Appendix 5-K

Wild Horse Ridge

Tank Seam Pad

And Access Road

LICENSED PROFESSIONAL ENGINEER
MARK A. REYNOLDS
5049079-2202
STATE OF UTAH

File in:
- ☐ Confidential
- ☐ Shelf
- ☒ Expandable

Refer to Record No 0084 Date 9/14/07
In C/ 0150025, 2007, Incoming
For additional information

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Introduction

This Appendix discusses the construction of the Wild Horse Ridge Tank Seam access road and portal pad. (Areas TS-16 and TS-17 on Plate 2-3G) Cut and Fill volumes have been determined for the road and pad and are summarized in Tables 5K-1 and 5K-2. Also included is an operational slope stability analysis and a reclaimed slope stability analysis. Pre-mining, Operational and Post-mining cross-sections are detailed in Attachment B of this Appendix. The as built slopes are at the same angle as the design analysis for slope stability.

TS-16 Constructions Description

Construction in this area included the widening of the switchback and adding two passing areas in the road. Construction began at the switchback and the material cut out of the side of the mountain to widen the turn was used just below the switchback and in the area around cross-section 4 to widen the road in these areas. Topsoil was recovered to a depth of 6-10 inches from the areas where the road was widened generating approximately 124 cu. yd. of material. The topsoil generated at the switchback was used at the same slope.

The area included in TS-16 will not be reclaimed but will be used for post mining access to the hunting cabin as described on page 4-7. During construction silt fences will be used below all cut and fill areas. Upon completion of construction all disturbed slopes will be covered will erosion control matting and reseeded (See Appendix 7-K). Cut slopes, fill slopes, and fill placement will follow the recommendations given in the Slope Stability analysis and report, included in Attachment B. A summary of the cut and fill volumes is shown Table 5K-1. Cross-Sections are shown in Attachment A.

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Table 5K-1

TS-16 Summary of Cut and Fill

Cross Section	Cut Vo. (Cu Yds.)	Topsoil (Cu Yds.)	Fill Vol. (Cu Yds.)	Excess (Cu Yds.)	Amount Hauled	Avg Haul Dist. (Ft)	Cum. Vol. (Cu Yds.)
1	1,982	~36	1,291	655 cut	161	450	-655
2	741	~28	860	147 Fill	-0-	-0-	-508
3	52	~30	319	297 fill	-0-	-0-	-211
4	35	~30	161	156 fill	-0-	-0-	-55
Totals	2,810	~124	2,631		161	450	

TS-17 Construction Descriptions

Construction will began at the hunting cabin turn off. Topsoil was removed form the project cut areas (Table 5K-2) and placed in the WHR Tank Seam Topsoil Stockpile located east of the pad. Material was then removed from the road cuts and compacted around the outside of the switchbacks located inside the area in order to allow it to be widened. As the cut progresses into the pad, topsoil was removed prior to the road cut being made and placed in the storage pile. Cuts were made starting at the east end of the pad and moving towards the west. Most of the material will be hauled approximately 200 ft. and placed at the Cross-sections are shown in attachment A.

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Table 5K-2

TS-17 Summary of Cut and Fill Volumes

Area	Cut Vo. (Cu Yds.)	Topsoil (Cu Yds.)	Fill Vol. (Cu Yds.)	Excess (Cu Yds.)	Amount Hauled	Avg Haul Dist. (Ft)	Cum. Vol. (Cu Yds.)
0+00	0	0	2,445	2,445 fill	2,445	300	2,445
0+50	0	0	3,038	3,038 fill	3,038	300	5,483
1+00	30	0	2,179	2,149 fill	2,149	300	7,632
1+50	50	0	2,056	2,006 fill	2,006	300	9,638
2+00	1,909	0	,1,046	863 cut	-0-	-0-	8,775
2+50	5,447	0	,1,446	4,001 cut	-0-	-0-	4,774
3+00	3,791	0	1,844	1,948 cut	-0-	-0-	2,826
3+50	2,375	0	676	_1,699 cut	-0-	-0-	1,124
4+00	1,453	0	240	1,213 cut	0	0	86
Totals	15,055	1,760	14,969		9,638	300	

Topsoil depths vary from 6-10 inches along the access road and are 8 inches at the pad site, but may be as deep as 20 inches along the northeast edge of the pad (Appendix 2-G). Assuming a topsoil depth of 8 inches approximately 1,400 cu. yds. of topsoil will be recovered from the construction area. The topsoil stockpile holds 1,760cu yds. of material. 0.71 acres need to be reclaimed.

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Silt fences will be placed below the disturbed area before both construction and reclamation begin. During the initial road cut, care was taken to prevent disturbed material from migrating downslope in the following manner. The initial removal was made using a backhoe. Trees and/or shrubs immediately ahead of the cut was removed by pulling them back into the previous cut. Using the backhoe, a berm was created on the downhill side of the cut, as shown in Figure 5G-1. When the berm was in place, the road cuts started as shown in Figure 5G-1 and 5G-2 using a backhoe and/or front end loader. The road cuts was made into the slope towards the cut face rather than parallel to the slope, which resulted in any rocks or sloughage dislodged by the equipment during the road cutting to be contained within the berm.

Cut slopes, fill slopes, and fill placement will follow the recommendations given in the Slope Stability analysis and report, included in Attachment B. Large boulders will also be placed according to the report. Where possible, care will be taken to avoid disturbing large trees of commercial value and any canyon sweetvetch plants located in the area (see chapter 3). Exposed slopes will be covered with erosion control matting as described in Appendix 7-K.

This procedure was followed for the construction of the Tank Seam portal pad as well. A road was cut across the entire length of the pad and a berm established. The backhoe was then turned into the mountain and start widening the pad, first recovering the topsoil.

Final crowning of the road, laying of road base and installation of permanent ditches was completed following the initial road contouring. The road contours are shown on Plate 5-2G.

During reclamation, the cut and fill process described above will be reversed. The reclaimed slopes will be reconstructed to approximate original contour. Subsoil material will be compacted in a minimum of 12 inch lifts. A minimum 8" of topsoil will be placed un-compacted over the regraded area. Topsoil material will be pocked to aid in water retention and runoff control during vegetation establishment (See Appendix 7-K). 1The 1,000 cu. yds. used in TS-15 and any material used in TS-7 and TS-8 will be replaced by material from TS-5 during reclamation. All material moved will be sampled for toxicity according to table 5O-1

Most areas of the road will remain in place for post-mining access to a hunting cabin. These areas are shown on Plate 2-3G and are labeled "area not requiring recontouring or topsoil within the disturbed boundary". The remaining areas of the road will be completely removed and used for fill material during the cut and fill process and the pre-mining road will be restored as shown on the cross-sections in Attachment A. A more detailed description of the hunting cabin can be found on page 4-4 of the MRP. No culverts will be removed since they are needed for access to the hunting cabin. During construction 1,000 cu. yds. Of material was hauled to TS-15 as described on page 5J-13. Any additional material generated due to miner variations will be hauled to TS-7 and TS-8 for reclamation in those areas.

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Attachment A

Cut and Fill Calculations

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Volume measurements were made using "Quicksurf" 3D modeling software with AutoCad. They are based on the contours shown on Plate 5-7G for pre-mining configuration, Plate 5-2G for operational configuration, and Plate 5-6G for post-mining configuration. Cross-sections for each configurations are shown on the following pages. The locations of the cross-sections are shown on Plates 5-6G and 2-3G.

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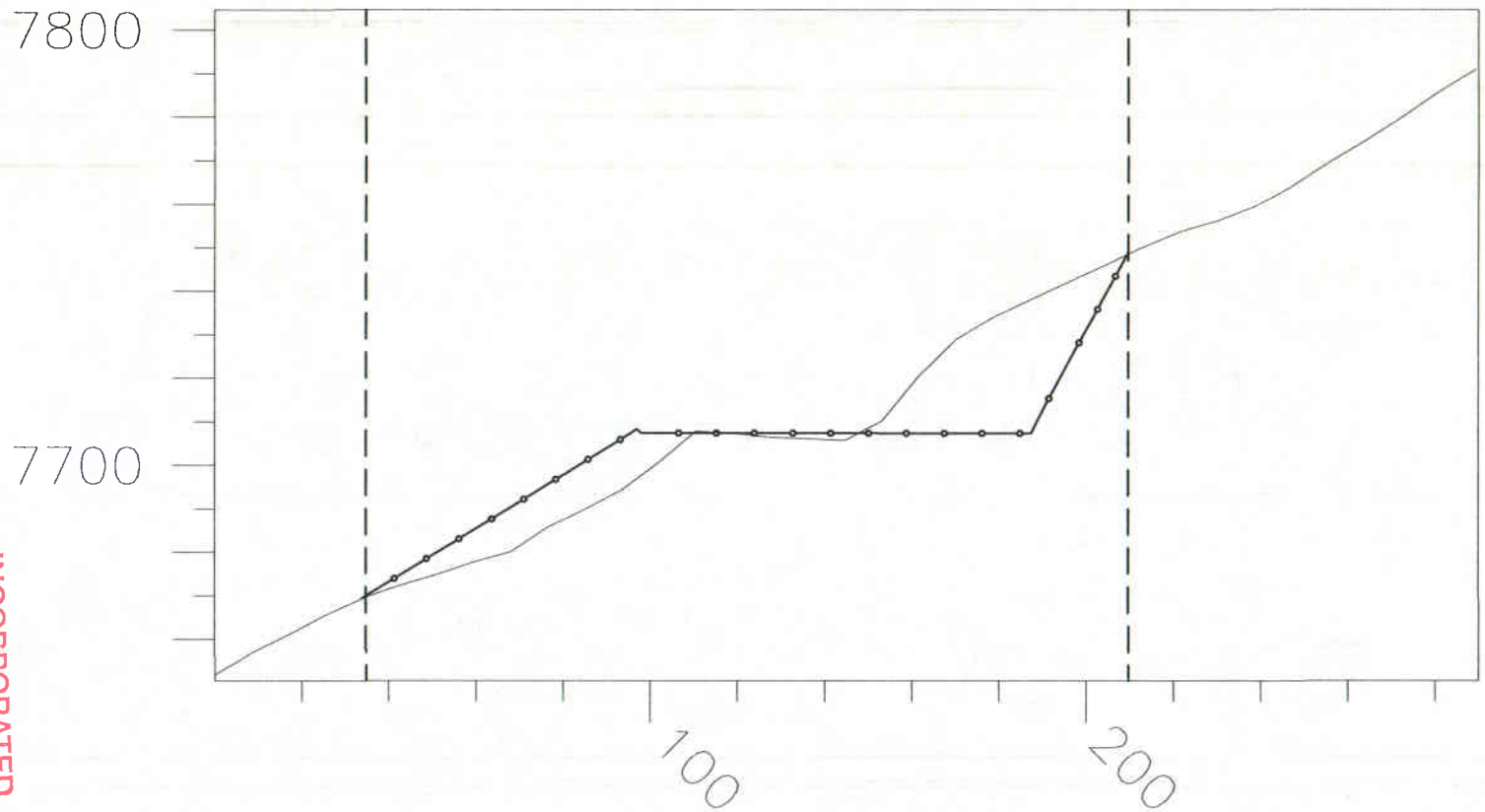
CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 40'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Lower Access Road	

Pre-Mining
Post-Mining/Operation
Dst. Boundary

TS-16 Section 1



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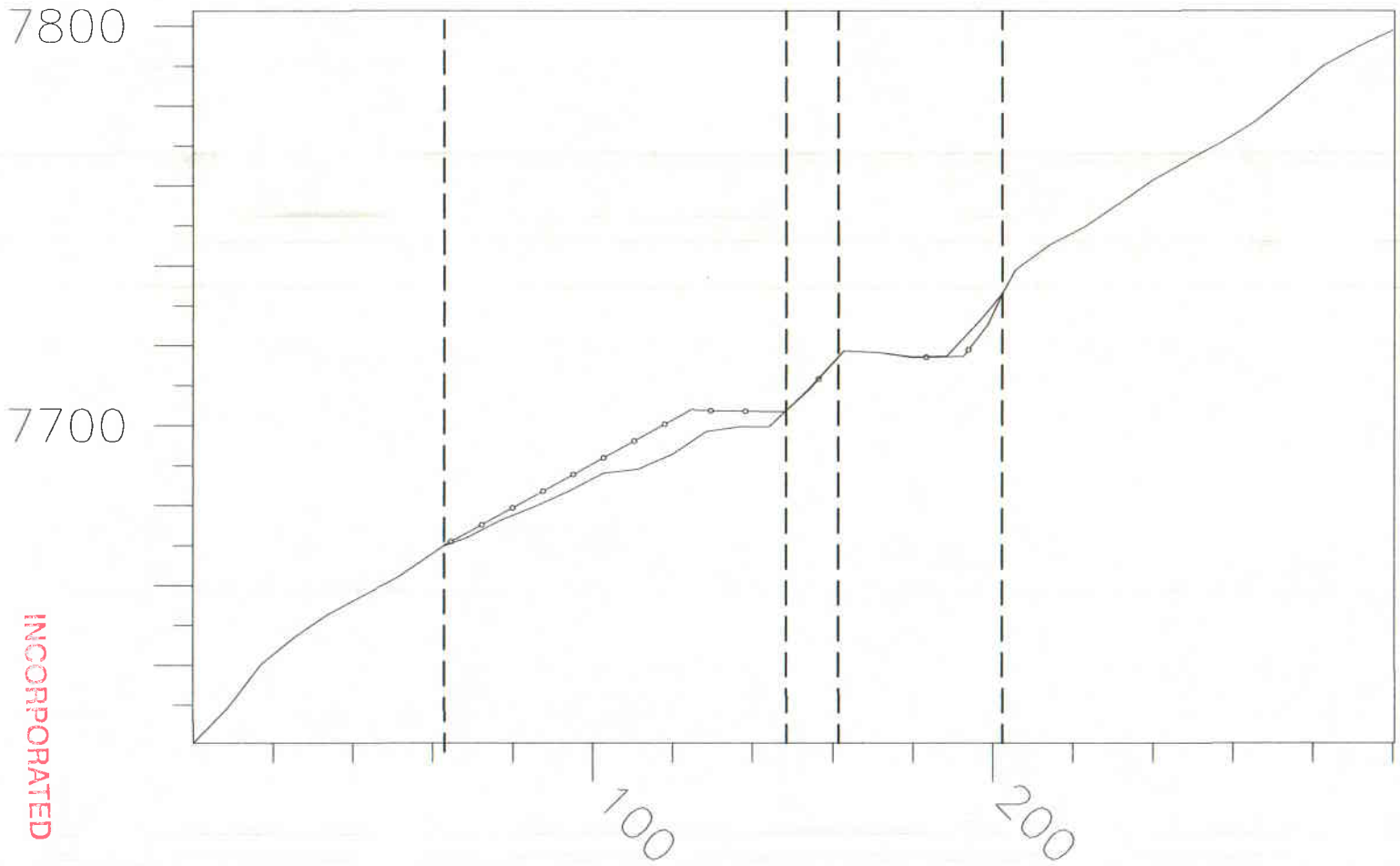
CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 40'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Lower Access Road	

Pre-Mining
Post-Mining/Operation
Dst. Boundary

TS-16 Section 2



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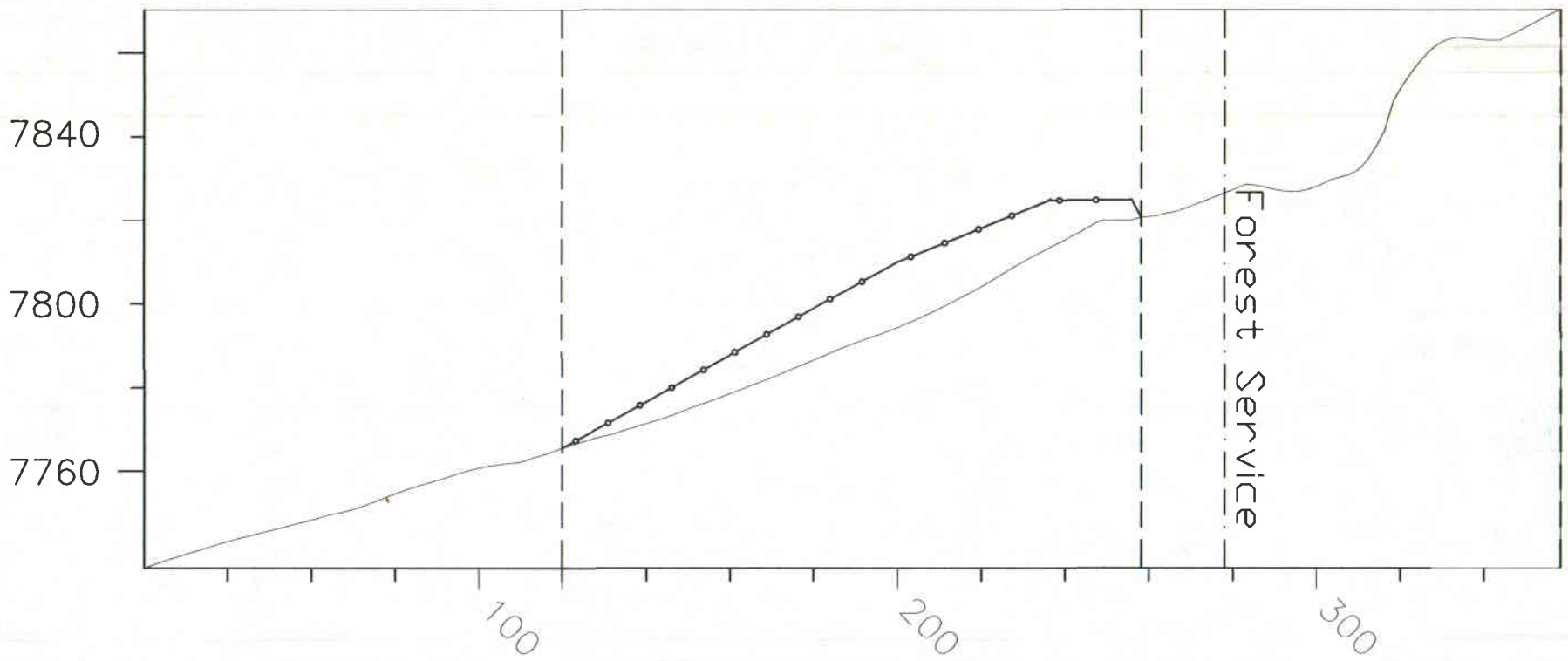
CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 40'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS-17 Section 0+00



CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 40'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

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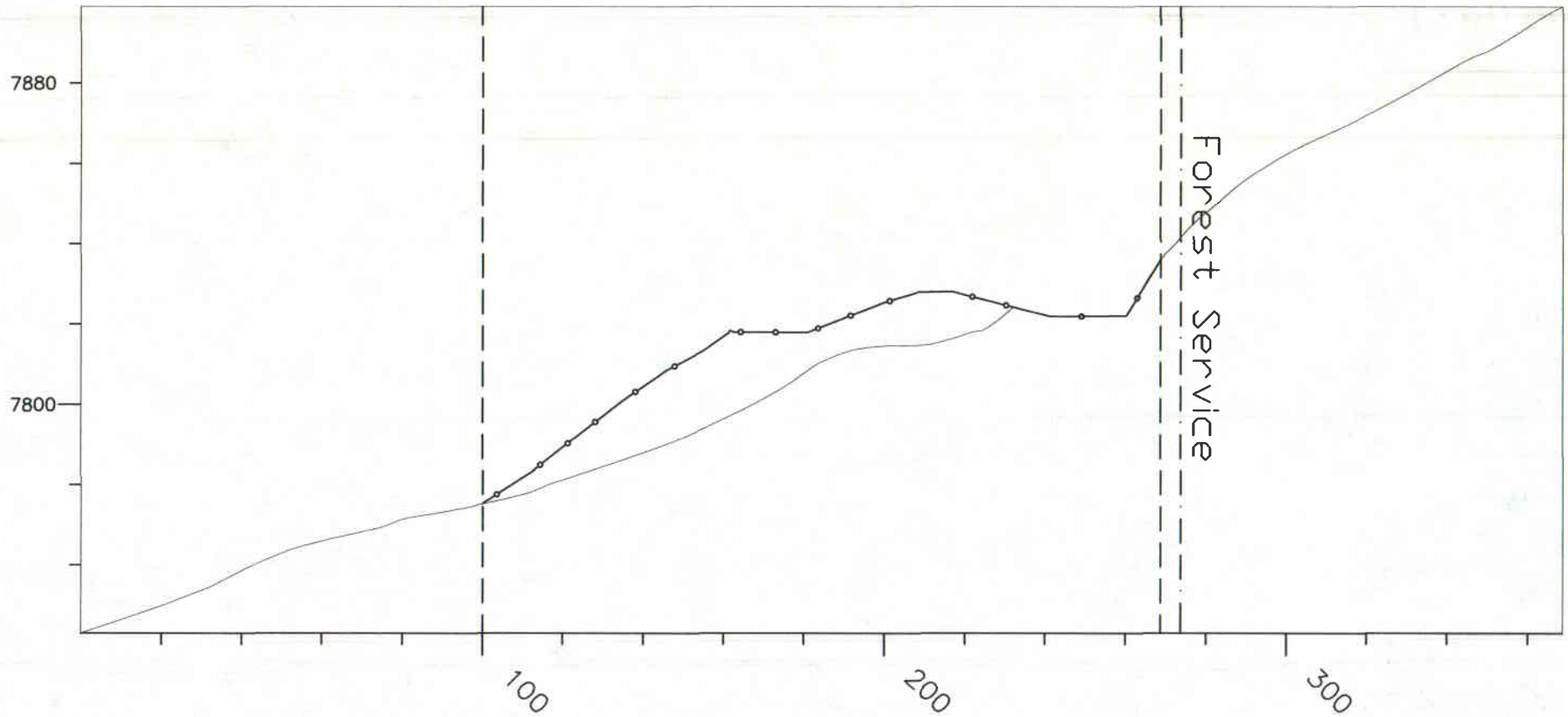
Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS-17 Section 0+50



CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 50'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

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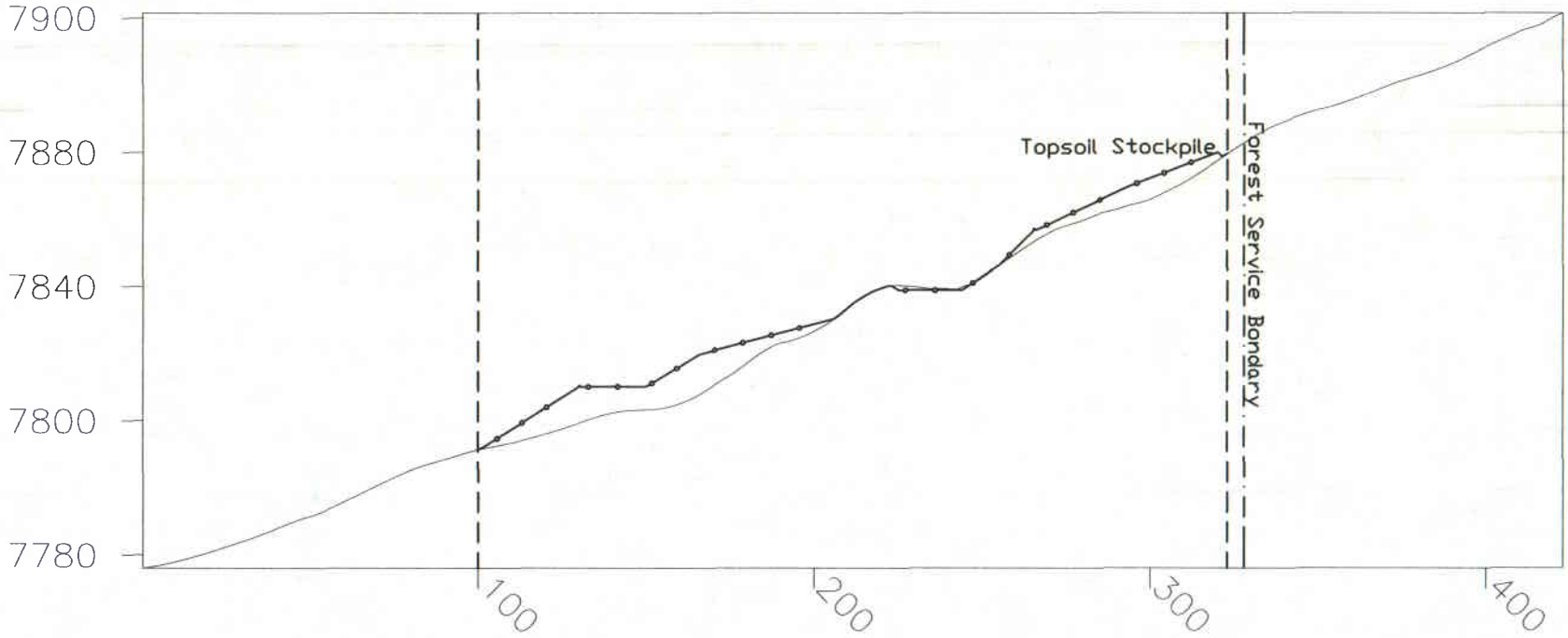
Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS-17 Section 1+00



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SURFACE FACILITIES		
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BEAR CANYON	WHR Tank Seam Access Road	

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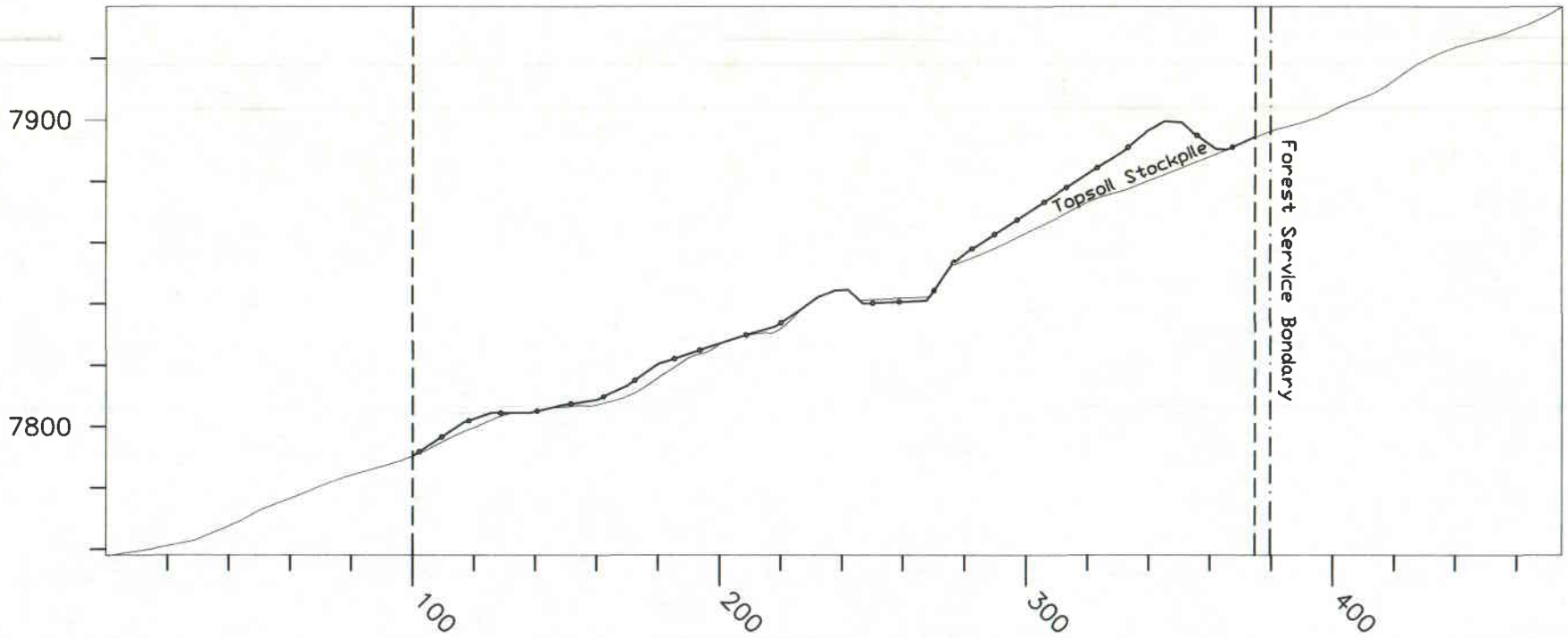
Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS-17 Section 1+50



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SURFACE FACILITIES		
SCALE: 1" = 60'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

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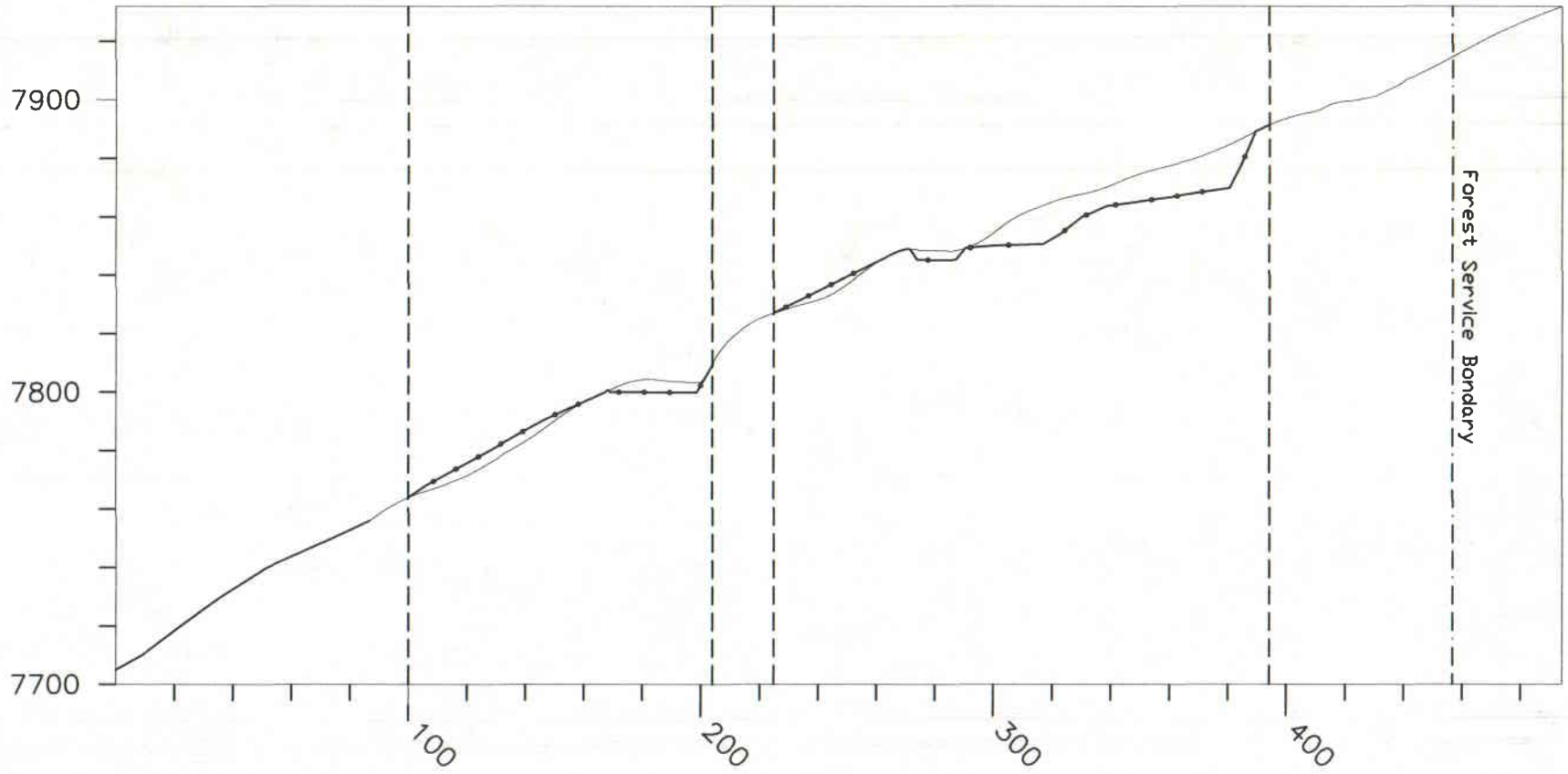
Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS 17 Section 2+00



CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 60'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

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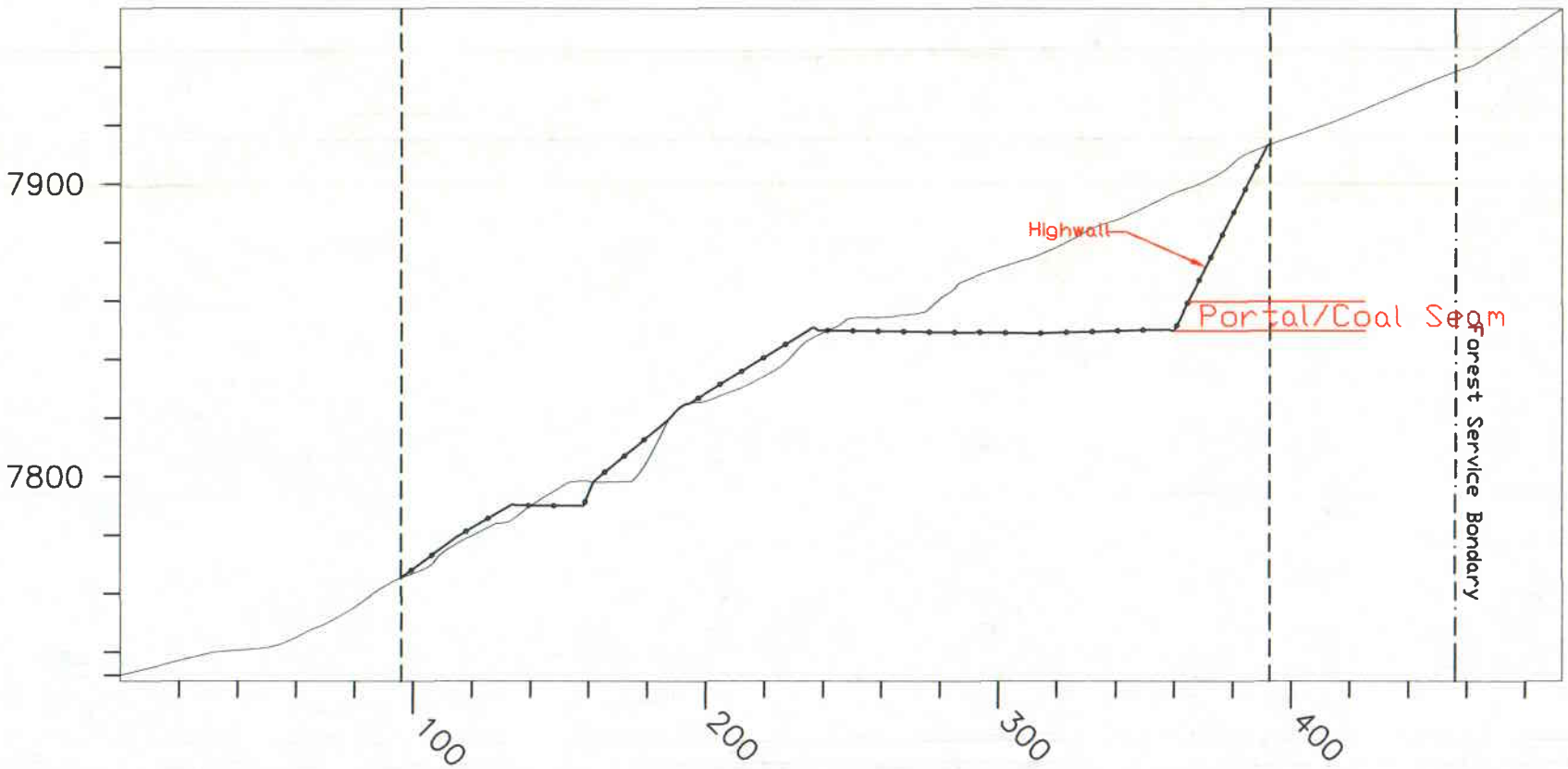
Pre/Post Mining
Operation
Dst. Boundary
Forest Service

TS-17 Section 2+50



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SURFACE FACILITIES		
SCALE: 1" = 70'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

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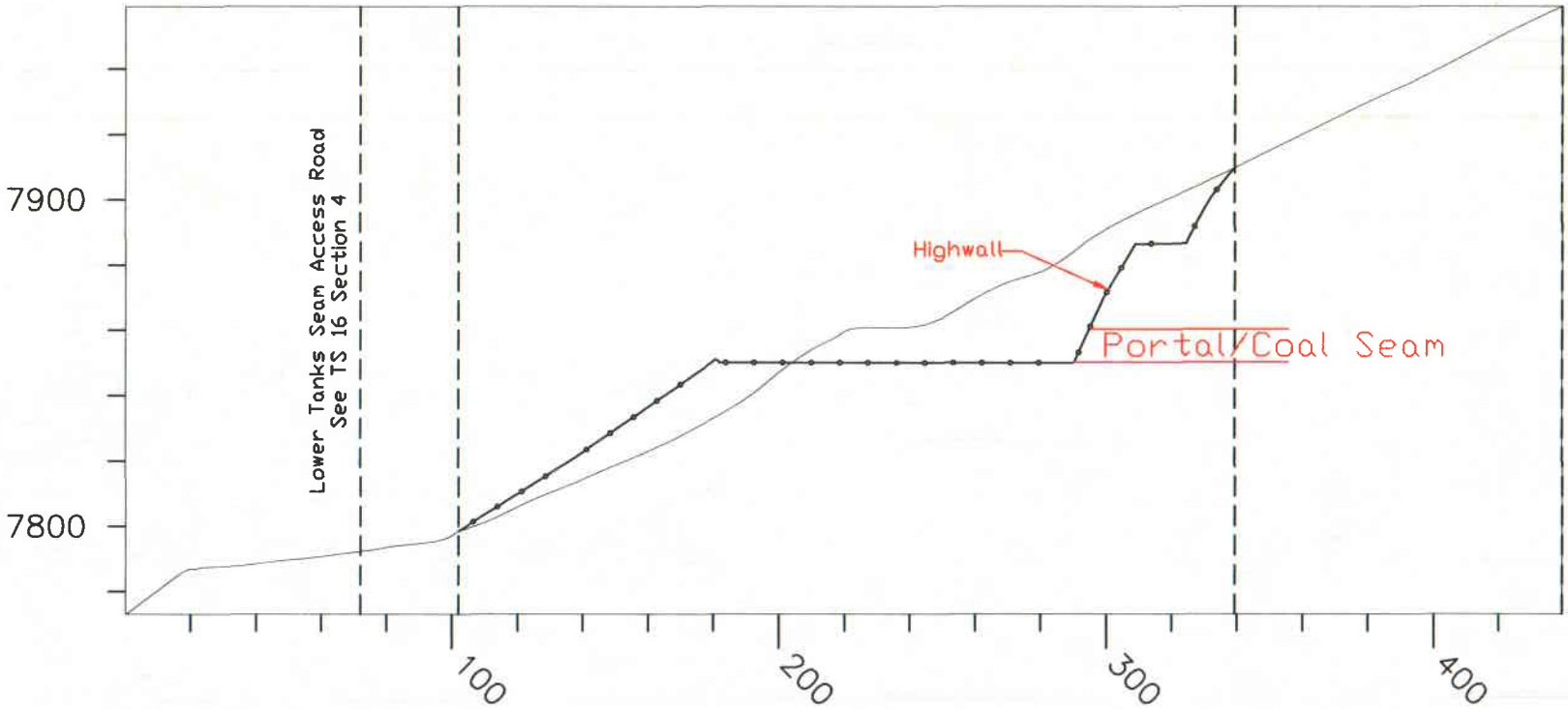
Pre/Post Mining
Operation
Dst. Boundary

TS-17 Section 3+00



CO-OP MINING CO.
HUNTINGTON, UTAH

SURFACE FACILITIES

SCALE:	DRAWN BY:	DATE:
1" = 45'	M. Reynolds	5/09/06

BEAR CANYON | WHR Tank Seam Access Road

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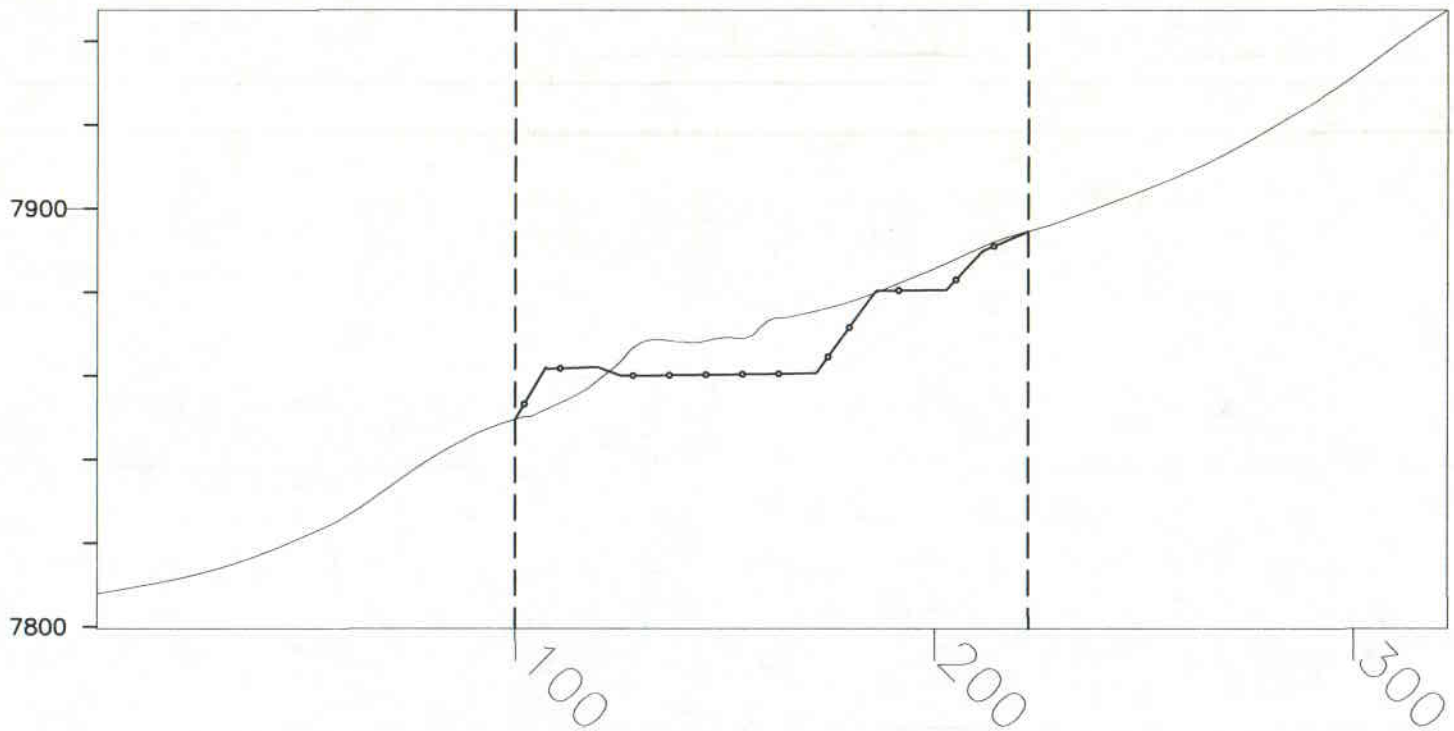
Pre/Post Mining
Operation
Dst. Boundary
Topsoil

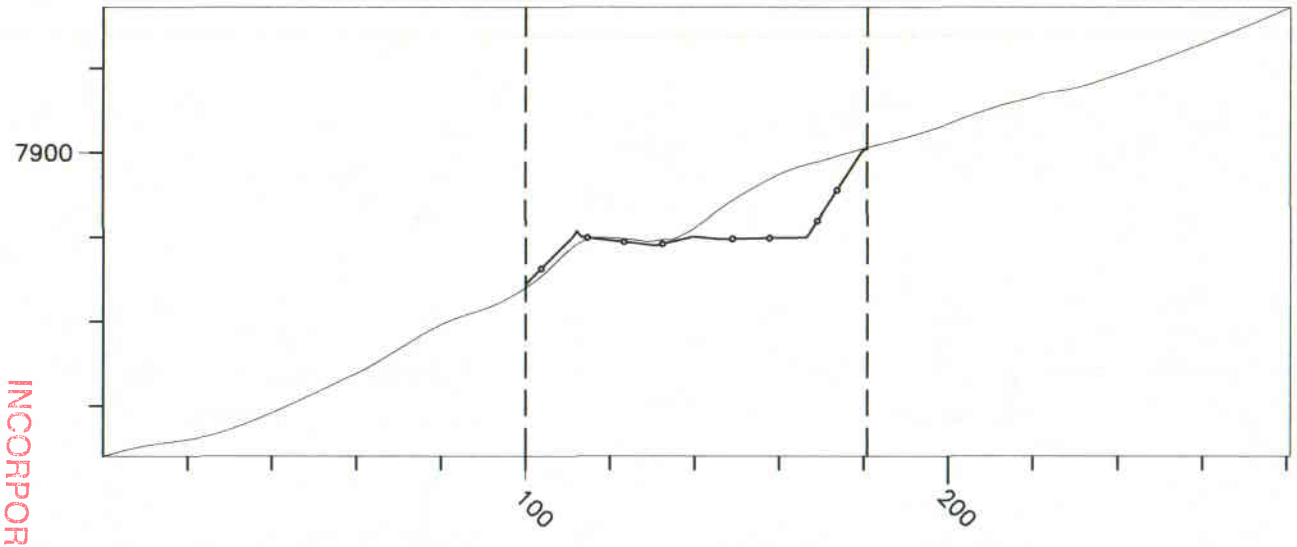
TS 17 Section 3+50



CO-OP MINING CO. HUNTINGTON, UTAH		
SURFACE FACILITIES		
SCALE: 1" = 45'	DRAWN BY: M. Reynolds	DATE: 5/09/06
BEAR CANYON	WHR Tank Seam Access Road	

Pre/Post Mining
Operation
Dst. Boundary

TS Section 4+00



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Inter-Mountain Laboratories, Inc
1673 Terra Avenue, Sheridan Wyoming 82801
(307) 672-8945

Soil Analysis Report

CW Mining Company
P.O Box 1245
Huntington, UT 84528

Report ID: S0704392001

Date: 5/17/2007
Work Order: S0704392

Project: C W Mining
Date Received 4/25/2007

Lab ID	Sample ID	pH	Saturation	Electrical Conductivity	Organic Matter	Calcium	Magnesium	Sodium	SAR	Alkalinity PE
		s.u	%	dS/m	%	meq/L	meq/L	meq/L		meq/L
S0704392-001	RFM-5 Floor	8.0	30.2	4.82	4.3	24.0	19.0	16.0	3.44	1.88
S0704392-002	RFM-5 Roof	8.0	58.8	0.40	6.0	1.17	1.65	0.61	0.51	1.67
S0704392-003	RFM-5 Seam	7.8	73.1	0.38	1.8	1.52	0.72	0.77	0.73	1.36
S0704392-004	RFM-6 Floor	8.5	28.6	0.41	3.7	0.58	0.73	2.26	2.80	2.40
S0704392-005	RFM-6 Roof	7.8	31.7	0.82	8.7	2.82	2.95	1.06	0.62	3.34
S0704392-006	RFM-6 Seam	8.1	69.3	0.26	4.2	0.72	0.35	1.01	1.38	1.25

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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 Laboratories Inc
1673 Terra Avenue Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report

CW Mining Company
P O Box 1245
Huntington, UT 84528

Report ID S0704392001
Date 5/17/2007
Work Order S0704392

Project C W Mining
Date Received 4/25/2007

Lab ID	Sample ID	Sand %	Silt %	Clay %	Texture	Nitrogen Nitrate ppm	Phosphorus ppm	CO3 %
S0704392-001	RFM-5 Floor	56.0	28.0	16.0	Sandy Loam	1.92	1.16	33.3
S0704392-002	RFM-5 Roof	94.0	5.0	1.0	Sand	0.12	0.57	3.7
S0704392-003	RFM-5 Seam					0.12	0.82	0.5
S0704382-004	RFM-6 Floor	46.0	27.0	27.0	Sandy Clay Loam	0.18	0.40	2.3
S0704392-005	RFM-6 Roof	74.0	17.0	9.0	Sandy Loam	0.03	1.36	24.5
S0704392-006	RFM-6 Seam	96.0	4.0	<0.1	Sand	<0.02	0.38	0.9

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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

Table 7-23 Summary of Storm Runoff Calculations for 10 Year 6 Hour Storm (cont)

Watershed	Curve Number CN	Time of Concentration (Hr)	Drainage Area (Acres)	Peak Discharge (CFS)
AU-20	76	0.119	12.38	1.48
AU-21	76	0.130	9.57	1.11
AU-22	76	0.090	12.13	1.57
AU-23	76	0.099	5.56	0.91
AU-24	76	0.119	13.89	1.66
AU-25	76	0.087	2.27	0.30
AU-26	76	0.1077	8.72	1.08
AU-27	76	0.027	0.2	0.03
AU-28	76	0.30	0.70	0.11
AU-28A	90	0.025	0.17	0.12
AU-29	76	0.21	1.23	0.20
AU-29A	76	0.020	0.46	0.05
AU-30	76	0.029	0.49	0.08
AU-31	76	0.048	2.21	0.32
AU-32	76	0.036	1.84	0.28
AU-33	76	0.040	0.71	0.11
AU-34	76	0.045	1.84	0.27
AU-35	76	0.032	0.2	0.13
AU-36	76	0.031	0.75	0.12
AU-37	76	0.198	139.82	13.64
AU-38	76	0.094	8.97	1.15
AU-39	76	0.048	1.26	0.18
AU-40	76	0.283	197.5	15.96
AU-41	76	0.100	11.59	1.46
AU-42	76	0.002	4.24	0.67
AU-43	76	0.095	13.7	1.75

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Table 7-23 Summary of Storm Runoff Calculations for 10 Year 6 Hour Storm (cont)

Watershed	Curve Number CN	Time of Concentration (Hr)	Drainage Area (Acres)	Peak Discharge (CFS)
AD-1A	76	0.090	3.70	0.48
AD-1B	76	0.037	2.12	0.32
AD-2A	76	0.040	0.97	0.15
AD-2B	83	0.025	1.08	0.41
AD-2C	83	0.012	0.25	0.10
AD-3A	76	0.034	1.49	0.23
AD-3B	76	0.034	0.78	0.12
AD-4	83	0.011	0.08	0.03
AD-5	76	0.056	2.13	0.30
AD-6	90	0.220	1.39	0.81
AD-7	90	0.145	2.95	1.83
AD-8 upper	90	0.021	0.70	0.48
AD-8 lower	90	0.247	2.79	1.59
AD-9	90	0.069	0.35	0.23
AD-10 upper	90	0.026	0.30	0.20
AD-10 lower	90	0.078	0.65	0.42
AD-11	95	0.011	0.69	0.65
AD-12 upper	90	0.020	0.22	0.15
AD-12 lower	90	0.076	0.34	0.22
AD-13	91	0.106	1.78	1.23
AD-14	90	0.009	0.08	0.05
AD-15	90	0.069	1.83	1.20
AD-16	90	0.030	0.77	1.24
AD-17	90	0.019	0.24	0.16
AD-18	90	0.170	0.9	0.55
AD-19	90	0.009	0.15	0.10
AD-20	90	0.0102	0.65	0.44
AD-21	90	0.0061	0.23	0.16

[1] Sized for the 100 Yr – 6 hr storm event.

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Table 7-24 Summary of Division Ditch Calculations

Ditch	Bottom Width (Ft)	Top Width (Ft)	Depth (Ft)	Type Side Slope H:V	Measured Slope %	Contributing Watershed	REQ'D Av. Rip-Rap Size (In.)
D-1D	0	1.33	0.67	1:1	2 Min 11 Max	AD-3A	Soil
D-2D	0	1.33	0.67	1:1	6 Min 20 Max	AD-3A, AD-5	Bedrock
D-3D	0	2	1	1:1	2 Min 6 Av. 18 Max	AD-3A, AD-5, AD-7	Soil Soil Grouted
D-4D	0	2	1	1:1	2 Min 6 Av. 17 Max	AD-14	Soil Soil D_{50} 6"
D-5D	0	1.33	0.67	1:1	4 Min 10 Max	AD-9	Soil
D-6D	0	3	1.5	1:1	2 Min 4 Max	AD-3A, AD-5 AD-7, AD-9, AD-10 AD-12, AD-14	Soil
D-7D	2	3.5	0.75	1.5:1	2 Min 6 Av. 55 Max	AD-1A, AD-1B, AD-2A AD-2B, AD-2C, AD-3B AD-4, AD-6, AD-8	Soil Soil D_{50} 6"
D-8D	0	2	1	1:1	2 Min 7 Max	AD-13	Soil
D-8D Water Bar	0	14	0.33	6:1	3 Av.	AD-13	Soil
D-9D	0	2	1	1:1	4 Min 10	AD-15	Soil
D-10D	1	3.33	0.67	1.5:1	7 Min 50	AD-6, AD-3B, (part) AD-2B, AD-2C	D_{50} 4" Bedrock
D-11D	0	1	0.5	1:1	41 Min Near Vert.	Tipple Wash Hose	Grouted Rip-Rap
D-12D	0	1	0.5	1:1	81 Av.	Tipple Wash Hose	Soil
D-13D Water Shed	0	6	0.5	10:1 2:1	0.5 Av.	AD-6 Partial	Soil
D-14D	0	1.33	0.67	1.5:1	0.06 Av.	AU-4A	Soil
D-15D	0	2.00	1.00	1:1	0.05 Av.	AD-16	Soil
D-16D	0	1.50	1.75	1:1	0.05 Av.	AD-18	Soil

Notes: 1. Dimensions given indicate minimum requirements. Actual dimensions may vary. Minimum required cross-sections will be maintained.

2. The use of line drainage ditches is required when flow velocities exceed approximately 5 feet per second. Rip-rap may be installed where not required.

Table 7-24 Summary of Division Ditch Calculations (Cont)

Ditch	Bottom Width (Ft)	Top Width (Ft)	Depth (Ft)	Type Side Slope H:V	Measured Slope %	Contributing Watershed	REQ'D Av. Rip-Rap Size (In.)
D-1U	2	1.33	0.67	1:1	2 Min 8 Max	AU-5	Soil
D-2U	0	1.33	0.67	1:1	7 Min 10 Max	AU-6, AU-11	Soil
D-3U	1	2	0.5	1:1	4 Min 18 Max	AU-8	Soil
D-4U	1	4	1	1.5:1	1 Min 10 Av. 18 Max	AU-10	Soil Soil D_{50} 6"
D-5U	0	1	0.5	1:1	4 Min 13 Max	AU-15	Soil
D-6U	0	1.33	0.67	1:1	3 Min 16 Max	AU-14	Soil
D-7U	0	1.33	0.67	1:1	1 Min 16 Max	AU-12	Soil
D-8U	2	4	0.67	1:1	2 Min 31 Max	AU-1, AU-1[a], AU-1B, AU—1C, AU-2, AU-2[a], AU-2B	Soil
D-9U	3	5	1	1:1	1 Min 6 Max	AU-16	Soil D_{50} 4"
D-10U	3	4	0.5	1:1	3 Min 10 Max	AU-17	Soil
D-11U	0	2	1	1:1	3 Min 8 Max	Misc. road damage	Soil
D-12U	0	3	1	1.5:1	3 Min 9 Max	AU-18	Soil D_{50} 4"
D-13U	0	2	1	1:1	2 Min 23 Max	Misc. road damage	Soil
D-14U	4	5.5	0.5	1.5:1	6 Min 66 Max	Sed Pond A Outlet	D_{50} 4" D_{50} 10"
D-15U	0	2	0.67	1.5:1	5 Min 16 Max	AU-3	Soil
D-16U	0	2	0.67	1.5:1	10 Av.	AU-1B	Soil

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Table 7-24 Summary of Division Ditch Calculations (Cont)

Ditch	Bottom Width (Ft)	Top Width (Ft)	Depth (Ft)	Type Side Slope H:V	Measured Slope %	Contributing Watershed	REQ'D Av. Rip-Rap Size (In.)
D-17U	0	2	0.67	1.5:1	13 Av.	AU-1[a]	Bedrock
D-18U	0	2	0.67	1.5:1	5 Min	AU-1	Soil
D-19U	0	2	0.67	1.5:1	6 Av.	AU-2B	Soil
D-20U	0	1.33	0.67	1:1	16 Av.	AU-42	Soil
D-21U	0	2	1.0	1:1	13 Av.	AU-43	D_{50}=3"
D-22U	0	3	1.0	1.5:1	11 Av.	AU-19, AU-25	D_{50}=6"
D-23U	0	1.16	0.58	1:1	19 Av.	AU-36	Soil
D-24U	0	2.00	1.0	1:1	14 Av.	C-28U	Soil
D-25U	0	1	0.5	1:1	16 Av.	AD-17	Soil
D-26U	0	1	0.5	1:1	24 Av.	AU-32	Soil
D-27U	0.50	0.9	0.3	1.5:1	13 Min, 30 Max	. C-31U	Bedrock
D-28U	0	1	0.5	1:1	14 Av.	AU-33	Soil
D-29U	0	1.33	0.67	1:1	8 Av.	AU-34	Soil
D-30U	0	1.16	0.58	1:1	13 Av.	AU-25	Soil
D-31U	0	3	1.0	1.5:1	12 Av.	AU-20, , AU-30, D-37U	Bedrock
D-32U	0	1	0.5	1:1	17 Av.	AU-30	Soil
D-33U	0	1.0	0.50	1:1	18 Av.	AU-27, AU-28, AU-29, AU-29A	Soil
D-34U	1	2.74	0.58	1.5:1	11 Av.	AU-24, AU-23, AU-28A	Soil
D-35U	0	1.125	0.75	1.5:1	10 Av.	AU-29, AU-27	Soil
D-36U	0	1.0	0.5	1:1	8 Av.	AU-27	Soil
D-37U	0	1.5	1.0	1.5:1	8 Av.	AU-26, AU-21,AU-22	Soil
D-38U	0	1.5	1.0	1.5:1	12 Min, 20 Max	AU-21, AU-22	D_{50}=3"
D-39U	0	0.75	0.5	1.5:1	10 Av.	AU-28	Soil

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Table 7-24 Summary of Division Ditch Calculations (Cont)

Ditch	Bottom Width (Ft)	Top Width (Ft)	Depth (Ft)	Type Side Slope H:V	Measured Slope %	Contributing Watershed	REQ'D Av. Rip-Rap Size (In.)
D-40U	0	0.75	0.50	1.5:1	9 Av.	AU-28A	D_{50}=3
D-42U	2.0	2.5	1.25	1:1	36 Min, 63Max	AU-22	Soil, D_{50}=3
D-43U	2.0	2	2.25	1:2	20 Min, 45 Max	AU-23	Soil

Notes:

1. Dimensions given indicate minimum requirements. Actual dimensions may vary. Minimum required cross-sections will be maintained.
2. The use of riprap to line drainage ditches is required when flow velocities exceed approximately 5 feet per second. Riprap may be installed where not required.

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Table 7-25 Culvert Characteristics

Culvert	Diameter (in.)	Type	Contributing Watersheds	Slope (ft/ft)	Outlet Condition
C-21U	36	CMP	Right Fork Drainage	0.06	Bedrock
C-22U	20	CMP	AU-19, AU-25	0.06	Soil
C-23U	36	CMP	AU-36, AU-35, C-24U ,C-28U	0.06	11" rip-rap
C-24U	32	CMP	AU-40, , C-26U	0.06	10" rip-rap
C-26U	30	CMP	AU-39, AU-32, AU-33,	0.06	8" rip-rap
C-27U	15	CMP	AU-31, C-31U	0.06	4" rip-rap
C-28U	15	CMP	C-29U, AU-34	0.06	4" rip-rap
C-29U	15	CMP	AU-20, AU-21, AU-22 AU-26, AU-30	0.06	3" rip-rap
C-30U	15	CMP	Abandoned In Place	0.06	Soil
C-31U	12	CMP	AU-27, AU-29, AU-29A, C-38U	0.06	Soil
C-33U	24	CMP	AU-24, AU-28A, AU-37 ,AU-23	0.06	8" rip-rap
C-34U	24	CMP	AU-38, C-27U, C-33U, AD-19	0.06	8" rip-rap
C-35U	84	CMP	Bear Creek	0.06	48" rip-rap
C-36U	15	CMP	Abandoned In Place	0.11	3" rip-rap
C-37U	15	CMP	Abandoned In Place		
C-38U	15	CMP	AU-28	0.08	Soil
C-39U	1512	CMP	AU-22,	0.06	Soil

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Table 7-25 Culvert Characteristics (Cont)

Culvert	Diameter (in.)	Type	Contributing Watersheds	Slope (ft/ft)	Outlet Condition
C-1D	15	CMP flexible	AD-6, AD-3B	1.00	24" rip-rap
C-2D	15	CMP, RCP flexible	AD-2B, AD-2C, AD-3B, AD-4, AD-6	4.0	10" rip-rap
C-3D	20	slt pipe	AD-3A	0.03	4" rip-rap
C-4D	21	CMP	AD-3A, AD-5, AD-7, AD-14, C-10D	0.18	9" rip-rap
C-5D	18	CMP	AD-9	0.08	Soil
C-6D	12	CMP	AD-10	0.48	9" rip-rap
C-7D	18	CMP	Abandoned In Place		
C-8D	18	CMP	AD-3A, AD-5, AD-7	0.05	3" rip-rap
C-9D	18	CMP	See C-8D	0.05	3" rip-rap
C-10D	18	CMP	Tipple Wash Hose	0.03	Soil
C-11D	12	CMP flexible	AD-4A	0.05 0.25	3" rip-rap
C-12D	8	CMP	AD-18	0.05	Soil

INCORPORATED
AUG 2 2 2007

APPENDIX 7-G

DIVERSION ADEQUACY CALCULATIONS

LICENSED PROFESSIONAL ENGINEER
MARK A. REYNOLDS
5048079-2202
STATE OF UTAH

AUG 2 2 2007

WATERSHED CHARACTERISTICS

Disturbed Areas

P = 1.5"

Watershed	CN	Area (Ac.)	Slope y (%)	Hyd length l (ft.)	1000 / S=-10 CN	$l^{.8}(s+1)^{.7}$ / $L=1900Y^{.5}$	T=1.67L Time of Conc (hr)
AD-1A	76	3.70	66	1,300	3.16	0.050	0.090
AD-1B	76	2.12	95.5	520	3.16	0.022	0.037
AD-2A	76	0.97	72	440	3.16	0.020	0.040
AD-2B	83	1.08	59	32 0	2.05	0.015	0.025
AD-2C	83	0.25	64	140	2.05	0.007	0.012
AD-3A	76	1.49	70	400	3.16	0.021	0.034
AD-3B	76	0.78	71	400	3.16	0.020	0.034
AD-4	83	0.08	49	100	2.05	0.007	0.011
AD-5	76	2.13	73	760	3.16	0.034	0.056
AD-6	90	1.39	1.7	720	1.11	0.131	0.220
AD-7	90	2.95	8.0	1,130	1.11	0.087	0.145
AD-8 upper	90	0.70	70	400	1.11	0.013	0.021
AD-8 lower	90	2.79	1.0	600	1.11	0.148	0.247
AD-9	90	0.35	7.2	420	1.11	0.042	0.069
AD-10 upper	90	0.30	34	320	1.11	0.01 5	0.026
AD-10 lower	90	0 .65	2.0	220	1.11	0.047	0.078
AD-11	95	0.69	20	110	0.53	0.007	0.011
AD-12 upper	90	0.22	64	340	1.11	0.012	0.020
AD-12 lower	90	0.34	8.0	500	1.11	0.045	0.076
AD-13	91	1.78	8.0	800	0.99	0.063	0.106
AD-14	90	0.08	61	120	1.11	0.005	0.009
AD-15	90	1.83	10.5	530	1.11	0.041	0.069
AD-16*	90	0.77	22	303	1.11	0.018	0.030
AD-17*	90	0.24	27	190	1.11	0.011	0.019
AD-18	90	0.9	3.2	771	1.11	0.102	0.170
AD-19*	90	0.15	49.24	109	1.11	0.005	0.009
AD-20*	90	0.65	48.76	126	1.11	0.006	0.010
AD-21	90	0.23	47.08	65	1.11	0.004	0.006

*Areas AD-16, AD-17 and AD-19 are ASCA areas treated by alternate sediment controls.

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WATERSHED CHARACTERISTICS

Undisturbed Areas

and ASCA Areas Not Reporting To Sediment Pond

P = 1.5"

Watershed	CN	Area (Ac.)	Slope y (%)	Hyd length l (ft.)	1000 / S=-10 CN	$l^{.8}(s+1)^{.7}$ / $L=1900Y^{.5}$	T=1.67L Time of Conc (hr)
AU-1	76	6.46	57	1,240	3.16	0.056	0.094
AU-1A	83	1.36	65	460	2.05	0.019	0.032
AU-1B	83	1.16	59	330	2.05	0.015	0.026
AU-1C	76	16.40	72	1,950	3.16	0.072	0.120
AU-2	76	2.23	62	975	3.16	0.045	0.075
AU-2A	76	1.64	63	1,025	3.16	0.046	0.077
AU-2B	76	3.80	63	1,100	3.16	0.049	0.081
AU-3	76	3.87	65	1,060	3.16	0.047	0.078
AU-3A	76	0.30	64	140	3.16	0.009	0.016
AU-4	76	7.97	63	1,300	3.16	0.056	0.093
AU-4A	83	0.92	52	357	2.05	0.018	0.029
AU-5	76	20.14	77.3	1,700	3.16	0.062	0.104
AU-6	76	2.73	70.0	780	3.16	0.035	0.059
AU-7	76	13.46	69.4	1,400	3.16	0.056	0.094
AU-8	76	4.95	85.7	720	3.16	0.030	0.050
AU-9	76	4.77	64.8	1,440	3.16	0.060	0.100
AU-10	76	35.52	76.1	2,380	3.16	0.082	0.137
AU-11	76	0.62	73.0	570	3.16	0.027	0.045
AU-12	76	2.33	44.1	480	3.16	0.030	0.050
AU-13	76	0.66	77.5	240	3.16	0.013	0.022
AU-14	76	2.43	66.7	620	3.16	0.030	0.050
AU-15	76	0.91	15.6	300	3.16	0.035	0.058
AU-16	76	44.93	71.0	2,580	3.16	0.091	0.152
AU-17	76	30.10	71.0	2,580	3.16	0.091	0.152
AU-18	76	36.55	71.0	2,580	3.16	0.091	0.152
AU-19	76	36.03	60.5	2,190	3.16	0.086	0.144
AU-20	76	12.38	51.5	1,563	3.16	0.071	0.119
AU-21	76	9.57	43.0	1,556	3.16	0.078	0.130
AU-22	76	12.13	52.93	1,112	3.16	0.054	0.090

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WATERSHED CHARACTERISTICS (Con't)

Undisturbed Areas
and ASCA Areas Not Reporting To Sediment Pond

P = 1.5"

Watershed	CN	Area (Ac.)	Slope y (%)	Hyd length l (ft.)	1000 / S=-10 CN	$l^{.8}(s+1)^{.7}$ / $L=1900Y^{.5}$	T=1.67L Time of Conc (hr)
AU-23	76	5.56	52.7	1,268	3.16	0.060	0.100
AU-24	76	13.92	59.3	1,710	3.16	0.072	0.119
AU-25	76	2.27	46.1	980	3.16	0.052	0.087
AU-26	76	8.72	50.2	1,354	3.16	0.064	0.108
AU-27	76	0.2	33.6	190	3.16	0.016	0.027
AU-28	76	0.70	57.6	300	3.16	0.018	0.030
AU-28A	76	0.17	31.49	300	1.11	0.015	0.025
AU-29	76	1.23	41.1	160	3.16	0.013	0.022
AU-29A	76	0.46	55.76	176	3.16	0.012	0.020
AU-30	76	0.49	49.5	265	3.16	0.018	0.029
AU-31	76	2.21	63.6	570	3.16	0.029	0.048
AU-32	76	1.84	81.2	460	3.16	0.021	0.036
AU-33	76	0.71	64.3	460	3.16	0.024	0.040
AU-34	76	1.84	71.0	560	3.16	0.027	0.045
AU-35	76	0.2	56.6	320	3.16	0.019	0.032
AU-36	76	0.75	56.3	310	3.16	0.019	0.031
AU-37	76	139.82	60.3	3,250	3.16	0.119	0.198
AU-38	76	8.97	75.3	1,480	3.16	0.057	0.094
AU-39	76	1.26	75.1	630	3.16	0.029	0.048
AU-40	76	197.5	62.8	5,210	3.16	0.169	0.283
AU-41	76	11.59	62.3	1,420	3.16	0.060	0.100
AU-42	76	4.24	46.1	10	3.16	0.001	0.002
AU-43	76	13.7	71.2	1,440	3.16	0.057	0.095
Bear Creek	76	1,728	58.1	12,800	3.16	0.362	0.604

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Summary of Peak Flows for 10-year, 6-hour storm P=1.5"
(SCS type B distribution)

Watershed	Peak Q (cfs.)	Watershed	Peak Q (cfs)	Watershed	Peak Q (cfs)
AD-1A	0.48	AU-1B	0.44	AU-23	0.91
AD-1B	0.32	AU-1B	0.44	AU-24	1.66
AD-2A	0.15	AU-1C	1.95	AU-25	0.30
AD-2B	0.41	AU-2	0.30	AU-26	1.08
AD-2C	0.10	AU-2A	0.22	AU-27	0.03
AD-3A	0.23	AU-2B	0.50	AU-28	0.11
AD-3B	0.12	AU-3	0.52	AU-28a	0.12
AD-4	0.03	AU-3A	0.05	AU-29	0.20
AD-5	0.30	AU-4	1.02	AU-29A	0.05
AD-6	0.81	AU-4A	0.35	AU-30	0.08
AD-7	1.83	AU-5	2.51	AU-31	0.32
AD-8 upper	0.48	AU-6	0.39	AU-32	0.28
AD-8 lower	1.59	AU-7	1.72	AU-33	0.11
AD-9	0.23	AU-8	0.72	AU-34	0.27
AD-10 upper	0.20	AU-9	0.60	AU-35	0.13
AD-10 lower	0.42	AU-10	4.05	AU-36	0.12
AD-11	0.65	AU-11	0.09	AU-37	13.64
AD-12 upper	0.15	AU-12	0.34	AU-38	1.15
AD-12 lower	0.22	AU-13	0.10	AU-39	0.18
AD-13	1.23	AU-14	0.35	AU-40	15.96
AD-14	0.05	AU-15	0.13	AU-41	1.46
AD-15	1.20	AU-16	4.92	AU-42	0.67
AD-16	1.24	AU-17	3.29	AU-43	1.75
AD-17	0.16	AU-18	4.00	BEAR CREEK	108.18
AD-18	0.55	AU-19	4.03	BEAR CREEK[1]	412.70
AD-19	0.10	AU-20	1.48		
AD-20	0.44	AU-21	1.11		
AD-21	0.16	AU-22	1.57		
AU-1	0.83				
AU-1A	0.51				

[1]Design flow for the 100 year, 6 hour storm event.

AUG 2 2 2007

PEAK
HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AD-20

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 90 Time of Conc. = 0.0102 hr Area = 0.65 ac

OUTPUT SUMMARY

Runoff depth = 0.6835 in
Initial Abstraction = 0.2222 in
Peak Flow = 0.44 cfs (0.6788 iph)
At T = 2.50 hrs

INPUT SUMMARY FOR W.S.: AD-21

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 90 Time of Conc. = 0.0061 hr Area = 0.23 ac

OUTPUT SUMMARY

Runoff depth = 0.0000 in
Initial Abstraction = 0.2222 in
Peak Flow = 0.16 cfs (0.6803 iph)
At T = 2.50 hrs

AUG 2 2 2007

PEAK

HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-20

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.1193 hr Area = 12.38 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 1.48 cfs (0.1185 iph)
At T = 2.55 hrs

INPUT SUMMARY FOR W.S.: AU-21

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.1301hr Area = 9.57 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 1.11cfs (0.1149 iph)
At T = 2.55 hrs

AUG 2 2 2007

PEAK
HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-22

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.0896 hr Area = 12.13 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 1.57cfs (0.1286 iph)
At T = 2.53 hrs

INPUT SUMMARY FOR W.S.: AU-23

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.0997hr Area = 5.56 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.91cfs (0.1629 iph)
At T = 2.50 hrs

AUG 2 2 2007

PEAK

HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-24

STORM:	WATERSHED:
Distribution = SCS Type 'B'	Curve Number = 76
Precip. Depth = 1.50 in	Time of Conc. = 0.119 hr
Duration = 6.00 hr	Area = 13.92 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 1.66 cfs (0.1182 iph)
At T = 2.55 hrs

AUG 2 2 2007

PEAK
HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-25

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.087 hr Area = 2.27 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.30 cfs (0.1296 iph)
At T = 2.53 hrs

INPUT SUMMARY FOR W.S.: AU-26

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.1077 hr Area = 8.72 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 1.08 cfs (0.1225 iph)
At T = 2.54 hrs

AUG 2 2 2007

PEAK
HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-27

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.027 hr Area = 0.20 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.03 cfs (0.1541 iph)
At T = 2.51 hrs

INPUT SUMMARY FOR W.S.: AU-28

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.030 hr Area = 0.70 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.11 cfs (0.1516 iph)
At T = 2.50 hrs

AUG 2 2 2007

PEAK

HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-28A

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 90 Time of Conc. = 0.025 hr Area = 0.17 ac

OUTPUT SUMMARY

Runoff depth = 0.6835 in
Initial Abstraction = 0.2222 in
Peak Flow = 0.12 cfs (0.6724 iph)
At T = 2.50 hrs

INPUT SUMMARY FOR W.S.: AU-29

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.0216 hr Area = 1.23 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.20 cfs (0.1573 iph)
At T = 2.50-hrs

AUG 2 2 2007

PEAK
HYDROGRAPH GENERATION PROGRAM

INPUT SUMMARY FOR W.S.: AU-29A

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.020 hr Area = 0.46 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.05 cfs (0.1016 iph)
At T = 2.59 hrs

INPUT SUMMARY FOR W.S.: AU-30

STORM:	WATERSHED:
Distribution = SCS Type 'B' Precip. Depth = 1.50 in Duration = 6.00 hr	Curve Number = 76 Time of Conc. = 0.029 hr Area = 0.49 ac

OUTPUT SUMMARY

Runoff depth = 0.1873 in
Initial Abstraction = 0.6316 in
Peak Flow = 0.08 cfs (0.1534 iph)
At T = 2.51 hrs

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Culvert	Dia (in.)	Type	Contributing Watersheds	Peak Q(cfs)	Slope (ft/ft)	Outlet Condition
C-21U	36	CMP	Right Fork Drainage	47.12	0.06	12" rip-rap
C-22U	20	CMP	AU-19, AU-25	4.33	0.06	4"rip-rap
C-23U	36	CMP	AU-36, AU-35,C-24U ,C-28U	40.66	0.06	11" rip-rap
C-24U	32	CMP	AU-40, C-26U	34.82	0.06	10" rip-rap
C-26U	30	CMP	AU-39, AU-32, AU-33, C-34U	18.86	0.06	8" rip-rap
C-27U	15	CMP	AU-31, C-31U	0.71	0.06	4" rip-rap
C-28U	15	CMP	AU-34, C-29U	5.59	0.06	4" rip-rap
C-29U	15	CMP	AU-20, AU-21, AU-22, AU-26, AU-30	5.32	0.06	3: rip-rap
C-30U	15	CMP	Abandoned In Place			
C-31U	12	CMP	AU-27, AU-29, AU-29A, C-38U	0.39	0.06	soil
C-33U	24	CMP	AU-23, AU-24, AU-28A, AU-37	16.33	0.06	8" rip-rap
C-34U	24	CMP	AD-19, AU-38, C-27U, C-33U	18.29	0.06	8" rip-rap
C-35U	84	CMP	BEAR CREEK	412.70	0.06	48" rip-rap
C-36U	15	CMP				
C-37U	15	CMP	Abandoned In Place			
C-38U	15	CMP	AU-28	0.11	0.08	soil
C-39U	12	CMP	AU-22	1.57	0.06	Soil

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-21U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	36 in
Discharge	47.12 cfs

Results	
Depth	1.56 ft
Flow Area	3.7 ft²
Wetted Perimeter	4.83 ft
Top Width	3.00 ft
Critical Depth	2.24 ft
Percent Full	51.9 %
Critical Slope	0.020765 ft/ft
Velocity	12.72 ft/s
Velocity Head	2.51 ft
Specific Energy	4.07 ft
Froude Number	2.02
Maximum Discharge	95.19 cfs
Discharge Full	88.49 cfs
Slope Full	0.017012 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 12" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-23U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	36 in
Discharge	40.66 cfs

Results	
Depth	1.43 ft
Flow Area	3.3 ft²
Wetted Perimeter	4.57 ft
Top Width	3.00 ft
Critical Depth	2.08 ft
Percent Full	47.6 %
Critical Slope	0.018610 ft/ft
Velocity	12.25 ft/s
Velocity Head	2.33 ft
Specific Energy	3.76 ft
Froude Number	2.05
Maximum Discharge	95.19 cfs
Discharge Full	88.49 cfs
Slope Full	0.012667 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 11" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-24U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	32	in
Discharge	34.82	cfs

Results		
Depth	1.39	ft
Flow Area	3.0	ft²
Wetted Perimeter	4.31	ft
Top Width	2.66	ft
Critical Depth	1.98	ft
Percent Full	52.3	%
Critical Slope	0.021445	ft/ft
Velocity	11.79	ft/s
Velocity Head	2.16	ft
Specific Energy	3.55	ft
Froude Number	1.97	
Maximum Discharge	69.53	cfs
Discharge Full	64.64	cfs
Slope Full	0.017411	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 10" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

C-25U Replaced with C-26U

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-26U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	30	in
Discharge	18.86	cfs

Results		
Depth	1.02	ft
Flow Area	1.9	ft²
Wetted Perimeter	3.46	ft
Top Width	2.46	ft
Critical Depth	1.47	ft
Percent Full	40.6	%
Critical Slope	0.016911	ft/ft
Velocity	10.08	ft/s
Velocity Head	1.58	ft
Specific Energy	2.59	ft
Froude Number	2.04	
Maximum Discharge	58.54	cfs
Discharge Full	54.42	cfs
Slope Full	0.007207	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 8" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-27U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	18 in
Discharge	0.71 cfs

Results	
Depth	0.23 ft
Flow Area	0.2 ft²
Wetted Perimeter	1.21 ft
Top Width	1.08 ft
Critical Depth	.31 ft
Percent Full	15.3 %
Critical Slope	0.017059 ft/ft
Velocity	4.13 ft/s
Velocity Head	.27 ft
Specific Energy	0.50 ft
Froude Number	1.83
Maximum Discharge	14.99 cfs
Discharge Full	13.94 cfs
Slope Full	0.000016 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 4" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-28U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060 000 ft/ft
Diameter	18 in
Discharge	5.59 cfs

Results	
Depth	0.66 ft
Flow Area	0.80 ft²
Wetted Perimeter	2.18 ft
Top Width	1.49 ft
Critical Depth	0.91 ft
Percent Full	44.1 %
Critical Slope	0.020550 ft/ft
Velocity	7.45 ft/s
Velocity Head	0.86 ft
Specific Energy	1.52 ft
Froude Number	1.85
Maximum Discharge	14.99 cfs
Discharge Full	13.94 cfs
Slope Full	0.009653 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 4" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-29U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	18	in
Discharge	5.32	cfs

Results		
Depth	0.64	ft
Flow Area	0.7	ft²
Wetted Perimeter	2.14	ft
Top Width	1.48	ft
Critical Depth	0.89	ft
Percent Full	42.8	%
Critical Slope	0.020119	ft/ft
Velocity	7.36	ft/s
Velocity Head	0.84	ft
Specific Energy	1.48	ft
Froude Number	1.86	
Maximum Discharge	14.99	cfs
Discharge Full	13.94	cfs
Slope Full	0.008743	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 3" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

C-30U Abandoned In Place

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-31U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	12 in
Discharge	0.39 cfs

Results	
Depth	0.19 ft
Flow Area	0.1 ft²
Wetted Perimeter	0.91 ft
Top Width	0.79 ft
Critical Depth	0.26 ft
Percent Full	19.4 %
Critical Slope	0.019205 ft/ft
Velocity	3.64 ft/s
Velocity Head	0.21 ft
Specific Energy	0.40 ft
Froude Number	1.74
Maximum Discharge	5.08 cfs
Discharge Full	4.73 cfs
Slope Full	0.000408 ft/ft
Flow Type	Supercritical

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Worksheet
Worksheet for Circular Channel

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-33U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.024000 ft/ft
Diameter	30 in
Discharge	16.33 cfs

Results	
Depth	0.94 ft
Flow Area	1.7 ft²
Wetted Perimeter	3.30 ft
Top Width	2.42 ft
Critical Depth	1.37 ft
Percent Full	37.6 %
Critical Slope	0.016104 ft/ft
Velocity	9.69 ft/s
Velocity Head	1.47 ft
Specific Energy	2.40 ft
Froude Number	2.05
Maximum Discharge	37.02 cfs
Discharge Full	34.42 cfs
Slope Full	0.005403 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 8" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-34U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	30	in
Discharge	18.29	cfs

Results		
Depth	1.00	ft
Flow Area	1.8	ft²
Wetted Perimeter	3.42	ft
Top Width	2.45	ft
Critical Depth	1.45	ft
Percent Full	39.9	%
Critical Slope	0.016717	ft/ft
Velocity	9.99	ft/s
Velocity Head	1.55	ft
Specific Energy	2.55	ft
Froude Number	2.04	
Maximum Discharge	58.54	cfs
Discharge Full	54.42	cfs
Slope Full	0.006778	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 8" m.d. riprap at outlet

AUG 2 2 2007

Worksheet
Worksheet for Circular Channel

C-36U Abandoned in place

AUG 2 2 2007

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-38U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.080000 ft/ft
Diameter	15 in
Discharge	0.11 cfs

Results	
Depth	0.09 ft
Flow Area	4.1e-2 ft^2
Wetted Perimeter	0.69 ft
Top Width	0.66 ft
Critical Depth	0.13 ft
Percent Full	7.4 %
Critical Slope	0.020852 ft/ft
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.20 ft
Froude Number	1.88
Maximum Discharge	10.65 cfs
Discharge Full	9.90 cfs
Slope Full	0.000010 ft/ft
Flow Type	Supercritical

MAY 22 2007

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-39U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	12 in
Discharge	1.57 cfs

Results	
Depth	0.40 ft
Flow Area	0.3 ft²
Wetted Perimeter	1.36 ft
Top Width	0.98 ft
Critical Depth	0.53 ft
Percent Full	39.7 %
Critical Slope	0.021536 ft/ft
Velocity	5.41 ft/s
Velocity Head	0.045 ft
Specific Energy	0.085 ft
Froude Number	1.75
Maximum Discharge	5.08 cfs
Discharge Full	4.73 cfs
Slope Full	0.006619 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 6" m.d. riprap at outlet

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Worksheet
Worksheet for Circular Channel

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Worksheet
Worksheet for Circular Channel

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DITCH	CHANNEL SLOPE %	CONTRIBUTING WATERSHED	PEAK Q (cfs)	BANK AND BOTTOM DESC.	MANNING'S $\eta^{(a)}$
D-23U	19 Av	AU-36	.12	soil	0.03
D-24U	14 Av	AU-35, C-28U	5.72	soil	0.03
D-25U	16 Av	AD-17	.16	soil	0.03
D-26U	24 Av	AU-32	.28	soil	0.03
D-27U	13 Min, 30 Max	AU-31, C-31U	0.71	bedrock	0.03
D-28U	14 Av	AU-33	.11	soil	0.03
D-29U	8 Av	AU-34	.27	soil	0.03
D-30U	13 Av	AU-25	.30	soil	0.03
D-31U	12 Av	AU-20, AU-30, C-37U	5.32	bedrock	0.03
D-32U	17 Av	AU-30	.08	soil	0.03
D-33U	18 Av	AU-27, AU-28, AU-29, AU-29A	0.39	soil	0.03
D-34U	11 Av	AU-24 , AU-23, AU-28A	2.69	soil	0.03
D-35U	10 Av	AU-29, AU-27	0.23	soil	0.03
D-36U	8 Av	AU-27	0.03	soil	0.03
D-37U	8 Av	AU-21, AU-26, AU-22	3.76	soil	0.03
D-38U	12 Min, 20 Max	AU-21, AU-22	2.68	D_{50} = 3", soil	0.03
D-39U	10 Av	AU-28	0.11	soil	0.03
D-40U	9 Av	AU-28A,	0.12	soil	0.03
D-42U	36 Av, 63 Max	AU-22	1.57	soil	0.03
D-43U	20 Min, 45 Max	AU-23	0.91	D_{50} = 5", soil	0.03

a) Based on tables from Barfield et al (1981) and the equation $\eta = .0395(D_{50})^{1/6}$;(D in ft)
b) Peak Q for misc. road drainage assumed to be 1.0 cfs based on similar disturbed areas.
(c) See table 7.2-10 for summary of diversion ditch calculation

AUG 2 2 200

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-24U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.140000	ft/ft
Left Side Slope	1.00	V : H
Right Side Slope	1.00	V : H
Bottom Width	0.00	ft
Discharge	05.72	cfs

Results		
Depth	0.83	ft
Flow Area	0.7	ft^2
Wetted Perimeter	2.36	ft
Top Width	1.67	ft
Critical Depth	1.15	ft
Critical Slope	0.025017	ft/ft
Velocity	8.21	ft/s
Velocity Head	1.05	ft
Specific Energy	1.88	ft
Froude Number	2.24	
Flow Type	Supercritical	

Use Minmum Depth = 1.0 ft Velocity 8.21 fps	Minimum Freeboard = 0.17 ft No riprap required /3" riprap below confluence with C-28U

AUG 2 2 2007

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-27U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.130 ft/ft 000
Left Side Slope	0.67 V : H
Right Side Slope	0.67 V : H
Bottom Width	0.50 ft
Discharge	0.71 cfs

Results	
Depth	0.20 ft
Flow Area	0.2 ft²
Wetted Perimeter	1.21 ft
Top Width	1.09 ft
Critical Depth	0.30 ft
Critical Slope	0.026331 ft/ft
Velocity	4.56 ft/s
Velocity Head	0.32 ft
Specific Energy	0.52 ft
Froude Number	2.12
Flow Type	Supercritical

Use Minimum Depth = 0.5 ft Velocity < 5 fps	Minimum Freeboard = 0.37 ft No riprap required

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-27U (Max Slope)
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.300000	ft/ft
Left Side Slope	0.67	V : H
Right Side Slope	0.67	V : H
Bottom Width	0.50	ft
Discharge	0.71	cfs

Results		
Depth	0.16	ft
Flow Area	0.1	ft^2
Wetted Perimeter	1.06	ft
Top Width	0.97	ft
Critical Depth	0.97	ft
Critical Slope	0.026332	ft/ft
Velocity	6.16	ft/s
Velocity Head	0.59	ft
Specific Energy	0.75	ft
Froude Number	3.15	
Flow Type	Supercritical	

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-31U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.120000 ft/ft
Left Side Slope	0.67 V : H
Right Side Slope	0.67 V : H
Bottom Width	0.00 ft
Discharge	5.32 cfs

Results	
Depth	0.69 ft
Flow Area	0.7 ft²
Wetted Perimeter	2.48 ft
Top Width	2.06 ft
Critical Depth	0.95 ft
Critical Slope	0.021493 ft/ft
Velocity	7.47 ft/s
Velocity Head	0.87 ft
Specific Energy	1.56 ft
Froude Number	2.24
Flow Type	Supercritical

Notes: Use Min. Depth = 1.0 ft: Minimum Freeboard = 0.31 ft.
Velocity = 7.47 fps: Use channel bottom is bedrock

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-33U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.180000	ft/ft
Left Side Slope	1.00	V : H
Right Side Slope	1.00	V : H
Bottom Width	0.00	ft
Discharge	0.39	cfs

Results		
Depth	0.28	ft
Flow Area	0.1	ft²
Wetted Perimeter	0.80	ft
Top Width	0.56	ft
Critical Depth	0.38	ft
Critical Slope	0.036121	ft/ft
Velocity	4.52	ft/s
Velocity Head	0.32	ft
Specific Energy	0.60	ft
Froude Number	2.12	
Flow Type	Supercritical	

Notes: Use Min. Depth = 0.50 ft: Minimum Freeboard = 0.22 ft.
Velocity < 5 fps: No riprap required

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-34U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.110000	ft/ft
Left Side Slope	0.67	V : H
Right Side Slope	0.67	V : H
Bottom Width	1.00	ft
Discharge	2.69	cfs

Results		
Depth	0.31	ft
Flow Area	0.50	ft²
Wetted Perimeter	2.12	ft
Top Width	1.93	ft
Critical Depth	0.48	ft
Critical Slope	0.021912	ft/ft
Velocity	5.13	ft/s
Velocity Head	0.54	ft
Specific Energy	0.85	ft
Froude Number	2.14	
Flow Type	Supercritical	

Notes: Use Min. Depth = 0.58 ft: Minimum Freeboard = 0.27 ft.
Velocity = 5 fps: No riprap required

JUG 2 2 2007

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-35U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.010000 ft/ft
Left Side Slope	.67 V : H
Right Side Slope	.67 V : H
Bottom Width	0.00 ft
Discharge	0.23 cfs

Results	
Depth	0.34 ft
Flow Area	0.2 ft^2
Wetted Perimeter	1.22 ft
Top Width	1.01 ft
Critical Depth	0.27 ft
Critical Slope	0.032673 ft/ft
Velocity	1.34 ft/s
Velocity Head	0.03 ft
Specific Energy	0.37 ft
Froude Number	0.57
Flow Type	Subcritical

Use Minimum Depth = 0.75ft Velocity < 5 fps	Minimum Freeboard =0.41 ft No riprap required

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-37U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.080000 ft/ft
Left Side Slope	0.67 V : H
Right Side Slope	0.67 V : H
Bottom Width	0.00 ft
Discharge	3.76 cfs

Results	
Depth	0.65 ft
Flow Area	0.6 ft²
Wetted Perimeter	2.35 ft
Top Width	1.95 ft
Critical Depth	0.83 ft
Critical Slope	0.022510 ft/ft
Velocity	5.88 ft/s
Velocity Head	0.54 ft
Specific Energy	1.19 ft
Froude Number	1.81
Flow Type	Supercritical

Use Minimum Depth = 1.0 ft Velocity < 5.88 fps	Minimum Freeboard = 0.35 ft Use D_{50} = 3"

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-38U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	070000	ft/ft
Left Side Slope	0.67	V : H
Right Side Slope	0.67	V : H
Bottom Width	0.00	ft
Discharge	2.68	cfs

Results		
Depth	0.59	ft
Flow Area	0.5	ft^2
Wetted Perimeter	2.12	ft
Top Width	1.76	ft
Critical Depth	0.73	ft
Critical Slope	0.023550	ft/ft
Velocity	5.14	ft/s
Velocity Head	0.41	ft
Specific Energy	1.00	ft
Froude Number	1.67	
Flow Type	Supercritical	

Use Minimum Depth = 1.0ft Max Slope = 15%	Minimum Freeboard = 0.48ft No rip-rap required

JUL 22 2007

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-39U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.100000 ft/ft
Left Side Slope	0.67 V : H
Right Side Slope	0.67 V : H
Bottom Width	0.00 ft
Discharge	0.11 cfs

Results	
Depth	0.17 ft
Flow Area	4.2e-2 ft²
Wetted Perimeter	0.60 ft
Top Width	0.50 ft
Critical Depth	0.20 ft
Critical Slope	0.036048 ft/ft
Velocity	2.64 ft/s
Velocity Head	0.11 ft
Specific Energy	0.28 ft
Froude Number	1.61
Flow Type	Supercritical

Use Minimum Depth = 0.5 ft Velocity <5 fps	Minimum Freeboard =0.33 ft No riprap required

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-40U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.090000 ft/ft
Left Side Slope	0.67 V : H
Right Side Slope	0.67 V : H
Bottom Width	0.00 ft
Discharge	0.12 cfs

Results	
Depth	0.18 ft
Flow Area	4.6e-2 ft²
Wetted Perimeter	0.63 ft
Top Width	0.53 ft
Critical Depth	0.21 ft
Critical Slope	0.035631 ft/ft
Velocity	2601 ft/s
Velocity Head	0.10 ft
Specific Energy0.28	1.14 ft
Froude Number	1.54
Flow Type	Supercritical

Use Minimum Depth =0.50 ft Velocity = <5	Minimum Freeboard =0.32 ft No riprap required

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Worksheet
Worksheet for Trapezoidal Channel

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-42U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	041000 ft/ft
Left Side Slope	1.00 V : H
Right Side Slope	1.00 V : H
Bottom Width	2.00 ft
Discharge	1.57 cfs

Results	
Depth	0.11 ft
Flow Area	0.2 ft²
Wetted Perimeter	2.31 ft
Top Width	2.22 ft
Critical Depth	0.26 ft
Critical Slope	0.023852 ft/ft
Velocity	6.82 ft/s
Velocity Head	0.72 ft
Specific Energy	0.83 ft
Froude Number	3.73
Flow Type	Supercritical

Use Minimum Depth = 0.25 ft Velocity 6.82	Minimum Freeboard = 0.14 ft Use D_{50} = 3"

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Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-43U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.030
Slope	0.220000 ft/ft
Left Side Slope	0.50 V : H
Right Side Slope	0.50 V : H
Bottom Width	2.00 ft
Discharge	0.91 cfs

Results	
Depth	0.09 ft
Flow Area	0.2 ft²
Wetted Perimeter	2.42 ft
Top Width	2.37 ft
Critical Depth	0.17 ft
Critical Slope	0.025566 ft/ft
Velocity	4.47 ft/s
Velocity Head	0.31 ft
Specific Energy	0.40 ft
Froude Number	2.69
Flow Type	Supercritical

Use Minimum Depth = 0.25ft Velocity = <5 fps	Minimum Freeboard = 0.16 ft No riprap required

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Appendix 7-K

Alternate Sediment Control Areas

And Small Area Exemptions

LICENSED PROFESSIONAL ENGINEER
MARK A. REYNOLDS
5049079-2202
8-22-07
STATE OF UTAH

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<u>BTCA Area K</u> - Outslope of Fill Area Around C-15U

This area is approx 0.32 acres, and includes the fill outslope of the lower Tank Seam Access Road around culvert C-15U (Plate 7-1E). The estimated volume of runoff from this area is 0.04 acre-ft, with a maximum slope length of 90 ft. Erosion and runoff will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water from crossing or saturating the fill slope, a berm will be maintained along the outer edge of the road, and the road will be sloped to drain water away from the slope.

<u>BTCA Area L</u> – Outslope of Lower WHR Tank Seam Access Road

This includes two areas along the lower WHR Tank Seam Access Road. This first one is just below the first switchback and is approximately 0.26 acres. The second one is 200 feet past the first switchback and is approximately 0.11. The estimated volume of runoff form these areas in less then 0.02 acre-ft, with a maximum slope length of 60 feet. Erosion and runoff will be controlled by the placement of erosion control matting of the slope, which will be maintained. The area will also be seeded and revegetated after construction and natural vegetation will be used for soil and erosion control during port-mining use. These areas are shown on Plate 7-1G.

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<u>BTCA Area M</u> - Outslope of Fill Area Around C-16U

This area is approx 0.091 acres, and includes the fill outslope of the lower Tank Seam Access Road around culvert C-16U (Plate 7-1E). The estimated volume of runoff from this area is 0.011 acre-ft, with a maximum slope length of 50 ft. Erosion will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water from crossing or saturating into the slope, a berm will be maintained along the outer edge of the road above the slope and the road will be sloped to drain water away from the fill slope.

<u>BTCA Area N</u> – Outslope of Fill Area Along WHR Tank Seam Access Road

This area consists of approximately 0.232 acres located below the second switchback on the WHR Tank Seam Access Road and 0.141 acres located on the slope just below the hunting cabin turn-off (Plate 7-1 G). The estimated volume of runoff from the first area is 0.029 acre-ft, with a maximum slope length of 76 feet. The estimated volume of runoff form the second area is 0.010 acre-ft, with a maximum slope length of 56 feet. Erosion will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water form crossing or saturating into the slope, a berm will be maintained along the outer edge of the road above the slope and the road will be sloped to drain water away form the fill slope.

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BTCA Area Q - Upper Tank Seam Access Road Outslope Below D-18U

This area is approx 0.089 acres. It includes the outslope ajacent to ditch D-18U (Plate 7-1E). The total runoff volume from this area is estimated to be 0.011 acre-ft. Erosion will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent water from crossing or saturating the slope, berms will be placed along the road, and the road sloped to drain water away from the fill slope.

BTCA Area S - Outslope of Fill Area Around C-18U, C-19U and C-20U

This area is approx 0.123 acres, and includes the fill outslope of the upper Tank Seam Access Road around culverts C-18U, C-19U and C-20U (Plate 7-1E). The estimated volume of runoff from this area is 0.015 acre-ft, with a maximum slope length of 35 ft. Erosion and runoff will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water from crossing or saturating the fill slope, a berm will be maintained along the outside edge of the road and the road will be sloped to drain water away from the fill slope.

BTCA Area T – WHR Tank Seam Topsoil Stockpile Area

This area consists of 0.23 acres, shown on Plate 7-1G. The topsoil stockpile will be totally contained by a berm to prevent any topsoil from being eroded from the stockpile.

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BTCA Area "Z" – WHR Tank Seam Portal Pad Area

This area consists of 0.32 acres and is the Wild Horse Ridge Tank Seam Portal Pad as shown on plate 7-1G. This area is controlled by Catch basin 3 at the lower end of the pad. A berm will be placed around the outside of the pad and it will be sloped away from the road to prevent any water from draining down the road.

Catch Basin 3 will contain runoff from watershed areas AD-20. Runoff calculations are shown in Appendix 7-G. The modified universal soil loss equation is:

A = R x K x LS x VM.

Where:

A = Amount of soil loss per unit area
R = Rainfall factor = 16 (See Appendix 7-F)
K = Soil Erodibility Factor = 0.1 (See Appendix 7-F)
LS = Topographic factor (See equation, App. 7-F)
VM = Soil Erodibility Factor

The catch basin will be inspected at least quarterly for stability, erosion, and capacity. Any problems noted will be corrected as soon as is practical. The catch basin will be cleaned as necessary to ensure adequate storage capacity to completely contain the volumes as shown in the designs.

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Table 7K-3 Catch Basin 3 Design

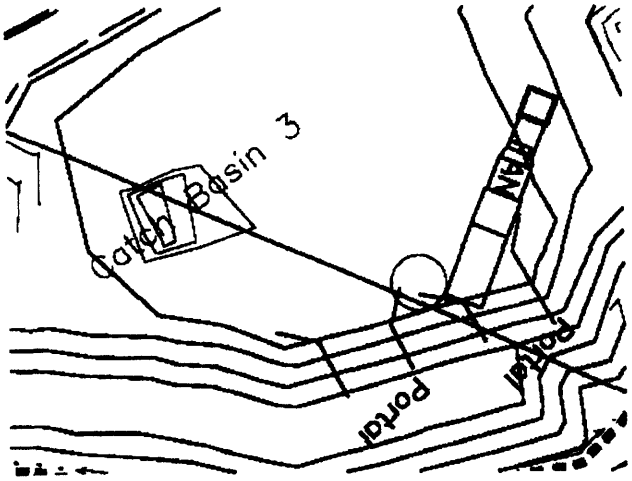
Catch Basin No.	3
Watershed	AD-20
Area (acres)	0.32
Peak Flow Q (in)	0.16
Soil Erodibility (tons/ac/EI)	1.2 (conservative)
Runoff Volume (cu ft)	186
Topographic factor	2.77
Soil Loss (Tons/ac-year)	5.32
Soil Volume - 3 year capacity (cu ft)	102
Design Volume	2,372

Stage-Capacity

Elevation	Area (sq ft)	Vol (cu ft)
7844	0	--------
		20.5
7845	41	
		116.5
7846	192	
		282.5
7847	373	
		535.5
7848	698	
		853.5
7849	1009	
		563.5
7849.5	1245	
Total Volume	2,732	

Basin Information

Bottom of Basin Elev:—7844
Spillway Elevation: 7849.5
Top of Dam Elev: 7850
Required Volume: 102



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980 Loader Cycle Time

(From Cat Performance Handbook)			0.55 min
a.	3/4 inch to 6 inch		0.00 min
b.	Pile (10 ft or less)	+	0.01 min
c.	3/4 inch to 6 inch	-	0.04 min
			0.52 min

(60 min/hr)/(0.52 min/cycle) = 115.4 cycles/hr
Efficiency 50 min/hr - (115.4 cycles/hr)(6 cu yd/cycle)(50 min/60 min) = 577 cu yd/hr (96 cycles/hr)

Summary of Reclamation Cost Estimate

Direct Costs		
a.	Seal Portals and Backfill	$ 112,500
b.	Removal of Structures	$ 210,538
c.	Soil Placement and Ripping	$ 165,965
d.	Channel Restoration	$ 403,728
e.	Revegetation	$ 462,968
f.	Monitor Well Plugging	$ 5,000
Total Direct Costs:		$ 1,360,699
Indirect Costs		
g.	Maintenance and Monitoring (10%)	$136,070
h.	Contingency (5%)	$68,035
i.	Engineering Redesign (2.5%)	$34,018
j.	Mobilization and Demobilization (5%)	$68,038
k.	Contract Management Fee (2.5%)	$34,018
Total Indirect Costs:		$340,176
Total Reclamation Cost (2001 dollars)		$1,700,875

Escalated Values		Escalation Factor
2002	- 1,753,942	3.12% (est)
2003	- 1,808,665	3.12% (est)
2004	- 1,865,096	3.12% (est)
2005	- 1,923,293	3.12% (est)

The total bond currently posted, rounded to the nearest $1,000, is **$1,825,000**.

Substation Power Transformers

Bear Canyon and Wild Horse Ridge Substations:

(8) Steel I-columns spaced 16 ft apart:

(4) 12 in x 5½ in x 32ft columns and

(4) 7 in x 4.5 in x 32 ft columns.

(17) 7 in x 4.5 in x 16 ft I-beams.

Average beam/column thickness approx. d in. Cut each column and beam twice.

Cut length = 2 cuts [(4 members) (12 in + 11 in) + (21 members) (7" + 9")] = 856" = 71 ft.

Assume ½ in plate can be cut twice as fast as 1" plate, etc.

02220-790-0010 (Torch Cutting, 1 in Plate)

Equivalent length for 1 in plate) = (d) (71 ft) = 26.6 ft

Cutting Cost = ($8.95 /ft) (26.6 ft) = $238

Cutting Time = (26.6 ft) / (85 ft/day) = 0.31 days

02220-300-1570 (750 KVA Transformer)

Cost = 6 Transformers x $665/trans. = $3,990

Time = 6 Trans / (0.45/day) = 13.33 days

Equipment Loading

Assume each beam takes 10 min average and each transformer, etc. takes 20 min average to load with crane.

Transformers, etc.

Time = (25 pieces) (10 min) + (6 pieces) (20 min) = 6.2 hrs = 0.77 days

01590-600-2500 (Crane Loading)

Crane + operator = (6.2 hrs) ($133.72 /hr) = $846

01590-200-5300 (Dump Truck and CLAB)

Truck + operator = (6.2 hrs) ($102.99/hr) (2) = $1,277

CLAB = (6.2 hrs) ($35.75/hr) (2) = $443

Concrete Demolition

Slab Volume=(19 ft) (19ft) (6/12) = (180.5 cu ft) / 27 = 6.69 CY x 2 slabs = 13.4 cu yd

Slab Volume=(30 ft) (9 ft) (6/12) = (135 cu ft) /27 = 5 CY Total = 5 + 13.4 = 18.4 cu yd

Cost = ($12.78 /cu yd) (18.4 cu yd) = $235

Time = 18.4 cu yd / (45 cu yd/day) = 0.40 days

02220-875-5550 (Concrete Disposal on Site) 002315-400-1300 (3 CY loader) 02320-200-0320 (16 ton truck)

Volume = 18.4 cu yd x 1.3 swell factor = 24 cu yd

Cost = ($10.69 /cu yd) (24 cu yd) = $257

Time = (24 cu yd) / (232 cu yd/day) = 0.10 days

02220-875-0700 (Chain Link Fence)

Length = 157 ft x 2 = 314 ft

Cost = ($2.51/ft) (314 ft) = $ 788

Time = (314 ft) / (280 ft/day) = 1.12 days

Cost Subtotal	$8,074
Time Subtotal	16.03 days

Conveyor Belt Tunnels

6" reinforced concrete walls, roof and floor. Dimensions = 8' W x 7' H
Total length of tunnels = 470'

Concrete Demolition
Volume = (470 ft) [(7 ft) (2) + (8 ft) (2)] (0.5 ft) = 7,050 cu ft / 27 = 261 cu yd
Cost = ($12.78/cu yd) (261 cu yd) = $3,336
Time = (261 cu yd) / (45 cu yd/day) = 5.8 days

02220-875-5550 (Concrete Disposal on Site), 002315-400-1300 (3 CY loader), 02320-200-0320 (16 ton truck)
Volume = 261 cu yd * 1.3 swell factor = 339 cu yd
Cost = ($10.69/cu yd) (339 cu yd) = $3,624
Time = (339 cu yd) /(232 cu yd/day) = 1.46 days

Cost Subtotal	$6,960
Time Subtotal	7.26 Days

Power Lines & Poles

Power Pole Removal: (50 poles)($100/pole) = $5,000
Wire length: (8,700 ft) ($11.30/100 ft) = $983

Cost Subtotal	$5,983
Time Subtotal	2 Days (est)

Fuel Containment Enclosure

8" reinforced concrte walls (160 ft. in length), and 6" floor.

Concrete Demolition
Volume = [(160 ft.) (2.5 ft) (.67) + (1,500 ft^2) (0.5 ft) = 1018 cu ft / 27 = 38 cu yd
Cost = ($12.78/cu yd) (38 cu yd) = $486
Time = (38 cu yd) / (45 cu yd/day) = 0.84 days
02220-875-5550 (Concrete Disposal on Site), 002315-400-1300 (3 CY loader), 02320-200-0320 (16 ton truck)
Volume = 38 cu yd * 1.3 swell factor = 49 cu yd
Cost = ($10.69/cu yd) (49 cu yd) = $528
Time = (49 cu yd) / (232 cu yd/day) = 0.21 days

Total remove structures

Cost Total	$ 210,538
Time Total	168.98 days

Scale House and Sediment Pond B (TS-3)
See Appendix 3L, Table 3L-2

Cut Subtotal	1,454 cu yds
Fill Subtotal	1,454 cu yds

Sediment Pond "A" (TS-4)
See Appendix 3-L, Table 3L-3.

Cut (350 sq ft) x (120ft) = 42,000 cu ft =	3,460 cu yds
Fill (350 sq ft) x (120ft) = 42,000 cu ft =	3,460 cu yds

Shower House and Sediment Pond C (TS-9)
See Appendix 3-L, Table 3L–8.

Cut (500 sq ft) x (185ft) = 92,500 cu ft =	5,851 cu yds
Fill (500 sq ft) x (185ft) = 92,500 cu ft =	5,851 cu yds

Wild Horse Ridge (TS-12 thru TS-15)
See Appendix 3-O, Table 3O-2, 3 & 4

Cut Subtotal =	23,641 cu yds
Fill Subtotal =	23,641 cu yds

Note: Approximately 12,500 cu yds of the Wild Horse Ridge volume will be regraded using a D9 dozer, and the remaining volume will regraded using a 330BL Excavator.

Wild Horse Ridge Tank Seam (TS-16 thru TS-17)
See Appendix 3-P.

Cut Subtotal	15,055 cu yds
Fill Subtotal	15,055 cu yds

Cut Total =	112,025 cu yds
Fill Total =	112,025 cu yds

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SOIL PLACEMENT

Areas		Earth Moved	Cu Yds	Equipment Used	Cost/hr	Time (hrs)	Cost
Tank Seam Access Road & Portal Pad (TS-10 & TS-11)		Cut	20,310	330BL	$153.13	20.2	$ 3,093
	Fill	20,310					
		Hauled	10,661				
Upper Storage Pad (TS-8)	Cut	3,666		330BL	$153.13	14.6	$ 2,236
		Fill	7,022				
Portal Pad Area & Road (TS-7)		Cut	6,445	330BL	$153.13	37.7	$5,773
		Fill	18,037				
Portal Access Road (TS-6)	Cut	8,126		330BL	$153.13	11.65	$ 1,784
		Fill	5,573				
		Excess Cut	2,553	included in fill volumes above			
Coal Storage Pad (TS-5)		Cut	40,585	D9 Cat	$190.80	50.3	$ 9,597
		Fill	25,157				
		Excess Cut	15,428	included in fill volumes above			
Scale House/ Sed Pond B (TS-3)		Cut	1,454	D9 Cat	$190.80	2.9	$ 553
		Fill	1,454				
Sediment Pond "A" (TS-4)	Cut	3,460		D9 Cat	$190.80	6.9	$ 1,317
		Fill	3,460				
Shower House/ Sed Pond C (TS-9)	Cut	5,851		D9 Cat	$190.80	11.7	$ 2,232
		Fill	5,851				
Wild Horse Ridge Area*** (TS-12 thru TS-15)	Cut	11,141		330BL	$153.13	23.3	$ 3,568
		12,500		D9 Cat	$190.80	25.0	$ 4,770
		Fill	23,641				
Wild Horse Ridge Tank Seam	Cut	1,760		D9 Cat	$153.13	3.2	$ 490
			13,295	330BL	$190.80	26.5	$ 5,056
(TS-16 thru TS-17)	Fill	15,055					
Totals		Cut	110,462			227.52	$40,469
		Fill	110,708				(28.44 days)

*See Appendix 3-L and the following page.

**Excess Cut will be hauled from TS-5 and TS-6 to TS-7 and TS-8, as discussed in Appendix 3-L.

***Wild Horse Ridge material being relocated with the excavator will be hauled an average distance of 200 ft, as shown on the following pages.

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Hauling = (12.38 min)(hr/60 min)(217)/(3 trucks) = 14.9 hrs = 1.9 days (concurrent w/soil placement)
Round trip 2 = 5.88 + 2(7.29) = 20.46 min.; Number of loads = (4,860 cu yd)/(10 cu yd truck) = 486 Loads
Hauling = (20.46 min) (hr/60 min)(486)/(3 trucks) = 55.2 hrs = 6.9 days (concurrent w/soil placement)

980 loader cost = ($142.77/hr) (40.6 + 14.9 + 55.2 hrs) =	$15,805
Dump Truck cost = ($68.38/hr) (40.6 + 14.9 + 55.2 hrs) (3 trucks) =	$23,788
	$39,593

Moving Excavator material for WHR Tank Seam regrading.

Avg. Distance = 390 ft = 0.07 miles @ avg. Speed of 7 MPH; haul time = 0.49 min.
Round trip time for 1 truck load (980 Loader) = 5.88 + 2(0.49) = 6.86 min.
Number of loads = (13,295 cu yd) / (10 cu yd truck) = 1,330loads
Hauling =(6.86 min)(hr/60 min)(1,330 loads)/(3 trucks)= 50.7hrs = 6.3 days (concurrent w/soil placement)

980 loader cost = ($142.77/hr) (50.7hrs) =	$,238
Dump Truck cost = ($68.38/hr) (50.7hrs) (3 trucks) =	$10,401
	$17,639

Cost Subtotal	$ 100,239
Time Subtotal	10.9**days**

Hauling Material to Fill Borehole

10,560 cu yd will need to be hauled from the Blind Canyon Seam portal.
Round trip time:
Loader haul time = 0.3 miles @ 7 mph x 2 loads = 5.14 min. to haul
Loader cycle time = 2 cycles/(106 cycles/hr) = 1.13 min. to load
Truck haul time = 1.1 miles @ 7 mph = 9.43 min.
Total cycle time = 15.70 min.
Number of loads = 10,560 cu yd/10 cu yd truck = 1,056 loads
980 Loader time = (15.7 min) (hr/60 min) (1,056 loads) /13 trucks = 21.2 hrs.
= 2.65 days (concurrent with soil placement)

CAT 330BL cost = ($153.13/hr) (21.2 hrs) =	$3,384
980 Loader cost = ($142.77/hr) (21.2 hrs) =	$3,027
Dump Truck cost = ($68.38/hr) (21.2 hrs) (13 trucks) =	$18,846
	$ 25,257

Cost Subtotal	**$ 25,257**
Time Subtotal	**2.65 days**

Soil Placement Cost Subtotal =	$ 40,469
Hauling Excess Cut Cost Subtotal =	$ 100,239
Filling Borehole Cost Subtotal =	$ 25,257

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Cost Total	$165,965
Time Total	31.5