07633	235.4	0.03937
168.1	0.07633	235.4	0.03937
168.2	0.07633	235.4	0.03937
168.2	0.07633	235.5	0.03937
168.2	0.07633	235.5	0.03937
168.2	0.07633	235.5	0.03937
168.2	0.07633	235.5	0.03937
168.2	0.07633	235.5	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.6	0.03937
168.3	0.07633	235.7	0.03937
168.4	0.07633	235.7	0.03937
168.4	0.07633	235.7	0.03937
168.4	0.07633	235.7	0.03937
168.4	0.07633	235.7	0.03937
168.4	0.07633	235.7	0.03937
168.4	0.07633	235.8	0.03937
168.5	0.07633	235.8	0.03937
168.5	0.07633	235.8	0.03937
168.5	0.07633	235.8	0.03937
168.5	0.07633	235.8	0.03937
168.5	0.07633	235.8	0.03937
168.6	0.07633	235.8	0.03937
168.6	0.07402	235.9	0.03937
168.6	0.07402	235.9	0.03937
168.6	0.07633	235.9	0.03937
168.6	0.07633	235.9	0.03937
168.6	0.07402	235.9	0.03937
168.7	0.07402	235.9	0.03937
168.7	0.07402	236.	0.03937
168.7	0.07633	236.	0.03937
168.7	0.07633	236.	0.03937
168.7	0.07633	236.	0.03937
168.7	0.07402	236.	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07402	236.1	0.03937
168.8	0.07633	236.2	0.03937
168.9	0.07402	236.2	0.03937
168.9	0.07402	236.2	0.03937
168.9	0.07402	236.2	0.03937
168.9	0.07402	236.2	0.03937
168.9	0.07402	236.2	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
168.9	0.07402	236.3	0.03937
169.	0.07402	236.3	0.03937
169.	0.07402	236.3	0.03937
169.	0.07402	236.3	0.03937
169.	0.07402	236.3	0.03937
169.	0.07402	236.3	0.03937
169.1	0.07402	236.3	0.03937
169.1	0.07402	236.4	0.03937
169.1	0.07402	236.4	0.03937
169.1	0.07402	236.4	0.03937
169.1	0.07402	236.4	0.03937
169.1	0.07402	236.4	0.03937
169.2	0.07402	236.4	0.03937
169.2	0.07402	236.5	0.03937
169.2	0.07402	236.5	0.03937
169.2	0.07402	236.5	0.03937
169.2	0.07402	236.5	0.03937
169.2	0.07402	236.5	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.6	0.03937
169.3	0.07402	236.7	0.03937
169.4	0.07402	236.7	0.03937
169.4	0.07402	236.7	0.03937
169.4	0.07402	236.7	0.03937
169.4	0.07402	236.7	0.03937
169.4	0.07402	236.7	0.03937
169.4	0.07402	236.8	0.03937
169.5	0.07402	236.8	0.03937
169.5	0.07402	236.8	0.03937
169.5	0.07402	236.8	0.03937
169.5	0.07402	236.8	0.03937
169.5	0.07402	236.8	0.03937
169.6	0.07402	236.8	0.03937
169.6	0.07402	236.9	0.03937
169.6	0.07402	236.9	0.03937
169.6	0.07402	236.9	0.03937
169.6	0.07402	236.9	0.03937
169.6	0.07402	236.9	0.03937
169.7	0.07402	236.9	0.03937
169.7	0.07402	237.	0.03937
169.7	0.07402	237.	0.03706
169.7	0.07402	237.	0.03937
169.7	0.07402	237.	0.03937
169.7	0.07171	237.	0.03937
169.8	0.07171	237.1	0.03937
169.8	0.07402	237.1	0.03706
169.8	0.07633	237.1	0.03706
169.8	0.07633	237.1	0.03706
169.8	0.07633	237.1	0.03706
169.8	0.07402	237.1	0.03937
169.8	0.07633	237.2	0.03937
169.9	0.07402	237.2	0.03706
169.9	0.07402	237.2	0.03706
169.9	0.07402	237.2	0.03706
169.9	0.07402	237.2	0.03706
169.9	0.07402	237.2	0.03706
169.9	0.07402	237.3	0.03706
170.	0.07402	237.3	0.03706
170.	0.07402	237.3	0.03937
170.	0.07402	237.3	0.03937
170.	0.07402	237.3	0.03706
170.	0.07402	237.3	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
170.1	0.07402	237.3	0.03937
170.1	0.07402	237.4	0.03937
170.1	0.07402	237.4	0.03937
170.1	0.07402	237.4	0.03937
170.1	0.07402	237.4	0.03937
170.1	0.07402	237.4	0.03937
170.2	0.07402	237.4	0.03706
170.2	0.07402	237.5	0.03706
170.2	0.07402	237.5	0.03706
170.2	0.07402	237.5	0.03706
170.2	0.07402	237.5	0.03706
170.2	0.07402	237.5	0.03706
170.3	0.07402	237.6	0.03706
170.3	0.07402	237.6	0.03937
170.3	0.07402	237.6	0.03937
170.3	0.07402	237.6	0.03706
170.3	0.07402	237.6	0.03706
170.3	0.07402	237.6	0.03706
170.3	0.07402	237.7	0.03706
170.4	0.07402	237.7	0.03706
170.4	0.07402	237.7	0.03706
170.4	0.07402	237.7	0.03706
170.4	0.07402	237.7	0.03706
170.4	0.07402	237.7	0.03706
170.4	0.07402	237.8	0.03706
170.5	0.07402	237.8	0.03706
170.5	0.07402	237.8	0.03706
170.5	0.07402	237.8	0.03706
170.5	0.07402	237.8	0.03706
170.5	0.07402	237.8	0.03706
170.6	0.07402	237.8	0.03706
170.6	0.07171	237.9	0.03706
170.6	0.07171	237.9	0.03706
170.6	0.07402	237.9	0.03706
170.6	0.07402	237.9	0.03706
170.6	0.07402	237.9	0.03706
170.7	0.07402	237.9	0.03706
170.7	0.07402	238.	0.03706
170.7	0.07171	238.	0.03706
170.7	0.07402	238.	0.03706
170.7	0.07171	238.	0.03706
170.7	0.07171	238.	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.1	0.03706
170.8	0.07171	238.2	0.03706
170.9	0.07171	238.2	0.03706
170.9	0.07171	238.2	0.03706
170.9	0.07402	238.2	0.03706
170.9	0.07402	238.2	0.03706
170.9	0.07171	238.2	0.03706
170.9	0.07171	238.3	0.03706
171.	0.07171	238.3	0.03706
171.	0.07171	238.3	0.03706
171.	0.07171	238.3	0.03706
171.	0.07171	238.3	0.03706
171.	0.07171	238.3	0.03706
171.1	0.07171	238.3	0.03706
171.1	0.07171	238.4	0.03706
171.1	0.07171	238.4	0.03706
171.1	0.07171	238.4	0.03706
171.1	0.07171	238.4	0.03937
171.1	0.07171	238.4	0.04168

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
171.2	0.07171	238.4	0.0463
171.2	0.07171	238.5	0.04168
171.2	0.07171	238.5	0.03706
171.2	0.07171	238.5	0.03706
171.2	0.07171	238.5	0.03706
171.2	0.07171	238.5	0.03706
171.3	0.07171	238.6	0.03706
171.3	0.07171	238.6	0.03706
171.3	0.07171	238.6	0.03937
171.3	0.07171	238.6	0.03937
171.3	0.07171	238.6	0.03937
171.3	0.07171	238.6	0.03937
171.3	0.07171	238.7	0.03937
171.4	0.07171	238.7	0.03937
171.4	0.07171	238.7	0.03937
171.4	0.07171	238.7	0.03937
171.4	0.07171	238.7	0.03937
171.4	0.07171	238.7	0.03937
171.4	0.07171	238.8	0.03937
171.5	0.07171	238.8	0.03937
171.5	0.07171	238.8	0.03937
171.5	0.07171	238.8	0.03937
171.5	0.07171	238.8	0.03937
171.5	0.07171	238.8	0.03937
171.6	0.07171	238.8	0.03937
171.6	0.07171	238.9	0.03937
171.6	0.07171	238.9	0.03937
171.6	0.07171	238.9	0.03937
171.6	0.07171	238.9	0.03937
171.6	0.07171	238.9	0.03937
171.7	0.07171	238.9	0.03937
171.7	0.07171	239.	0.03706
171.7	0.07171	239.	0.03706
171.7	0.07171	239.	0.03706
171.7	0.07171	239.	0.03706
171.7	0.07171	239.	0.03706
171.8	0.07171	239.1	0.03706
171.8	0.07171	239.1	0.03937
171.8	0.07171	239.1	0.03937
171.8	0.07171	239.1	0.03937
171.8	0.07171	239.1	0.03937
171.8	0.07171	239.1	0.03706
171.8	0.07171	239.2	0.03937
171.9	0.07171	239.2	0.03706
171.9	0.07171	239.2	0.03706
171.9	0.07171	239.2	0.03706
171.9	0.07171	239.2	0.03706
171.9	0.07171	239.2	0.03706
171.9	0.07171	239.3	0.03706
172.	0.07171	239.3	0.03706
172.	0.07171	239.3	0.03706
172.	0.07171	239.3	0.03706
172.	0.07171	239.3	0.03706
172.	0.07171	239.3	0.03706
172.1	0.07171	239.3	0.03706
172.1	0.07171	239.4	0.03706
172.1	0.07171	239.4	0.03706
172.1	0.07171	239.4	0.03706
172.1	0.07171	239.4	0.03706
172.1	0.07171	239.4	0.03706
172.2	0.07171	239.4	0.03706
172.2	0.07171	239.5	0.03706
172.2	0.07171	239.5	0.03706
172.2	0.07171	239.5	0.03706
172.2	0.07171	239.5	0.03706
172.2	0.07171	239.5	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.6	0.03706
172.3	0.07171	239.7	0.03706
172.4	0.07171	239.7	0.03706
172.4	0.07171	239.7	0.03706
172.4	0.07171	239.7	0.03706
172.4	0.07171	239.7	0.03706
172.4	0.07171	239.7	0.03706
172.4	0.07171	239.8	0.03706
172.5	0.07171	239.8	0.03706
172.5	0.07171	239.8	0.03706
172.5	0.07171	239.8	0.03706
172.5	0.07171	239.8	0.03706
172.5	0.07171	239.8	0.03706
172.6	0.07171	239.8	0.03706
172.6	0.07171	239.9	0.03706
172.6	0.07171	239.9	0.03706
172.6	0.07171	239.9	0.03706
172.6	0.07171	239.9	0.03706
172.6	0.07171	239.9	0.03706
172.7	0.07171	239.9	0.03706
172.7	0.07171	240.	0.03706
172.7	0.07171	240.	0.03706
172.7	0.07171	240.	0.03706
172.7	0.0694	240.	0.03706
172.7	0.0694	240.	0.03706
172.8	0.0694	240.1	0.03706
172.8	0.0694	240.1	0.03706
172.8	0.0694	240.1	0.03706
172.8	0.0694	240.1	0.03706
172.8	0.07171	240.1	0.03706
172.8	0.0694	240.1	0.03706
172.8	0.0694	240.2	0.03706
172.9	0.0694	240.2	0.03706
172.9	0.0694	240.2	0.03706
172.9	0.0694	240.2	0.03706
172.9	0.0694	240.2	0.03706
172.9	0.0694	240.2	0.03706
172.9	0.0694	240.3	0.03706
173.	0.0694	240.3	0.03706
173.	0.0694	240.3	0.03706
173.	0.0694	240.3	0.03706
173.	0.0694	240.3	0.03706
173.	0.0694	240.3	0.03706
173.1	0.0694	240.3	0.03706
173.1	0.0694	240.4	0.03706
173.1	0.0694	240.4	0.03706
173.1	0.0694	240.4	0.03706
173.1	0.0694	240.4	0.03706
173.1	0.0694	240.4	0.03706
173.2	0.0694	240.4	0.03706
173.2	0.0694	240.5	0.03706
173.2	0.0694	240.5	0.03706
173.2	0.0694	240.5	0.03706
173.2	0.0694	240.5	0.03706
173.2	0.0694	240.5	0.03706
173.3	0.0694	240.6	0.03706
173.3	0.0694	240.6	0.03706
173.3	0.0694	240.6	0.03706
173.3	0.0694	240.6	0.03706
173.3	0.0694	240.6	0.03706
173.3	0.0694	240.6	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
173.3	0.0694	240.7	0.03706
173.4	0.0694	240.7	0.03706
173.4	0.0694	240.7	0.03706
173.4	0.0694	240.7	0.03706
173.4	0.0694	240.7	0.03706
173.4	0.0694	240.7	0.03706
173.4	0.0694	240.8	0.03706
173.5	0.0694	240.8	0.03937
173.5	0.0694	240.8	0.03706
173.5	0.0694	240.8	0.03706
173.5	0.0694	240.8	0.03706
173.5	0.0694	240.8	0.03937
173.6	0.0694	240.8	0.03706
173.6	0.0694	240.9	0.03706
173.6	0.0694	240.9	0.03706
173.6	0.0694	240.9	0.03706
173.6	0.0694	240.9	0.03706
173.6	0.0694	240.9	0.03706
173.7	0.0694	240.9	0.03706
173.7	0.0694	241.	0.03706
173.7	0.0694	241.	0.03706
173.7	0.0694	241.	0.03706
173.7	0.0694	241.	0.03706
173.7	0.0694	241.	0.03706
173.8	0.0694	241.1	0.03706
173.8	0.0694	241.1	0.03706
173.8	0.0694	241.1	0.03706
173.8	0.0694	241.1	0.03706
173.8	0.0694	241.1	0.03706
173.8	0.0694	241.1	0.03937
173.8	0.0694	241.2	0.03937
173.9	0.0694	241.2	0.03706
173.9	0.0694	241.2	0.03706
173.9	0.0694	241.2	0.03706
173.9	0.0694	241.2	0.03937
173.9	0.0694	241.2	0.03937
173.9	0.0694	241.3	0.03937
174.	0.0694	241.3	0.03706
174.	0.0694	241.3	0.03706
174.	0.0694	241.3	0.03937
174.	0.0694	241.3	0.03706
174.	0.0694	241.3	0.03706
174.1	0.0694	241.3	0.03706
174.1	0.0694	241.4	0.03937
174.1	0.0694	241.4	0.03937
174.1	0.0694	241.4	0.03937
174.1	0.0694	241.4	0.03937
174.1	0.0694	241.4	0.03937
174.2	0.0694	241.4	0.03937
174.2	0.0694	241.5	0.03937
174.2	0.0694	241.5	0.03937
174.2	0.0694	241.5	0.03937
174.2	0.0694	241.5	0.03937
174.2	0.0694	241.5	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.6	0.03937
174.3	0.0694	241.7	0.03937
174.4	0.0694	241.7	0.03937
174.4	0.0694	241.7	0.03937
174.4	0.0694	241.7	0.03937
174.4	0.0694	241.7	0.03937
174.4	0.0694	241.7	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
174.4	0.0694	241.8	0.03937
174.5	0.0694	241.8	0.03937
174.5	0.0694	241.8	0.03937
174.5	0.0694	241.8	0.03937
174.5	0.0694	241.8	0.03937
174.5	0.0694	241.8	0.03937
174.6	0.0694	241.8	0.03937
174.6	0.0694	241.9	0.03937
174.6	0.0694	241.9	0.03937
174.6	0.0694	241.9	0.03937
174.6	0.0694	241.9	0.03937
174.6	0.0694	241.9	0.03937
174.7	0.0694	241.9	0.03937
174.7	0.0694	242.	0.03937
174.7	0.0694	242.	0.03706
174.7	0.0694	242.	0.03706
174.7	0.0694	242.	0.03706
174.7	0.0694	242.	0.03937
174.8	0.0694	242.1	0.03706
174.8	0.0694	242.1	0.03937
174.8	0.0694	242.1	0.03937
174.8	0.0694	242.1	0.03937
174.8	0.0694	242.1	0.03706
174.8	0.0694	242.1	0.03937
174.8	0.0694	242.2	0.03706
174.9	0.0694	242.2	0.03706
174.9	0.0694	242.2	0.03937
174.9	0.0694	242.2	0.03937
174.9	0.0694	242.2	0.03706
174.9	0.0694	242.2	0.03937
174.9	0.0694	242.3	0.03937
175.	0.0694	242.3	0.03937
175.	0.0694	242.3	0.03937
175.	0.0694	242.3	0.03937
175.	0.0694	242.3	0.03706
175.	0.0694	242.3	0.03706
175.1	0.06709	242.3	0.03706
175.1	0.0694	242.4	0.03937
175.1	0.0694	242.4	0.03706
175.1	0.0694	242.4	0.03475
175.1	0.0694	242.4	0.03475
175.1	0.0694	242.4	0.03706
175.2	0.0694	242.4	0.03706
175.2	0.0694	242.5	0.03937
175.2	0.06709	242.5	0.03706
175.2	0.06709	242.5	0.03937
175.2	0.06709	242.5	0.03937
175.2	0.06709	242.5	0.03937
175.3	0.06709	242.6	0.03937
175.3	0.0694	242.6	0.03937
175.3	0.0694	242.6	0.03937
175.3	0.06709	242.6	0.03937
175.3	0.06709	242.6	0.03937
175.3	0.06709	242.6	0.03937
175.3	0.06709	242.7	0.03937
175.4	0.06709	242.7	0.03937
175.4	0.06709	242.7	0.03937
175.4	0.06709	242.7	0.03937
175.4	0.06709	242.7	0.03937
175.4	0.06709	242.7	0.03937
175.4	0.06709	242.8	0.03937
175.5	0.06709	242.8	0.03937
175.5	0.06709	242.8	0.03937
175.5	0.06709	242.8	0.03937
175.5	0.06709	242.8	0.03937
175.5	0.06709	242.8	0.03937

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
175.6	0.06709	242.8	0.03937
175.6	0.06709	242.9	0.03937
175.6	0.06709	242.9	0.03937
175.6	0.06709	242.9	0.03937
175.6	0.06709	242.9	0.03706
175.6	0.06709	242.9	0.03706
175.7	0.06709	242.9	0.03937
175.7	0.06709	243.	0.03937
175.7	0.06709	243.	0.03937
175.7	0.06709	243.	0.03706
175.7	0.06709	243.	0.03706
175.7	0.06709	243.	0.03937
175.8	0.06709	243.1	0.03706
175.8	0.06709	243.1	0.03706
175.8	0.06709	243.1	0.03706
175.8	0.06709	243.1	0.03937
175.8	0.06709	243.1	0.03937
175.8	0.06709	243.1	0.03937
175.8	0.06709	243.2	0.03937
175.9	0.06709	243.2	0.03937
175.9	0.06709	243.2	0.03937
175.9	0.06709	243.2	0.03937
175.9	0.06709	243.2	0.03937
175.9	0.06709	243.2	0.03937
175.9	0.06709	243.3	0.03937
176.	0.06709	243.3	0.03706
176.	0.06709	243.3	0.03706
176.	0.06709	243.3	0.03706
176.	0.06709	243.3	0.03706
176.	0.06709	243.3	0.03937
176.1	0.06709	243.3	0.03937
176.1	0.06709	243.4	0.03937
176.1	0.0694	243.4	0.03937
176.1	0.0694	243.4	0.03937
176.1	0.0694	243.4	0.03937
176.1	0.0694	243.4	0.03937
176.2	0.0694	243.4	0.03937
176.2	0.0694	243.5	0.03937
176.2	0.0694	243.5	0.03937
176.2	0.0694	243.5	0.03937
176.2	0.06709	243.5	0.03937
176.2	0.06709	243.5	0.03706
176.3	0.06709	243.6	0.03706
176.3	0.06709	243.6	0.03937
176.3	0.06709	243.6	0.03706
176.3	0.06709	243.6	0.03706
176.3	0.06709	243.6	0.03706
176.3	0.06709	243.6	0.03706
176.3	0.06709	243.7	0.03706
176.4	0.06709	243.7	0.03937
176.4	0.06709	243.7	0.03937
176.4	0.06709	243.7	0.03706
176.4	0.06709	243.7	0.03706
176.4	0.06709	243.7	0.03706
176.4	0.06709	243.8	0.03937
176.5	0.06709	243.8	0.03706
176.5	0.06709	243.8	0.03706
176.5	0.06709	243.8	0.03706
176.5	0.06709	243.8	0.03706
176.5	0.06709	243.8	0.03706
176.6	0.06709	243.8	0.03706
176.6	0.06709	243.9	0.03706
176.6	0.06709	243.9	0.03706
176.6	0.06709	243.9	0.03706
176.6	0.06709	243.9	0.03706
176.6	0.06709	243.9	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
176.7	0.06709	243.9	0.03706
176.7	0.06709	244.	0.03937
176.7	0.06709	244.	0.03706
176.7	0.06709	244.	0.03706
176.7	0.06709	244.	0.03706
176.7	0.06709	244.	0.03706
176.8	0.06709	244.1	0.03706
176.8	0.06709	244.1	0.03937
176.8	0.06709	244.1	0.03937
176.8	0.06709	244.1	0.03706
176.8	0.06709	244.1	0.03937
176.8	0.06709	244.1	0.03937
176.8	0.06709	244.2	0.03706
176.9	0.06709	244.2	0.03706
176.9	0.06709	244.2	0.03706
176.9	0.06709	244.2	0.03706
176.9	0.06709	244.2	0.03706
176.9	0.06709	244.2	0.03706
176.9	0.06709	244.3	0.03706
177.	0.06709	244.3	0.03706
177.	0.06709	244.3	0.03706
177.	0.06709	244.3	0.03706
177.	0.06709	244.3	0.03706
177.	0.06709	244.3	0.03706
177.1	0.06709	244.3	0.03706
177.1	0.06709	244.4	0.03706
177.1	0.06709	244.4	0.03706
177.1	0.06709	244.4	0.03706
177.1	0.06709	244.4	0.03937
177.1	0.06709	244.4	0.03706
177.2	0.06709	244.4	0.03706
177.2	0.06709	244.5	0.03706
177.2	0.06709	244.5	0.03706
177.2	0.06709	244.5	0.03706
177.2	0.06709	244.5	0.03706
177.2	0.06709	244.5	0.03706
177.3	0.06709	244.6	0.03706
177.3	0.06709	244.6	0.03706
177.3	0.06709	244.6	0.03706
177.3	0.06709	244.6	0.03706
177.3	0.06478	244.6	0.03706
177.3	0.06478	244.6	0.03937
177.3	0.06709	244.7	0.03706
177.4	0.06709	244.7	0.03706
177.4	0.06478	244.7	0.03706
177.4	0.06478	244.7	0.03937
177.4	0.07171	244.7	0.03706
177.4	0.06478	244.7	0.03706
177.4	0.0694	244.8	0.03706
177.5	0.06478	244.8	0.03706
177.5	0.06478	244.8	0.03706
177.5	0.06478	244.8	0.03706
177.5	0.06478	244.8	0.03706
177.5	0.06709	244.8	0.03706
177.6	0.06709	244.8	0.03706
177.6	0.06709	244.9	0.03706
177.6	0.06709	244.9	0.03706
177.6	0.06709	244.9	0.03706
177.6	0.06709	244.9	0.03706
177.6	0.06709	244.9	0.03706
177.7	0.06709	244.9	0.03706
177.7	0.06709	245.	0.03937
177.7	0.06709	245.	0.03706
177.7	0.06709	245.	0.03706
177.7	0.06709	245.	0.03706
177.7	0.06709	245.	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
177.8	0.06709	245.1	0.03706
177.8	0.06709	245.1	0.03706
177.8	0.06709	245.1	0.03706
177.8	0.06709	245.1	0.03706
177.8	0.06478	245.1	0.03706
177.8	0.06709	245.1	0.03706
177.8	0.06709	245.2	0.03706
177.9	0.06709	245.2	0.03706
177.9	0.06709	245.2	0.03706
177.9	0.06709	245.2	0.03706
177.9	0.06478	245.2	0.03706
177.9	0.06478	245.2	0.03706
177.9	0.06478	245.3	0.03706
178.	0.06478	245.3	0.03706
178.	0.06478	245.3	0.03706
178.	0.06478	245.3	0.03706
178.	0.06478	245.3	0.03706
178.	0.06478	245.3	0.03706
178.1	0.06478	245.3	0.03706
178.1	0.06478	245.4	0.03706
178.1	0.06478	245.4	0.03706
178.1	0.06478	245.4	0.03706
178.1	0.06478	245.4	0.03706
178.1	0.06478	245.4	0.03706
178.2	0.06478	245.4	0.03706
178.2	0.06478	245.5	0.03706
178.2	0.06478	245.5	0.03706
178.2	0.06478	245.5	0.03706
178.2	0.06478	245.5	0.03706
178.2	0.06478	245.5	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.6	0.03706
178.3	0.06478	245.7	0.03706
178.4	0.06478	245.7	0.03706
178.4	0.06478	245.7	0.03706
178.4	0.06478	245.7	0.03706
178.4	0.06478	245.7	0.03706
178.4	0.06478	245.7	0.03706
178.4	0.06478	245.8	0.03706
178.5	0.06478	245.8	0.03706
178.5	0.06478	245.8	0.03706
178.5	0.06478	245.8	0.03706
178.5	0.06478	245.8	0.03706
178.5	0.06478	245.8	0.03706
178.6	0.06478	245.8	0.03706
178.6	0.06478	245.9	0.03706
178.6	0.06478	245.9	0.03706
178.6	0.06478	245.9	0.03706
178.6	0.06478	245.9	0.03937
178.6	0.06478	245.9	0.03706
178.7	0.06478	245.9	0.03706
178.7	0.06478	246.	0.03706
178.7	0.06478	246.	0.03706
178.7	0.06478	246.	0.03706
178.7	0.06478	246.	0.03706
178.7	0.06478	246.	0.03706
178.8	0.06478	246.1	0.03706
178.8	0.06478	246.1	0.03706
178.8	0.06478	246.1	0.03706
178.8	0.06478	246.1	0.03706
178.8	0.06478	246.1	0.03706
178.8	0.06478	246.1	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
178.8	0.06478	246.2	0.03706
178.9	0.06478	246.2	0.03706
178.9	0.06478	246.2	0.03706
178.9	0.06478	246.2	0.03706
178.9	0.06478	246.2	0.03706
178.9	0.06478	246.2	0.03706
178.9	0.06478	246.3	0.03706
179.	0.06478	246.3	0.03706
179.	0.06478	246.3	0.03706
179.	0.06478	246.3	0.03706
179.	0.06478	246.3	0.03706
179.	0.06478	246.3	0.03706
179.1	0.06478	246.3	0.03706
179.1	0.06478	246.4	0.03706
179.1	0.06478	246.4	0.03706
179.1	0.06478	246.4	0.03706
179.1	0.06478	246.4	0.03706
179.1	0.06478	246.4	0.03706
179.2	0.06478	246.4	0.03706
179.2	0.06478	246.5	0.03706
179.2	0.06478	246.5	0.03706
179.2	0.06478	246.5	0.03706
179.2	0.06478	246.5	0.03706
179.2	0.06478	246.5	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.6	0.03706
179.3	0.06478	246.7	0.03706
179.4	0.06478	246.7	0.03706
179.4	0.06478	246.7	0.03706
179.4	0.06478	246.7	0.03706
179.4	0.06478	246.7	0.03706
179.4	0.06478	246.7	0.03706
179.4	0.06478	246.8	0.03706
179.5	0.06478	246.8	0.03706
179.5	0.06478	246.8	0.03706
179.5	0.06478	246.8	0.03706
179.5	0.06478	246.8	0.03706
179.5	0.06478	246.8	0.03706
179.6	0.06478	246.8	0.03706
179.6	0.06478	246.9	0.03706
179.6	0.06478	246.9	0.03706
179.6	0.06478	246.9	0.03706
179.6	0.06478	246.9	0.03706
179.6	0.06478	246.9	0.03706
179.7	0.06478	246.9	0.03706
179.7	0.06478	247.	0.03706
179.7	0.06478	247.	0.03706
179.7	0.06478	247.	0.03706
179.7	0.06478	247.	0.03706
179.7	0.06478	247.	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.1	0.03706
179.8	0.06478	247.2	0.03706
179.9	0.06478	247.2	0.03706
179.9	0.06478	247.2	0.03706
179.9	0.06478	247.2	0.03706
179.9	0.06478	247.2	0.03706
179.9	0.06478	247.2	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
179.9	0.06478	247.3	0.03706
180.	0.06478	247.3	0.03706
180.	0.06478	247.3	0.03706
180.	0.06478	247.3	0.03706
180.	0.06478	247.3	0.03706
180.	0.06478	247.3	0.03706
180.1	0.06478	247.3	0.03706
180.1	0.06478	247.4	0.03706
180.1	0.06478	247.4	0.03706
180.1	0.06478	247.4	0.03706
180.1	0.06247	247.4	0.03706
180.1	0.06247	247.4	0.03706
180.2	0.06247	247.4	0.03706
180.2	0.06247	247.5	0.03706
180.2	0.06247	247.5	0.03706
180.2	0.06247	247.5	0.03706
180.2	0.06247	247.5	0.03706
180.2	0.06247	247.5	0.03706
180.3	0.06478	247.6	0.03706
180.3	0.06247	247.6	0.03706
180.3	0.06247	247.6	0.03706
180.3	0.06247	247.6	0.03706
180.3	0.06247	247.6	0.03706
180.3	0.06247	247.6	0.03706
180.3	0.06478	247.7	0.03706
180.4	0.06247	247.7	0.03706
180.4	0.06247	247.7	0.03706
180.4	0.06247	247.7	0.03706
180.4	0.06247	247.7	0.03706
180.4	0.06247	247.7	0.03706
180.4	0.06247	247.8	0.03706
180.5	0.06247	247.8	0.03706
180.5	0.06247	247.8	0.03706
180.5	0.06247	247.8	0.03706
180.5	0.06247	247.8	0.03706
180.5	0.06247	247.8	0.03706
180.6	0.06247	247.8	0.03706
180.6	0.06247	247.9	0.03706
180.6	0.06247	247.9	0.03706
180.6	0.06247	247.9	0.03706
180.6	0.06247	247.9	0.03706
180.6	0.06247	247.9	0.03706
180.7	0.06247	247.9	0.03706
180.7	0.06247	248.	0.03706
180.7	0.06247	248.	0.03706
180.7	0.06247	248.	0.03706
180.7	0.06247	248.	0.03706
180.7	0.06247	248.	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.1	0.03706
180.8	0.06247	248.2	0.03706
180.9	0.06247	248.2	0.03706
180.9	0.06247	248.2	0.03706
180.9	0.06247	248.2	0.03706
180.9	0.06247	248.2	0.03706
180.9	0.06247	248.2	0.03706
180.9	0.06247	248.3	0.03706
181.	0.06247	248.3	0.03706
181.	0.06247	248.3	0.03706
181.	0.06247	248.3	0.03706
181.	0.06247	248.3	0.03706
181.	0.06247	248.3	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
181.1	0.06247	248.3	0.03706
181.1	0.06247	248.4	0.03706
181.1	0.06247	248.4	0.03706
181.1	0.06247	248.4	0.03706
181.1	0.06247	248.4	0.03706
181.1	0.06247	248.4	0.03706
181.2	0.06247	248.4	0.03706
181.2	0.06247	248.5	0.03706
181.2	0.06247	248.5	0.03706
181.2	0.06247	248.5	0.03706
181.2	0.06247	248.5	0.03706
181.2	0.06247	248.5	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.6	0.03706
181.3	0.06247	248.7	0.03706
181.4	0.06247	248.7	0.03706
181.4	0.06247	248.7	0.03706
181.4	0.06247	248.7	0.03706
181.4	0.06247	248.7	0.03706
181.4	0.06247	248.7	0.03706
181.4	0.06247	248.8	0.03706
181.5	0.06247	248.8	0.03706
181.5	0.06247	248.8	0.03706
181.5	0.06247	248.8	0.03706
181.5	0.06247	248.8	0.03706
181.5	0.06247	248.8	0.03706
181.6	0.06247	248.8	0.03706
181.6	0.06247	248.9	0.03706
181.6	0.06247	248.9	0.03706
181.6	0.06247	248.9	0.03706
181.6	0.06247	248.9	0.03706
181.6	0.06247	248.9	0.03706
181.7	0.06247	248.9	0.03706
181.7	0.06247	249.	0.03706
181.7	0.06247	249.	0.03706
181.7	0.06247	249.	0.03706
181.7	0.06247	249.	0.03706
181.7	0.06247	249.	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.1	0.03706
181.8	0.06247	249.2	0.03706
181.9	0.06247	249.2	0.03706
181.9	0.06247	249.2	0.03706
181.9	0.06247	249.2	0.03706
181.9	0.06247	249.2	0.03706
181.9	0.06247	249.2	0.03706
181.9	0.06247	249.3	0.03706
182.	0.06247	249.3	0.03706
182.	0.06247	249.3	0.03706
182.	0.06247	249.3	0.03706
182.	0.06247	249.3	0.03706
182.	0.06247	249.3	0.03706
182.1	0.06247	249.3	0.03706
182.1	0.06247	249.4	0.03706
182.1	0.06247	249.4	0.03706
182.1	0.06247	249.4	0.03706
182.1	0.06247	249.4	0.03706
182.1	0.06247	249.4	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
182.2	0.06247	249.4	0.03706
182.2	0.06247	249.5	0.03706
182.2	0.06247	249.5	0.03706
182.2	0.06247	249.5	0.03706
182.2	0.06247	249.5	0.03706
182.2	0.06247	249.5	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.6	0.03706
182.3	0.06247	249.7	0.03706
182.4	0.06247	249.7	0.03706
182.4	0.06247	249.7	0.03706
182.4	0.06247	249.7	0.03706
182.4	0.06247	249.7	0.03706
182.4	0.06247	249.7	0.03706
182.4	0.06247	249.8	0.03706
182.5	0.06247	249.8	0.03706
182.5	0.06247	249.8	0.03706
182.5	0.06247	249.8	0.03706
182.5	0.06247	249.8	0.03706
182.5	0.06016	249.8	0.03706
182.6	0.06247	249.8	0.03706
182.6	0.06016	249.9	0.03706
182.6	0.06016	249.9	0.03706
182.6	0.06247	249.9	0.03706
182.6	0.06247	249.9	0.03706
182.6	0.06247	249.9	0.03706
182.7	0.06247	249.9	0.03706
182.7	0.06247	250.	0.03706
182.7	0.06247	250.	0.03706
182.7	0.06247	250.	0.03706
182.7	0.06247	250.	0.03706
182.7	0.06247	250.	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.1	0.03706
182.8	0.06247	250.2	0.03706
182.9	0.06247	250.2	0.03706
182.9	0.06247	250.2	0.03706
182.9	0.06247	250.2	0.03706
182.9	0.06247	250.2	0.03706
182.9	0.06247	250.2	0.03706
182.9	0.06247	250.3	0.03706
183.	0.06247	250.3	0.03706
183.	0.06247	250.3	0.03706
183.	0.06247	250.3	0.03706
183.	0.06247	250.3	0.03706
183.	0.06247	250.3	0.03706
183.1	0.06247	250.3	0.03706
183.1	0.06247	250.4	0.03706
183.1	0.06247	250.4	0.03706
183.1	0.06247	250.4	0.03706
183.1	0.06247	250.4	0.03706
183.1	0.06247	250.4	0.03706
183.2	0.06016	250.4	0.03706
183.2	0.06247	250.5	0.03706
183.2	0.06247	250.5	0.03706
183.2	0.06247	250.5	0.03706
183.2	0.06247	250.5	0.03706
183.2	0.06016	250.5	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.6	0.03706
183.3	0.06016	250.7	0.03706
183.4	0.06016	250.7	0.03706
183.4	0.06016	250.7	0.03706
183.4	0.06016	250.7	0.03706
183.4	0.06016	250.7	0.03706
183.4	0.06016	250.7	0.03706
183.4	0.06016	250.8	0.03706
183.5	0.06016	250.8	0.03706
183.5	0.06016	250.8	0.03706
183.5	0.06016	250.8	0.03706
183.5	0.06016	250.8	0.03706
183.5	0.06016	250.8	0.03706
183.6	0.06016	250.8	0.03706
183.6	0.06016	250.9	0.03706
183.6	0.06016	250.9	0.03706
183.6	0.06016	250.9	0.03706
183.6	0.06016	250.9	0.03706
183.6	0.06016	250.9	0.03706
183.7	0.06016	250.9	0.03706
183.7	0.06016	251.	0.03706
183.7	0.06016	251.	0.03706
183.7	0.06016	251.	0.03706
183.7	0.06016	251.	0.03706
183.7	0.06016	251.	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.1	0.03706
183.8	0.06016	251.2	0.03706
183.9	0.06016	251.2	0.03706
183.9	0.06016	251.2	0.03706
183.9	0.06016	251.2	0.03706
183.9	0.06016	251.2	0.03706
183.9	0.06016	251.2	0.03706
183.9	0.06016	251.3	0.03706
184.	0.06016	251.3	0.03706
184.	0.06016	251.3	0.03706
184.	0.06016	251.3	0.03706
184.	0.06016	251.3	0.03706
184.	0.06016	251.3	0.03706
184.1	0.06016	251.3	0.03706
184.1	0.06016	251.4	0.03706
184.1	0.06016	251.4	0.03706
184.1	0.06016	251.4	0.03706
184.1	0.06016	251.4	0.03706
184.1	0.06016	251.4	0.03706
184.2	0.06016	251.4	0.03706
184.2	0.06016	251.5	0.03706
184.2	0.05785	251.5	0.03706
184.2	0.05785	251.5	0.03706
184.2	0.05785	251.5	0.03706
184.2	0.06016	251.5	0.03706
184.3	0.06016	251.6	0.03706
184.3	0.06016	251.6	0.03706
184.3	0.06016	251.6	0.03706
184.3	0.06247	251.6	0.03706
184.3	0.06016	251.6	0.03706
184.3	0.06016	251.6	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
184.3	0.06016	251.7	0.03706
184.4	0.06016	251.7	0.03706
184.4	0.06016	251.7	0.03706
184.4	0.06016	251.7	0.03706
184.4	0.06016	251.7	0.03706
184.4	0.06016	251.7	0.03706
184.4	0.06016	251.8	0.03706
184.5	0.06016	251.8	0.03706
184.5	0.06016	251.8	0.03706
184.5	0.06016	251.8	0.03706
184.5	0.06016	251.8	0.03706
184.5	0.06016	251.8	0.03706
184.6	0.06016	251.8	0.03706
184.6	0.06016	251.9	0.03706
184.6	0.06016	251.9	0.03706
184.6	0.06016	251.9	0.03706
184.6	0.06016	251.9	0.03706
184.6	0.06016	251.9	0.03706
184.7	0.06016	251.9	0.03706
184.7	0.06016	252.	0.03706
184.7	0.06016	252.	0.03706
184.7	0.06016	252.	0.03706
184.7	0.06016	252.	0.03706
184.7	0.06016	252.	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.1	0.03706
184.8	0.06016	252.2	0.03706
184.9	0.06016	252.2	0.03706
184.9	0.06016	252.2	0.03706
184.9	0.06016	252.2	0.03706
184.9	0.06016	252.2	0.03706
184.9	0.06016	252.2	0.03706
184.9	0.06016	252.3	0.03706
185.	0.06016	252.3	0.03706
185.	0.06016	252.3	0.03706
185.	0.06016	252.3	0.03706
185.	0.06016	252.3	0.03706
185.	0.06016	252.3	0.03706
185.1	0.06016	252.3	0.03706
185.1	0.06016	252.4	0.03706
185.1	0.06016	252.4	0.03706
185.1	0.06016	252.4	0.03706
185.1	0.06016	252.4	0.03706
185.1	0.06016	252.4	0.03706
185.2	0.06016	252.4	0.03706
185.2	0.06016	252.5	0.03706
185.2	0.06016	252.5	0.03706
185.2	0.06016	252.5	0.03706
185.2	0.06016	252.5	0.03706
185.2	0.06016	252.5	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.6	0.03706
185.3	0.06016	252.7	0.03706
185.4	0.06016	252.7	0.03706
185.4	0.06016	252.7	0.03706
185.4	0.06016	252.7	0.03706
185.4	0.06016	252.7	0.03706
185.4	0.06016	252.7	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
185.4	0.06016	252.8	0.03706
185.5	0.06016	252.8	0.03706
185.5	0.06016	252.8	0.03706
185.5	0.06016	252.8	0.03706
185.5	0.06016	252.8	0.03706
185.5	0.05785	252.8	0.03706
185.6	0.06016	252.8	0.03706
185.6	0.05785	252.9	0.03706
185.6	0.06016	252.9	0.03706
185.6	0.06016	252.9	0.03706
185.6	0.06016	252.9	0.03706
185.6	0.06016	252.9	0.03706
185.7	0.06016	252.9	0.03706
185.7	0.05785	253.	0.03706
185.7	0.05785	253.	0.03706
185.7	0.05785	253.	0.03706
185.7	0.05785	253.	0.03706
185.7	0.05785	253.	0.03706
185.8	0.05785	253.1	0.03706
185.8	0.05785	253.1	0.03706
185.8	0.05785	253.1	0.03706
185.8	0.05785	253.1	0.03706
185.8	0.06016	253.1	0.03706
185.8	0.05785	253.1	0.03706
185.8	0.05785	253.2	0.03706
185.9	0.05785	253.2	0.03706
185.9	0.05785	253.2	0.03706
185.9	0.05785	253.2	0.03706
185.9	0.05785	253.2	0.03706
185.9	0.05785	253.2	0.03706
185.9	0.05785	253.3	0.03706
186.	0.05785	253.3	0.03706
186.	0.05785	253.3	0.03706
186.	0.05785	253.3	0.03706
186.	0.05785	253.3	0.03706
186.	0.05785	253.3	0.03706
186.1	0.05785	253.3	0.03706
186.1	0.05785	253.4	0.03706
186.1	0.05785	253.4	0.03706
186.1	0.05785	253.4	0.03706
186.1	0.05785	253.4	0.03706
186.1	0.05785	253.4	0.03706
186.2	0.05785	253.4	0.03706
186.2	0.05785	253.5	0.03706
186.2	0.05785	253.5	0.03706
186.2	0.05785	253.5	0.03706
186.2	0.05785	253.5	0.03706
186.2	0.05785	253.5	0.03706
186.3	0.05785	253.6	0.03706
186.3	0.05785	253.6	0.03706
186.3	0.05785	253.6	0.03706
186.3	0.05785	253.6	0.03475
186.3	0.05785	253.6	0.03475
186.3	0.05785	253.6	0.03475
186.3	0.05785	253.7	0.03475
186.4	0.05785	253.7	0.03475
186.4	0.05785	253.7	0.03475
186.4	0.05785	253.7	0.03475
186.4	0.05785	253.7	0.03706
186.4	0.05785	253.7	0.03706
186.4	0.05785	253.8	0.03706
186.5	0.05785	253.8	0.03706
186.5	0.05785	253.8	0.03937
186.5	0.05785	253.8	0.03706
186.5	0.05785	253.8	0.03706
186.5	0.05785	253.8	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
186.6	0.05785	253.8	0.03706
186.6	0.05785	253.9	0.03937
186.6	0.05785	253.9	0.03706
186.6	0.05785	253.9	0.03706
186.6	0.05785	253.9	0.03706
186.6	0.05785	253.9	0.03706
186.7	0.05785	253.9	0.03706
186.7	0.05785	254.	0.03706
186.7	0.05785	254.	0.03706
186.7	0.05785	254.	0.03706
186.7	0.05785	254.	0.03706
186.7	0.05785	254.	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.1	0.03706
186.8	0.05785	254.2	0.03706
186.9	0.05785	254.2	0.03706
186.9	0.05785	254.2	0.03706
186.9	0.05785	254.2	0.03706
186.9	0.05785	254.2	0.03706
186.9	0.05785	254.2	0.03706
186.9	0.05785	254.3	0.03706
187.	0.05785	254.3	0.03706
187.	0.05785	254.3	0.03706
187.	0.05785	254.3	0.03706
187.	0.05785	254.3	0.03706
187.	0.05785	254.3	0.03706
187.1	0.05785	254.3	0.03706
187.1	0.05785	254.4	0.03706
187.1	0.05785	254.4	0.03706
187.1	0.05785	254.4	0.03706
187.1	0.05785	254.4	0.03706
187.1	0.05785	254.4	0.03706
187.2	0.05785	254.4	0.03706
187.2	0.05785	254.5	0.03706
187.2	0.05785	254.5	0.03706
187.2	0.05785	254.5	0.03706
187.2	0.05785	254.5	0.03706
187.2	0.05785	254.5	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.6	0.03706
187.3	0.05785	254.7	0.03706
187.4	0.05785	254.7	0.03706
187.4	0.05785	254.7	0.03706
187.4	0.05785	254.7	0.03706
187.4	0.05785	254.7	0.03706
187.4	0.05785	254.7	0.03706
187.4	0.05785	254.8	0.03706
187.5	0.05785	254.8	0.03706
187.5	0.05785	254.8	0.03706
187.5	0.05785	254.8	0.03706
187.5	0.05785	254.8	0.03706
187.5	0.05785	254.8	0.03706
187.6	0.05785	254.8	0.03706
187.6	0.05785	254.9	0.03706
187.6	0.05785	254.9	0.03706
187.6	0.05785	254.9	0.03706
187.6	0.05785	254.9	0.03706
187.6	0.05785	254.9	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
187.7	0.05785	254.9	0.03706
187.7	0.05785	255.	0.03706
187.7	0.05785	255.	0.03706
187.7	0.05785	255.	0.03706
187.7	0.05785	255.	0.03706
187.7	0.05785	255.	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.1	0.03706
187.8	0.05785	255.2	0.03706
187.9	0.05785	255.2	0.03706
187.9	0.05785	255.2	0.03706
187.9	0.05785	255.2	0.03706
187.9	0.05785	255.2	0.03706
187.9	0.05785	255.2	0.03706
187.9	0.05785	255.3	0.03706
188.	0.05785	255.3	0.03706
188.	0.05785	255.3	0.03706
188.	0.05785	255.3	0.03706
188.	0.05785	255.3	0.03706
188.	0.05785	255.3	0.03706
188.1	0.05785	255.3	0.03706
188.1	0.05785	255.4	0.03706
188.1	0.05785	255.4	0.03706
188.1	0.05785	255.4	0.03706
188.1	0.05785	255.4	0.03706
188.1	0.05785	255.4	0.03706
188.2	0.05785	255.4	0.03706
188.2	0.05785	255.5	0.03706
188.2	0.05785	255.5	0.03706
188.2	0.05785	255.5	0.03706
188.2	0.05785	255.5	0.03706
188.2	0.05785	255.5	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.6	0.03706
188.3	0.05785	255.7	0.03706
188.4	0.05785	255.7	0.03706
188.4	0.05785	255.7	0.03706
188.4	0.05785	255.7	0.03706
188.4	0.05785	255.7	0.03706
188.4	0.05785	255.7	0.03706
188.4	0.05785	255.8	0.03706
188.5	0.05785	255.8	0.03706
188.5	0.05785	255.8	0.03706
188.5	0.05785	255.8	0.03706
188.5	0.05785	255.8	0.03706
188.5	0.05785	255.8	0.03706
188.6	0.05785	255.8	0.03706
188.6	0.05785	255.9	0.03706
188.6	0.05785	255.9	0.03706
188.6	0.05785	255.9	0.03706
188.6	0.05785	255.9	0.03475
188.6	0.05785	255.9	0.03475
188.7	0.05785	255.9	0.03475
188.7	0.05785	256.	0.03706
188.7	0.05785	256.	0.03706
188.7	0.05785	256.	0.03475
188.7	0.05785	256.	0.03706
188.7	0.05785	256.	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
188.8	0.05785	256.1	0.03706
188.8	0.05785	256.1	0.03706
188.8	0.05554	256.1	0.03706
188.8	0.05554	256.1	0.03706
188.8	0.05554	256.1	0.03706
188.8	0.05554	256.1	0.03706
188.8	0.05554	256.1	0.03706
188.9	0.05554	256.2	0.03706
188.9	0.05554	256.2	0.03706
188.9	0.05554	256.2	0.03706
188.9	0.05554	256.2	0.03706
188.9	0.05554	256.2	0.03706
188.9	0.05554	256.3	0.03706
189.	0.05554	256.3	0.03706
189.	0.05554	256.3	0.03706
189.	0.05554	256.3	0.03706
189.	0.05554	256.3	0.03706
189.	0.05554	256.3	0.03706
189.1	0.05554	256.4	0.03706
189.1	0.05554	256.4	0.03706
189.1	0.05554	256.4	0.03706
189.1	0.05554	256.4	0.03706
189.1	0.05554	256.4	0.03706
189.1	0.05554	256.4	0.03706
189.2	0.05554	256.4	0.03706
189.2	0.05554	256.5	0.03706
189.2	0.05554	256.5	0.03706
189.2	0.05554	256.5	0.03706
189.2	0.05554	256.5	0.03706
189.2	0.05554	256.5	0.03475
189.3	0.05554	256.6	0.03706
189.3	0.05554	256.6	0.03706
189.3	0.05554	256.6	0.03475
189.3	0.05554	256.6	0.03706
189.3	0.05554	256.6	0.03706
189.3	0.05554	256.6	0.03706
189.3	0.05554	256.6	0.03706
189.4	0.05554	256.7	0.03706
189.4	0.05554	256.7	0.03706
189.4	0.05554	256.7	0.03706
189.4	0.05554	256.7	0.03706
189.4	0.05554	256.7	0.03706
189.4	0.05554	256.8	0.03706
189.5	0.05554	256.8	0.03706
189.5	0.05554	256.8	0.03706
189.5	0.05554	256.8	0.03706
189.5	0.05554	256.8	0.03706
189.5	0.05554	256.8	0.03706
189.6	0.05554	256.9	0.03706
189.6	0.05554	256.9	0.03706
189.6	0.05554	256.9	0.03706
189.6	0.05554	256.9	0.03706
189.6	0.05554	256.9	0.03706
189.6	0.05554	256.9	0.03706
189.7	0.05554	256.9	0.03706
189.7	0.05554	257.	0.03706
189.7	0.05554	257.	0.03706
189.7	0.05554	257.	0.03706
189.7	0.05554	257.	0.03706
189.7	0.05554	257.	0.03706
189.8	0.05554	257.1	0.03706
189.8	0.05554	257.1	0.03706
189.8	0.05554	257.1	0.03706
189.8	0.05554	257.1	0.03706
189.8	0.05554	257.1	0.03706
189.8	0.05554	257.1	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
189.8	0.05554	257.1	0.03706
189.9	0.05554	257.2	0.03706
189.9	0.05554	257.2	0.03706
189.9	0.05554	257.2	0.03706
189.9	0.05554	257.2	0.03706
189.9	0.05554	257.2	0.03706
189.9	0.05554	257.3	0.03706
190.	0.05554	257.3	0.03706
190.	0.05554	257.3	0.03706
190.	0.05554	257.3	0.03706
190.	0.05554	257.3	0.03706
190.	0.05554	257.3	0.03706
190.1	0.05554	257.4	0.03706
190.1	0.05554	257.4	0.03706
190.1	0.05554	257.4	0.03706
190.1	0.05554	257.4	0.03706
190.1	0.05554	257.4	0.03706
190.1	0.05554	257.4	0.03706
190.2	0.05554	257.4	0.03706
190.2	0.05554	257.5	0.03706
190.2	0.05554	257.5	0.03706
190.2	0.05554	257.5	0.03706
190.2	0.05554	257.5	0.03706
190.2	0.05554	257.5	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.3	0.05554	257.6	0.03706
190.4	0.05554	257.7	0.03706
190.4	0.05554	257.7	0.03706
190.4	0.05554	257.7	0.03706
190.4	0.05554	257.7	0.03706
190.4	0.05554	257.7	0.03706
190.4	0.05554	257.8	0.03706
190.5	0.05554	257.8	0.03706
190.5	0.05554	257.8	0.03706
190.5	0.05554	257.8	0.03706
190.5	0.05554	257.8	0.03706
190.5	0.05554	257.8	0.03706
190.6	0.05554	257.9	0.03706
190.6	0.05554	257.9	0.03706
190.6	0.05554	257.9	0.03475
190.6	0.05554	257.9	0.03706
190.6	0.05554	257.9	0.03475
190.6	0.05554	257.9	0.03475
190.7	0.05554	257.9	0.03475
190.7	0.05554	258.	0.03475
190.7	0.05554	258.	0.03706
190.7	0.05554	258.	0.03706
190.7	0.05554	258.	0.03706
190.7	0.05554	258.	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.8	0.05554	258.1	0.03706
190.9	0.05554	258.2	0.03706
190.9	0.05554	258.2	0.03706
190.9	0.05554	258.2	0.03706
190.9	0.05554	258.2	0.03706
190.9	0.05554	258.2	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
190.9	0.05554	258.3	0.03706
191.	0.05554	258.3	0.03706
191.	0.05554	258.3	0.03706
191.	0.05554	258.3	0.03706
191.	0.05554	258.3	0.03706
191.	0.05554	258.3	0.03706
191.1	0.05554	258.4	0.03706
191.1	0.05554	258.4	0.03706
191.1	0.05554	258.4	0.03706
191.1	0.05554	258.4	0.03706
191.1	0.05554	258.4	0.03706
191.1	0.05554	258.4	0.03706
191.2	0.05554	258.4	0.03706
191.2	0.05554	258.5	0.03706
191.2	0.05554	258.5	0.03706
191.2	0.05554	258.5	0.03706
191.2	0.05554	258.5	0.03706
191.2	0.05554	258.5	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.3	0.05554	258.6	0.03706
191.4	0.05554	258.7	0.03706
191.4	0.05554	258.7	0.03706
191.4	0.05323	258.7	0.03706
191.4	0.05323	258.7	0.03706
191.4	0.05323	258.7	0.03706
191.4	0.05323	258.8	0.03706
191.5	0.05323	258.8	0.03706
191.5	0.05554	258.8	0.03706
191.5	0.05323	258.8	0.03706
191.5	0.05554	258.8	0.03706
191.5	0.05554	258.8	0.03706
191.6	0.05554	258.9	0.03706
191.6	0.05554	258.9	0.03706
191.6	0.05554	258.9	0.03706
191.6	0.05554	258.9	0.03706
191.6	0.05785	258.9	0.03706
191.6	0.05554	258.9	0.03706
191.7	0.05554	258.9	0.03706
191.7	0.05554	259.	0.03706
191.7	0.05554	259.	0.03706
191.7	0.05554	259.	0.03706
191.7	0.05554	259.	0.03706
191.7	0.05554	259.	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.8	0.05554	259.1	0.03706
191.9	0.05554	259.2	0.03706
191.9	0.05554	259.2	0.03706
191.9	0.05554	259.2	0.03475
191.9	0.05554	259.2	0.03475
191.9	0.05554	259.2	0.03475
191.9	0.05554	259.3	0.03475
192.	0.05554	259.3	0.03706
192.	0.05554	259.3	0.03475
192.	0.05554	259.3	0.03706
192.	0.05554	259.3	0.03706
192.	0.05554	259.3	0.03475

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
192.1	0.05554	259.4	0.03475
192.1	0.05554	259.4	0.03475
192.1	0.05554	259.4	0.03475
192.1	0.05554	259.4	0.03475
192.1	0.05554	259.4	0.03706
192.1	0.05554	259.4	0.03475
192.2	0.05554	259.4	0.03706
192.2	0.05554	259.5	0.03475
192.2	0.05554	259.5	0.03706
192.2	0.05554	259.5	0.03706
192.2	0.05554	259.5	0.03706
192.2	0.05554	259.5	0.03475
192.3	0.05554	259.6	0.03706
192.3	0.05554	259.6	0.03706
192.3	0.05554	259.6	0.03706
192.3	0.05554	259.6	0.03475
192.3	0.05554	259.6	0.03475
192.3	0.05554	259.6	0.03475
192.3	0.05554	259.6	0.03475
192.4	0.05554	259.7	0.03706
192.4	0.05554	259.7	0.03706
192.4	0.05554	259.7	0.03706
192.4	0.05554	259.7	0.03475
192.4	0.05554	259.7	0.03475
192.4	0.05554	259.8	0.03475
192.5	0.05554	259.8	0.03475
192.5	0.05554	259.8	0.03475
192.5	0.05554	259.8	0.03706
192.5	0.05554	259.8	0.03706
192.5	0.05554	259.8	0.03475
192.6	0.05554	259.9	0.03475
192.6	0.05554	259.9	0.03475
192.6	0.05554	259.9	0.03706
192.6	0.05554	259.9	0.03475
192.6	0.05554	259.9	0.03706
192.6	0.05554	259.9	0.03475
192.7	0.05554	259.9	0.03475
192.7	0.05554	260.	0.03475
192.7	0.05554	260.	0.03475
192.7	0.05554	260.	0.03706
192.7	0.05554	260.	0.03475
192.7	0.05554	260.	0.03475
192.8	0.05554	260.1	0.03706
192.8	0.05554	260.1	0.03706
192.8	0.05554	260.1	0.03706
192.8	0.05554	260.1	0.03706
192.8	0.05554	260.1	0.03475
192.8	0.05554	260.1	0.03475
192.8	0.05554	260.1	0.03475
192.9	0.05554	260.2	0.03475
192.9	0.05554	260.2	0.03475
192.9	0.05554	260.2	0.03475
192.9	0.05554	260.2	0.03475
192.9	0.05554	260.2	0.03475
192.9	0.05554	260.3	0.03475
193.	0.05554	260.3	0.03475
193.	0.05554	260.3	0.03475
193.	0.05554	260.3	0.03475
193.	0.05554	260.3	0.03475
193.	0.05554	260.3	0.03475
193.1	0.05554	260.4	0.03475
193.1	0.05554	260.4	0.03475
193.1	0.05554	260.4	0.03475
193.1	0.05554	260.4	0.03475
193.1	0.05554	260.4	0.03475
193.1	0.05554	260.4	0.03475

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
193.2	0.05554	260.4	0.03475
193.2	0.05554	260.5	0.03475
193.2	0.05554	260.5	0.03475
193.2	0.05554	260.5	0.03706
193.2	0.05554	260.5	0.03706
193.2	0.05554	260.5	0.03706
193.3	0.05554	260.6	0.03475
193.3	0.05554	260.6	0.03937
193.3	0.05554	260.6	0.04168
193.3	0.05554	260.6	0.03475
193.3	0.05554	260.6	0.03475
193.3	0.05554	260.6	0.03706
193.3	0.05554	260.6	0.03706
193.4	0.05554	260.7	0.03706
193.4	0.05554	260.7	0.03475
193.4	0.05554	260.7	0.03475
193.4	0.05554	260.7	0.03475
193.4	0.05554	260.7	0.03475
193.4	0.05554	260.8	0.03706
193.5	0.05554	260.8	0.03706
193.5	0.05554	260.8	0.03706
193.5	0.05554	260.8	0.03706
193.5	0.05554	260.8	0.03706
193.5	0.05554	260.8	0.03706
193.6	0.05554	260.9	0.03706
193.6	0.05554	260.9	0.03706
193.6	0.05554	260.9	0.03706
193.6	0.05554	260.9	0.03706
193.6	0.05554	260.9	0.03706
193.6	0.05554	260.9	0.03706
193.7	0.05323	260.9	0.03706
193.7	0.05554	261.	0.03706
193.7	0.05554	261.	0.03706
193.7	0.05554	261.	0.03706
193.7	0.05554	261.	0.03706
193.7	0.05554	261.	0.03706
193.8	0.05323	261.1	0.03706
193.8	0.05323	261.1	0.03706
193.8	0.05554	261.1	0.03706
193.8	0.05092	261.1	0.03706
193.8	0.05554	261.1	0.03706
193.8	0.05554	261.1	0.03706
193.8	0.05323	261.1	0.03706
193.9	0.05323	261.2	0.03706
193.9	0.05323	261.2	0.03706
193.9	0.05554	261.2	0.03706
193.9	0.05554	261.2	0.03706
193.9	0.05554	261.2	0.03706
193.9	0.05554	261.3	0.03706
194.	0.05554	261.3	0.03706
194.	0.05554	261.3	0.03706
194.	0.05554	261.3	0.03706
194.	0.05554	261.3	0.03706
194.	0.05554	261.3	0.03475
194.1	0.05554	261.4	0.03475
194.1	0.05554	261.4	0.03706
194.1	0.05554	261.4	0.03706
194.1	0.05554	261.4	0.03706
194.1	0.05554	261.4	0.03706
194.1	0.05554	261.4	0.03706
194.2	0.05554	261.4	0.03706
194.2	0.05554	261.5	0.03706
194.2	0.05554	261.5	0.03706
194.2	0.05554	261.5	0.03706
194.2	0.05554	261.5	0.03706
194.2	0.05554	261.5	0.03706

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
194.3	0.05554	261.6	0.03475
194.3	0.05554	261.6	0.03706
194.3	0.05554	261.6	0.03475
194.3	0.05554	261.6	0.03706
194.3	0.05554	261.6	0.03475
194.3	0.05554	261.6	0.03475
194.3	0.05554	261.6	0.03475
194.4	0.05554	261.7	0.03475
194.4	0.05554	261.7	0.03706
194.4	0.05323	261.7	0.03475
194.4	0.05323	261.7	0.03475
194.4	0.05554	261.7	0.03475
194.4	0.05554	261.8	0.03475
194.5	0.05554	261.8	0.03475
194.5	0.05554	261.8	0.03475
194.5	0.05323	261.8	0.03475
194.5	0.05554	261.8	0.03475
194.5	0.05323	261.8	0.03475
194.6	0.05554	261.9	0.03706
194.6	0.05554	261.9	0.03475
194.6	0.05323	261.9	0.03475
194.6	0.05323	261.9	0.03475
194.6	0.05323	261.9	0.03706
194.6	0.05554	261.9	0.03475
194.7	0.05323	261.9	0.03475
194.7	0.05323	262.	0.03475
194.7	0.05323	262.	0.03475
194.7	0.05554	262.	0.03475
194.7	0.05323	262.	0.03475
194.7	0.05323	262.	0.03475
194.8	0.05323	262.1	0.03706
194.8	0.05323	262.1	0.03475
194.8	0.05323	262.1	0.03475
194.8	0.05323	262.1	0.03475
194.8	0.05323	262.1	0.03475
194.8	0.05323	262.1	0.03475
194.8	0.05554	262.1	0.03475
194.9	0.05323	262.2	0.03475
194.9	0.05323	262.2	0.03475
194.9	0.05323	262.2	0.03475
194.9	0.05323	262.2	0.03475
194.9	0.05323	262.2	0.03475
194.9	0.05323	262.3	0.03475
195.	0.05323	262.3	0.03475
195.	0.05323	262.3	0.03475
195.	0.05323	262.3	0.03475
195.	0.05323	262.3	0.03706
195.	0.05323	262.3	0.03706
195.1	0.05323	262.4	0.03475
195.1	0.05323	262.4	0.03475
195.1	0.05323	262.4	0.03475
195.1	0.05323	262.4	0.03475
195.1	0.05323	262.4	0.03475
195.1	0.05323	262.4	0.03475
195.2	0.05323	262.4	0.03475
195.2	0.05323	262.5	0.03475
195.2	0.05323	262.5	0.03475
195.2	0.05323	262.5	0.03475
195.2	0.05323	262.5	0.03475
195.2	0.05323	262.5	0.03475
195.3	0.05323	262.6	0.03475
195.3	0.05323	262.6	0.03475
195.3	0.05323	262.6	0.03475
195.3	0.05323	262.6	0.03475
195.3	0.05323	262.6	0.03475
195.3	0.05323	262.6	0.03475

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
195.3	0.05323	262.6	0.03475
195.4	0.05323	262.7	0.03475
195.4	0.05323	262.7	0.03475
195.4	0.05323	262.7	0.03475
195.4	0.05323	262.7	0.03475
195.4	0.05323	262.7	0.03475
195.4	0.05323	262.8	0.03475
195.5	0.05323	262.8	0.03475
195.5	0.05323	262.8	0.03475
195.5	0.05323	262.8	0.03475
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195.6	0.05323	262.9	0.03475
195.6	0.05323	262.9	0.03475
195.7	0.05323	262.9	0.03475
195.7	0.05323	263.	0.03475
195.7	0.05323	263.	0.03475
195.7	0.05323	263.	0.03475
195.7	0.05323	263.	0.03475
195.7	0.05323	263.	0.03475
195.8	0.05323	263.1	0.03475
195.8	0.05323	263.1	0.03475
195.8	0.05323	263.1	0.03475
195.8	0.05323	263.1	0.03475
195.8	0.05323	263.1	0.03475
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196.	0.05323	263.3	0.03475
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196.	0.05323	263.3	0.03475
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196.1	0.05323	263.4	0.03475
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196.1	0.05323	263.4	0.03475
196.1	0.05323	263.4	0.03475
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196.4	0.05323	263.7	0.03475
196.4	0.05323	263.7	0.03475
196.4	0.05323	263.7	0.03475
196.4	0.05323	263.7	0.03475
196.4	0.05323	263.7	0.03475

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
196.4	0.05323	263.8	0.03475
196.5	0.05323	263.8	0.03475
196.5	0.05323	263.8	0.03475
196.5	0.05323	263.8	0.03475
196.5	0.05323	263.8	0.03475
196.5	0.05323	263.8	0.03475

SOLUTION

Pumping Test
Aquifer Model: Leaky
Solution Method: Hantush

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.9255	cm^2/sec
S	0.073	
ß	0.1458	
Kz/Kr	1.	
b	35.66	ft

K = T/b = 0.0008515 cm/sec
Ss = S/b = 0.002047 1/ft

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
T	0.9255	0.006717	+/- 0.01317	137.8	cm^2/sec
S	0.073	0.04462	+/- 0.08745	1.636	
ß	0.1458	0.007536	+/- 0.01477	19.34	
Kz/Kr	1.	not estimated			
b	35.66	not estimated			ft

C.I. is approximate 95% confidence interval for parameter
t-ratio = estimate/std. error
No estimation window

K = T/b = 0.0008515 cm/sec
Ss = S/b = 0.002047 1/ft

Parameter Correlations

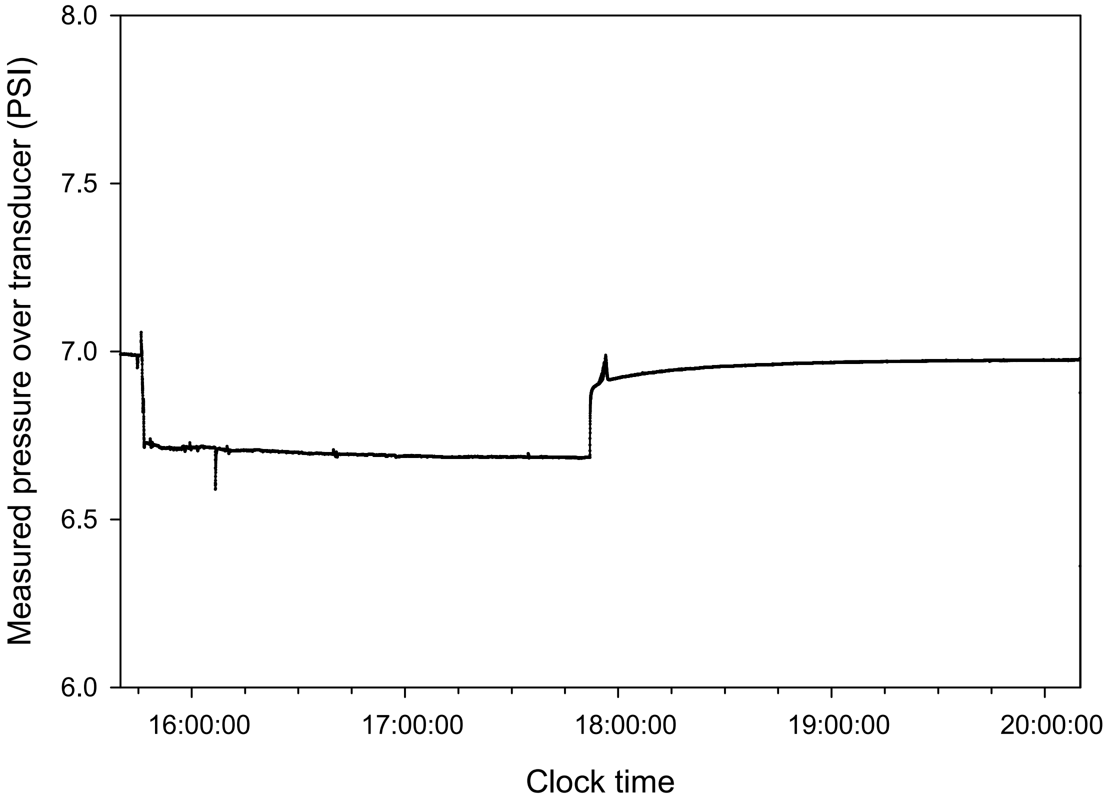
	T	S	ß
T	1.00	0.99	0.34
S	0.99	1.00	0.31
ß	0.34	0.31	1.00

Residual Statistics

for weighted residuals

Sum of Squares . . . . . . 0.3061 ft^2
Variance . . . . 3.791E-5 ft^2
Std. Deviation . . . . 0.006157 ft
Mean . . . . -0.0003668 ft
No. of Residuals 8076
No. of Estimates 3

CLEM-4 Pumping test raw data
Test conducted 9 May 2017



Appendix 7-20

Supplemental Information for the Coal Hollow Mine

Statement of

Probable Hydrologic Consequences R645-301-728

Coal Hollow Mine

C0250005

North Private Lease Area

Erik C. Petersen, P.G.

13 May 2017

Introduction

This information presented in this document is provided in response to a request for information by the Division of Oil, Gas and Mining in their Technical Analysis and Findings for the Coal Hollow Mine (see Task ID: 5369, Coal Hollow, NPL AREAS 2 & 3). Specifically this document address deficiencies listed by the Division for the Statement of Probable Hydrologic Consequences (R301-645-728) for the North Private Lease Areas 2 and 3 at the Coal Hollow Mine.

The requested supplemental is presented in the following sections of this document. The information provided herein is organized following the format of the information requests provided by the Division.

Presentation of Information

Division Information Request Summary:

The final predicted postmining groundwater flow should be compared to the premining groundwater flow and discussed with respect to the potential for impacts to the local and regional groundwater system. The comparison and discussion should include a description of the *anticipated post-reclamation aquifer characteristics. The discussions and maps used in this description should be supported by data and referenced material and should include:*

Division Information Request item:

Final aquifer hydraulic properties (e.g., hydraulic conductivity, storativity, saturated thickness, etc.) including those of backfilled overburden;

Pre-Mining Condition

Within the North Private Lease, the only appreciable groundwater systems are alluvial groundwater systems located in the low-lying areas of the Kanab Creek valley (See Appendix 7-16 and Appendix 7-19 for details). The alluvial sediments that contain these systems are comprised of interbedded clays, silts, sands, gravels and boulders (See Appendix 7-16 and Appendix 7-18 for details). In most instances, the alluvial deposits that support the alluvial groundwater systems in the North Private Lease are mixtures of more than one of these sediment types in varying proportions (See Appendix 7-18). Within proposed mining areas in the Kanab Creek valley, the alluvial deposits are usually saturated from depths ranging from about 13 to 30 feet below the ground surface, with continuous saturation below to the base of the alluvial deposits (See Appendix 7-16 for details). Shallower depths to alluvial groundwater are measured in monitoring wells NLP-4 and NLP-5, which are completed near the banks of Kanab Creek in the deeply incised stream channel (see Appendix 7-18). In all proposed mining areas, the base of the alluvial groundwater system rests on Tropic Shale bedrock. The Tropic Shale is a marine shale/claystone unit that includes laterally continuous interbedded layers of bentonite clay (See Appendix 7-16 for details). Accordingly, the Tropic Shale has very low hydraulic conductivity and may be considered as an aquaclude (allowing little or no water to pass through the formation). This conclusion is based on physical examination of bedrock outcrops and drilling cores of the Tropic Shale bedrock, and by the results of laboratory testing of the shale. A drilling core consisting of unweathered Tropic Shale was analyzed at the laboratory to determine its hydraulic conductivity. The core sample was remolded and compacted at the laboratory prior to the analysis. The measured hydraulic conductivity of this sample was 8.24×10^{-8} cm per second (See Appendix 7-16 for details). Such a low value of hydraulic conductivity supports the conclusion that the potential for groundwater migration through the Tropic Shale (vertically or laterally) is low. Bedrock hills consisting of Tropic Shale are present along both the western and eastern margins of the Kanab Creek valley in the North Private Lease, forming a continuous barrier to alluvial groundwater flow into or out of the Kanab Creek valley to the east or west. Because of this hydrologic isolation caused by the surrounding low-permeability bedrock, groundwaters in the North Private Lease are not associated with regional type groundwater flow systems.

Potentiometric data indicate that groundwater in the alluvial groundwater system flows through the subsurface from upstream valley locations across the norther boundary of the North Private Lease (See Appendix 7-16 for details including a potentiometric map included as Figure 18 that shows the groundwater flow directions – from which hydraulic gradients may also be determined). Direct infiltration of precipitation waters and, in irrigated areas, infiltration of irrigation waters likely also contributes recharge to the underlying alluvial groundwater systems. Within the North Private Lease, local increases in discharge rates in Kanab Creek occur, which are likely in response of the upwelling of alluvial groundwater into the Kanab Creek stream channel. However, pump testing of wells near Kanab Creek indicate that the alluvial groundwater near the creek exist under semi-confined conditions. Additionally, alluvial groundwater levels monitored in wells along the Kanab Creek stream banks indicate that the creek is locally perched above the underlying alluvial groundwater system, suggesting less than complete hydraulic communication between the stream and the underlying alluvial groundwater systems in these areas (See Appendix 7-16, Appendix 7-18, and Appendix 7-19 for further information).

Drilling information from areas laterally more distant from the Kanab Creek stream channel (on both the western and eastern sides of the creek) indicate that the alluvial sediments in these locations consist primarily of clays, silts, and fine-grained sands which are likely of low permeability (See Appendix 7-16 for details). Groundwater flow rates through these silty, clayey sediments nearer the margins of the Kanab Creek valley in the North Private Lease during pre-mining conditions are likely not large. This conclusion is also supported by the lack of appreciable springs or seeps occurring within or below the North Private Lease (that would indicate natural groundwater discharge from the alluvial groundwater system). This information suggests that the amount of alluvial groundwater flowing through the eastern and western margins of the Kanab Creek valley within the North Private Lease under pre-mining conditions is likely meager. It is noted that only one seep has been identified within the North Private Lease. This seep (Coyote Seep) is present in the bottom of an erosional scour (See Appendix 7-16). The erosional scour is deep enough to intersect the local elevation of the water table and thus water weeps from the alluvial groundwater system at that location. Discharge from Coyote Seep is meager or absent, with discharge usually being less than 1 gpm when flow is present.

Calculations of alluvial groundwater outflow at the southern lease boundary of the North Private Lease indicate that only relatively small quantities of groundwater exit the lease area in the bottom of the drainage through the subsurface. Calculations performed during May of 2017 indicate the groundwater subsurface outflow to be about 5 gpm. On the day the field investigation was performed, the measured surface-water flow in Kanab Creek (Station Kanab Creek @ C.R.) was 330 gpm. Thus, the total combined outflow of groundwater and surface water at that time was 335 gpm, indicating that 98.5 percent of the total quantity of water exiting the North Private Lease was surface water, and only 1.5 percent was alluvial groundwater outflow (See Appendix 7-19 for details).

The storativity of an aquifer is the volume of water released from storage per unit decline in hydraulic head. The storativity of an aquifer can range from zero to the value of effective porosity. Typically, the storativity of unconsolidated sediments in unconfined groundwater systems is somewhat less than the effective porosity value, because surface tension of water will result in some water being bound to the sedimentary particles by surface tension, and this water is retained in the sediments after gravity drainage. The unconsolidated sediments which comprise the matrix of alluvial groundwaters in the North Private Lease consist of clays, silts, sands, and gravels in varying proportions. Porosity values for these sediment types can range from about 25 to 50 percent, with some clays having porosity up to about 60% (Fetter, 1988). Typical average values of storativity (specific yield) reported for various types of unconsolidated sediments range from two to seven percent for clays and sandy clays, 18 percent for silts, from 21 to 27 percent for sands, and 22 to 25 percent for gravels and gravelly sand (Fetter, 1988).

Aquifer testing of alluvial groundwater systems near Kanab Creek in the central portions of the North Private Lease indicates that these systems exist under semi-confined conditions, with a storativity (storage coefficient) of 1.6 $x10^{-4}$.

Information on the saturated thicknesses of the alluvial groundwater systems in the North Private Lease is provided in Appendix 7-18 (see well logs and posted static water levels for alluvial monitoring wells). The total thickness of the alluvium in the central portions of the Kanab Creek valley at the North Private Lease area as encountered during drilling activities is up to about 114 feet at well CN2-70 (Appendix 7-18). The depth to water in the North Private Lease and adjacent area within the Kanab Creek valley is commonly in the range of about 13 to 35 feet. The saturated thickness of the alluvial sediments at CN2-70 was about 80 feet. As the thickness of the alluvial deposits thins toward the western and eastern portions of the Kanab Creek valley, saturated alluvial thicknesses are less (Appendix 7-18).

The transmissivity of an aquifer is equal to the hydraulic conductivity (K) times that saturated thickness of the aquifer (b) and may be represented as:

$$T = Kb$$

Because of the variable thicknesses of the saturated alluvial sediments in the North Private Lease area, values of transmissivity are determined locally based on the saturated thickness in the area of investigation.

Mining has not yet occurred within Areas 2 and 3 of the North Private Lease area (where alluvial groundwater systems are present), thus there are currently no backfilled overburden aquifers within North Private Lease mining areas 2 and 3. Mining in Area 1 has occurred, but mining in Area 1 has occurred in locations where the overburden has consisted almost entirely of Tropic Shale bedrock or weathered Tropic Shale sediments. No alluvial groundwater systems are present within Area 1.

Projection of Post-Mining Conditions

The values of hydraulic conductivity and storativity (which are mostly inherent in the physical properties of the aquifer matrix) of the alluvial groundwater system in the Kanab Creek valley outside of pit mining areas will not be appreciably changed in the post-mining environment at the North Private Lease. Depending on the length of time that mining pits remain open and the quantity of alluvial groundwater discharged to the mine pits during mining operations, it is possible that the aquifer saturated thickness could temporarily decrease in response to such groundwater withdrawals. Detailed information regarding the likely potential groundwater discharges under mining conditions is presented in Appendix 7-16. The information in this regard in Appendix 7-16 is based on the results of aquifer pump testing and analysis, and on analytical modeling of the alluvial groundwater system in the North Private Lease.

Within the backfilled mine pit areas, the post-mining aquifer properties of the fills will obviously be different from those of the pre-mining condition. The final aquifer hydraulic properties of the backfilled pit areas will be variable over the extent of the North Private Lease area. The aquifer parameters for specific backfilled pits will be a function of the types and mixtures of materials emplaced in the fill. As was the case during mining operations at the existing Coal Hollow Mine (south) area, mining activities in the North Private Lease will include excavating and handling overburden consisting of Tropic Shale bedrock and unconsolidated sediments consisting of clays, silts, sands, and gravels in varying proportions. A mixture of these materials will comprise the material backfilled into the completed surface mining pits. It is anticipated that the composition of the backfill will vary from location to location depending on the character of the materials being excavated concurrently with the time of the pit backfill.

In the absence of specific information on the hydrologic properties of future mine pit backfills (i.e. because the backfilled pits do not currently exist), it is difficult to make definitive determinations about what the final hydraulic properties of the placed backfill will be. However, using published ranges of values for various types of rocks and sediments, it is possible to estimate the ranges of hydraulic conductivity of materials that are anticipated to comprise the material used to backfill mine pits at the North Private Lease area. Based on the pervasiveness of silty and clayey materials in the lease area (See Appendix 7-16 and Appendix 7-18), and the likelihood that the run-of-mine backfill will contain appreciable quantities of these fine-grained materials, it is anticipated that hydraulic conductivities of the mixed backfill may fall in the lower range of silty sand or the range of silt, which is on the order of perhaps 10^{-5} to 10^{-6} cm/sec (Freeze and Cherry, 1979).

To the degree that the placed backfill contains large percentages of soft, waxy, bentonite-bearing Tropic Shale claystones, the hydraulic conductivity of such backfill material may be lower. In order to evaluate the permeability characteristics of the Tropic Shale, a sample of Tropic Shale bedrock was collected from the Coal Hollow Mine for laboratory testing of hydraulic conductivity. A drilling core consisting of unweathered Tropic Shale was analyzed at the laboratory to determine its hydraulic conductivity. The core sample was remolded and compacted at the laboratory prior to the analysis. The measured hydraulic conductivity of this sample was 8.24×10^{-8} cm per second. This value of hydraulic conductivity likely represents a lower limit to the projected range of hydraulic conductivity for the backfill material (i.e. this could possibly be similar to the hydraulic conductivity of the placed backfill if it were to be composed entirely of soft Tropic Shale bedrock that became tightly compacted – which is not considered to be a likely occurrence.

The storativity of the placed backfill will likely be a function of the degree to which the placed material compacts and the grain-size distribution of the material.

The transmissivity of the placed backfill will be a function of the extent to which the backfilled areas re-saturate with water and change over time (discussed below).

It is anticipated that groundwater that may potentially accumulate within the placed backfill will occur under unconfined or semi-confined conditions. This is because, assuming vertical recharge from the surface into the backfill sediments, in order for the backfill sediments to become saturated, downward vertical groundwater flow (recharge) to the backfill sediments would need to occur. If low-permeability confining layers were present in the fill, these would inhibit the downward movement of groundwater, potentially resulting in perched, unconfined groundwater conditions with potentially discontinuous zones of saturation.

As indicated in R645-731-112, surface-mining fill areas are excluded from the requirement to restore approximate premining recharge capacity and to allow movement of water to the ground-water system. As discussed in a following section of this document below, ACD proposes to emplace low-permeability sediments along the eastern margins of mine pits where the pit areas are juxtaposed to undisturbed portions of the alluvial groundwater system. The low-permeability barrier will create a degree of isolation between the undisturbed and disturbed portions of the groundwater systems in Areas 2 and 3 at the North Private Lease.

Division Information Request item

Anticipated post-reclamation potentiometric surface and estimated time to resaturate

As discussed previously, it is considered possible that water level drawdowns will occur adjacent to mine pit areas if alluvial groundwater is intercepted by the mine pits in appreciable quantities. This occurrence is further described in Appendix 7-18. However, such occurrences, if they occur, are anticipated to be short lived. As discussed above, alluvial groundwater entering the North Private Lease beneath the northern lease boundary is sourced largely from up-gradient areas. That alluvial groundwater continues to flow down-gradient in a southerly direction across the North Private Lease. After mining in the North Private Lease is completed, alluvial groundwater will continue to flow across this boundary providing recharge to down-stream alluvial aquifers in the North Private Lease area. Additionally, as described in Appendix 7-16, water levels in the alluvial groundwater systems in the North Private Lease are similar to the local elevation of Kanab Creek. Post-mining recharge to the alluvial groundwater systems in the

North Private Lease could occur as a result of the direct infiltration of precipitation waters in unmined areas as well as infiltration of irrigation waters in irrigated farm fields located up-gradient of mining areas. Additionally, infiltration of surface-waters from Kanab Creek into the underlying alluvial sediments in the North Private Lease area will likely contribute to post-mining recharge of alluvial groundwater systems. However, the apparent weak hydraulic connection between the stream channel and the underlying alluvial groundwater systems in the central portion of the North Private Lease would likely retard recharge rates from the creek to the groundwater system in that area (See Appendix 7-18 for further information). Based on the quantities of alluvial groundwater that are anticipated to be intercepted by the mine pits in the North Private Lease, it seems reasonable to estimate that water levels in the alluvial groundwater system in the North Private Lease could recover to near pre-mining levels within a few years or less (depending on the climatic conditions prevailing in the region at the time).

In the absence of specific information on the actual hydrologic properties of future mine pit backfills (i.e. because the backfilled pits do not currently exist), it is difficult to make definitive determinations of the time it will take for the placed backfill in reclaimed mine pits to become water saturated. However, information useful in making as a first order approximation is presented below.

Generally, the rate at which backfilled mine pits become saturated is related to the amount of recharge water available, the hydraulic conductivity of the backfill sediments, and the effective porosity of the sediments.

Field observations in the North Private Lease and surrounding areas have shown that as a result of the clayey surface sediments in the area, runoff from torrential precipitation events and snowmelt events is substantial. During light to moderate precipitation events, precipitation waters are readily absorbed into the upper few inches of clayey soil, where they are subsequently lost to evaporation or consumed by vegetation (particularly during the warmer portions of the year). Considering these factors, it is considered likely that the percentage of the annual precipitation that infiltrates below the rooting zones and recharges underlying groundwater systems is probably not large.

As indicated in Section 724.411, precipitation in the Coal Hollow Mine area averages about 16 inches annually. If it is arbitrarily assumed that that 90 percent of the annual precipitation is lost to surface runoff and evapotranspiration, then 10% (1.6 inches or 0.13 feet) would be available for groundwater recharge. Under this scenario, it is assumed that the effective porosity of the placed backfill is on the order of 15% (typical to lower range for various unconsolidated sediment types; Fetter, 1988). Thus, infiltrating 0.13 feet of water into material with 15% porosity would result in a saturation of a 0.87-foot thickness of material. Using these relationships, a first order approximation of the time to fully saturate a mine pit that is 80 feet deep could be determined by dividing the total number of feet of backfill thickness by the per-year infiltration rate. In this arbitrary example, the time required to saturate the backfill would be 80 feet of thickness divided by 0.87 feet of infiltration per year, or about 92 years. Similarly, using the same methods, if the average percentage of the annual precipitation water available for groundwater recharge were doubled to 20%, a time to fill for a 80-foot deep mine pit would be 46 years. In the unlikely scenario that half of the annual 16 inches of precipitation were available to recharge the pit area, then a time to re-saturate of about 18 years would be calculated.

It should be noted that these calculations are all based on the assumption that recharge to the backfilled pits will occur primarily from downward vertical recharge of precipitation waters. As discussed previously, the potential for lateral migration of groundwater through the low-permeability Tropic Shale highwalls of reclaimed mine pits is minimal. Additionally, the potential for lateral migration of alluvial groundwaters into the reclaimed mine pit areas from surrounding undisturbed alluvial groundwater systems will be minimized by the emplacement of low-permeability materials along the margins of the mine pits.

In making these first-order projections, it is important to consider that other factors may also significantly influence the time required for backfilled pits to eventually re-saturate. Some of these include the existing saturation state of the materials at the time the materials are placed as backfill, and the potential that infiltrating precipitation waters could be held under perched conditions on impermeable strata. Under such conditions, the downward migration rates could be so slow that it could take many years for the water to migrate vertically to the base of the backfilled pit and potentially resulting in discontinuous zones of saturation. Additionally, in low-lying areas where ponding of surface runoff can occur, a greater percentage of the precipitation water could infiltrate into the underlying backfill areas. Contrastingly, in sloped areas where the runoff of precipitation is favored, infiltration rates could be significantly lower.

As discussed in Section R645-301-731.200, in order to better characterize the actual aquifer conditions in backfilled mine pit areas in the North Private Lease, Alton Coal Development proposes to construct a monitoring well (if it is possible to do so) within the backfill of mine pit 12 when the mining in that area is complete and the pit is backfilled. This well may then be used for the purposes of 1) monitoring the rate at which the backfilled material re-saturates over time, and 2) eventually for the purpose of performance of aquifer testing to determine the aquifer characteristics of the placed backfill material after the sediments have become adequately saturated for such tests to occur.

Division Information Request item

Post-reclamation effects on adjacent aquifers, wells, springs, and surface waters

As discussed previously, the alluvial groundwater system in the Kanab Creek valley is bounded on both the east and west by continuous upland ridges of low-permeability Tropic Shale bedrock. Accordingly, because of this hydrologic isolation, potential impacts to groundwater or surface-water resources (adjacent aquifers, wells, springs, or surface waters) located to the east or west of the proposed Areas 2 and 3 mining areas outside of this well-defined region in the North Private Lease are not anticipated.

No springs or seeps were identified in alluvial groundwater systems down-gradient of Areas 2 and 3 of the North Private Lease for a distance of at least one mile (See Appendix 7-16 for details). Thus, impacts to flow rates in alluvial springs below the lease area as a result of the proposed mining activities are not anticipated. Recent aquifer testing of the alluvial groundwater system at the southern North Private Lease boundary suggests that the quantity of alluvial groundwater exiting the lease under the pre-mining condition at this southern boundary is not large (~5 gpm) under current conditions (See Appendix 7-19 for details). Consequently, in the absence of identified appreciable discharge of alluvial groundwater below the lease boundary, modest, temporary declines in water levels in the shallow alluvial groundwater system should not result in substantial impacts (i.e. the approximately 5 gpm contribution of alluvial groundwater discharge is small relative to the quantity of surface water that is available in the stream (with a total outflow at the southern lease boundary of 98.5% creek water and 1.5% alluvial groundwater flow through the underground alluvial sediments). Some modest, short-term decreases in discharge rates in Kanab Creek could occur as the alluvial groundwater systems in up-gradient areas in the North Private Lease are gradually resaturated after mining in the area is complete.

Division Information Request item

Backfilling Tropic Shale in Pit 20 and Pit 21 will increase TDS in the alluvial aquifer. The amendment must address how earth materials will be handled to protect groundwater quality and prevent the harmful infiltration of increased TDS into the alluvial aquifer.

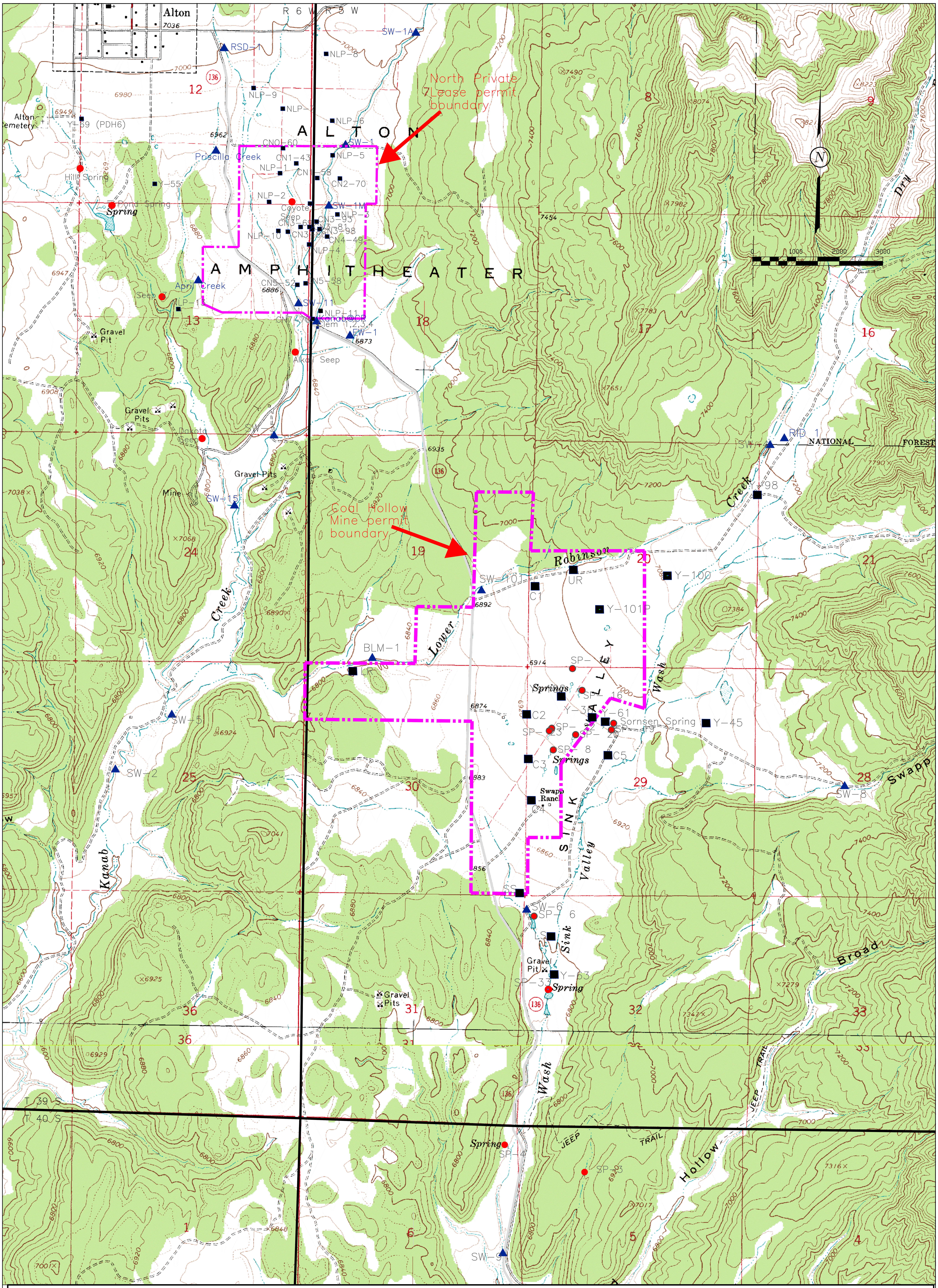
Reclaimed land surfaces in the North Private Lease will be graded to promote runoff of surface waters overlying backfilled areas, thus minimizing the potential for infiltration of precipitation waters into backfilled areas.

Additionally, to further minimize the potential for water quality in North Private Lease alluvial groundwaters to become degraded as a result of interactions with soluble minerals in the run-of-mine backfill material in reclaimed mine pit areas, Alton Coal Development, LLC will, where reasonably feasible, place low-permeability materials (likely clayey alluvium or Tropic Shale) along the margins of the mine pits adjacent to undisturbed Kanab Creek alluvium. It is anticipated that the TDS concentrations of groundwaters that may accumulate in the reclaimed mine pits will be higher than those of surrounding alluvial groundwater systems as a result of chemical interactions with the various naturally occurring minerals present in the backfill. Through the placement of a low-permeability barrier along the margins of the mine pit areas, alluvial groundwaters in the undisturbed alluvial groundwater systems near the Kanab Creek stream channel will be largely isolated from the reclaimed mining areas located to the west. In other words, the potential for lateral migration of higher-TDS groundwaters potentially present in backfilled areas toward undisturbed alluvial groundwaters near Kanab Creek will be minimized.

References Cited

Fetter, C.W., 1988, Applied Hydrogeology, Merrill Publishing Company, Columbus, Ohio, 592 p.

Freeze, R.A., and Cherry, J.C., 1979, Groundwater, Prentice-Hall, Incl, Englewood Cliffs, New Jersey, 604 p.



LEGEND:

COAL LINE

PERMIT BOUNDARY

COUNTY ROAD

SPRING MONITORING STATION

SURFACE WATER STATION

WELL MONITORING STATION

DRAWN BY:	CHECKED BY:
C. McCOURT	ECP
DRAWING:	DATE:
7-10	8/26/09
	SCALE:
	1" = 1000'
JOB NUMBER: 1400	SHEET

REVISIONS

DATE:	BY:
11/14/12	KN
10/25/13	KN
11/06/14	KN
10/05/15	KN
06/16/17	KN

WATER MONITORING LOCATIONS

COAL HOLLOW PROJECT
ALTON, UTAH

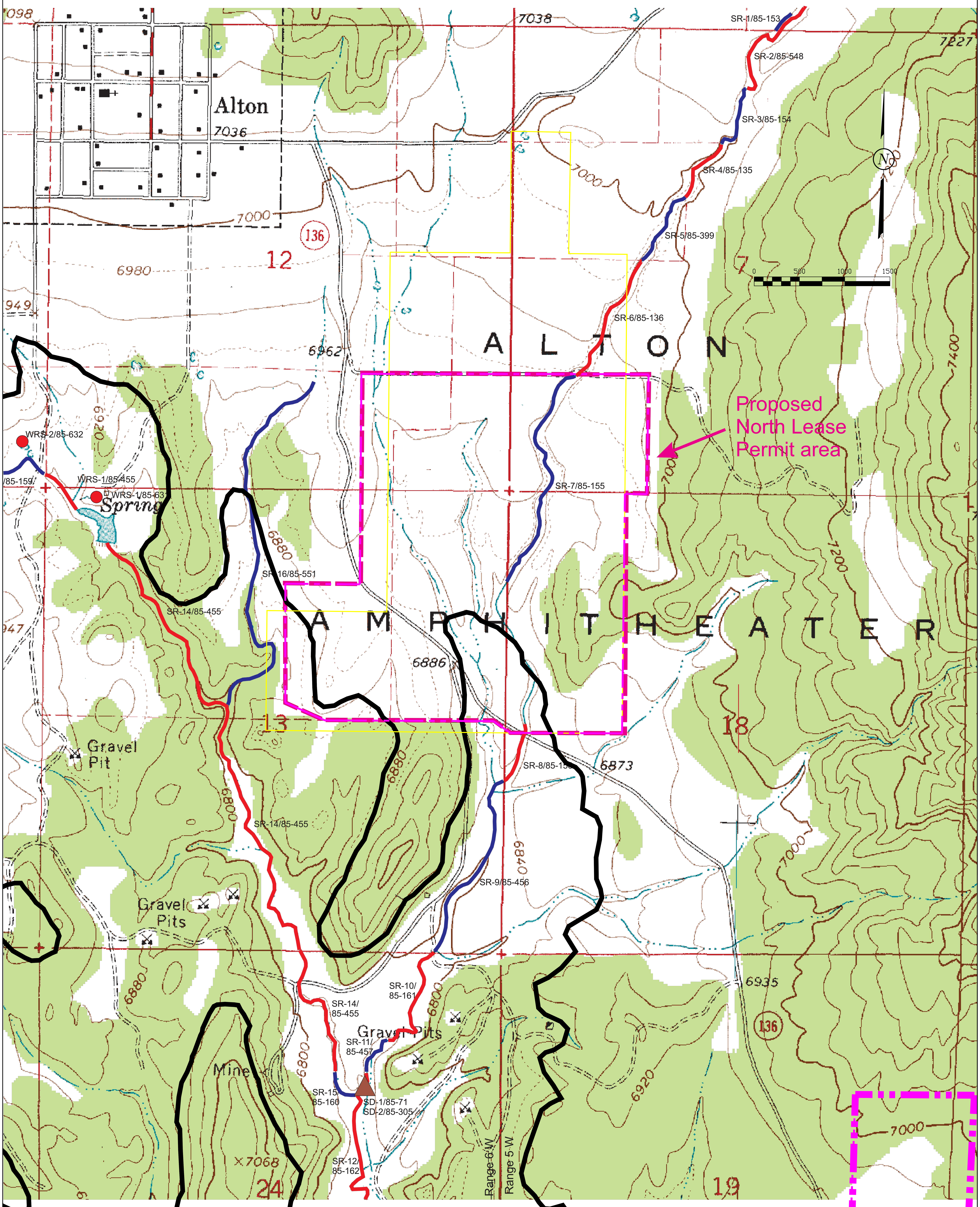
DRAWING: 7-

ERIK CARL PETERSEN
5373615-2250

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192

R6W R5W



LEGEND:	DRAWN BY:	CHECKED BY:	REVISIONS		PROJECT AREA WATER RIGHTS
PERMIT BOUNDARY	K. NICHOLES	E. PETERSEN	DATE:	BY:	
COAL LINE BOUNDARY	DRAWING:	DATE:			
COUNTY ROAD	7-3N	03/17/15			COAL HOLLOW PROJECT ALTON, UTAH
● WRS SPRING		SCALE: 1" = 500'			
▲ SD SURFACE DIVERSION	JOB NUMBER:	SHEET			
SR SURFACE REACH	0001				DRAWING: 7-3N

ERIK CARL PETERSEN
5373615-2250
State of Utah

Alton Coal Development
Coal Hollow Project

463 North 100 West, Suite 1
Cedar City, Utah 84721
Phone (435)867-5331
Fax (435)867-1192