APPENDIX 12-A

Quality Assurance and Quality Control (QA/QC) Program
Soil and Overburden Sample Analysis

(9/93)

(QA/QC) Program
Soil and Overburden Sample Analysis

GENERAL REQUIREMENTS

Navajo Mine will contract with the same laboratory for the duration of baseline characterization studies and monitoring programs. Navajo Mine will notify OSMRE when anticipating a laboratory change. Navajo Mine will attempt to coordinate proper procedures, techniques, and planning of sampling programs between OSMRE and the laboratory.

SAMPLE COLLECTION, HANDLING AND TRANSPORT

To meet the requirements of 30 CFR 780.22(b)(2) and (c) and 30 CFR 777.13(a), Navajo Mine's laboratory will list, with references, the methods of sample preparation and analyses used to analyze soil, overburden and regraded spoil parameters. The following are procedures to be initiated and completed for sample collection, handling and transport:

1. Samples will not be exposed to high temperatures. If temperatures exceeding 35°C are possible the overburden/spoil samples will be stored during sampling and insulated to maintain cool temperatures.

2. Samples will be identified and labeled using a system that will correspond with submitted sample location maps and laboratory analytical results.

3. Sufficient sample quantities will be collected to meet the needs for sample splits outlined in the following sections of this document. Regraded spoil samples will be representative of the rooting zone material.

4. Time between sample collection and preparation will not exceed thirty (30) days.

SAMPLE PREPARATION AND STORAGE

Laboratory Preparation

All analyses must be performed on air-dried samples with data being reported on a 100°C basis. If exceptions occur the information will be reported.

Drying

Drying will be initiated as soon as possible after the samples arrive at the laboratory. They will be air dried at a temperature not exceeding 35°C by spreading samples on non-metallic trays to a depth of 1-2 cm. Drying can be excluded for sample analyses that require an "as received basis" for analyses completion. Soil clods will be broken so that there are none larger than 1 cm in diameter. Samples will be mixed daily and respread to allow for faster drying. Drying may be accelerated by passing air from a fan over the samples.

Core Crushing

1. Core crushing will be accomplished utilizing equipment that minimizes particle size reduction. Equipment used will also have a minimal chance of chemical contamination of the samples and be easily cleaned between samples.

2. The entire core sample will be crushed to <2 mm with constant sample removal.

Soil Flailing

1. Soil samples will be flailed to pass a 2 mm sieve with constant sample removal. Determination of the coarse fraction (weight basis) will be made on the basis of the field sample.

2. Soil samples are to be sieved, prior to flailing, with separation of >1 cm coarse fragments.

Grinding

Samples for Leco Furnace analyses (total sulfur and organic carbon) must be ground to <.25 mm.

Splitting

Samples will be passed through a mechanical sample splitter and recombined four to five times to insure complete sample mixing. Depending upon how many subsamples are needed, the mixed sample will be split using a mechanical splitter into several small samples and then recombined to achieve the desired number of subsamples.

The laboratory will prepare and maintain two splits of the original samples with one sample being retained by the laboratory for analyses and one returned to the company to be available to the Regulatory Authority (RA) when requested.

Sample Storage

Samples will be stored in the laboratory, or elsewhere, at temperatures <30°C. After preparation, samples will be stored in suitable containers under controlled storage conditions. Storage conditions used will be outlined in the final reports to the RA.

QUALITY ASSURANCE PROGRAM ELEMENTS

The following information will be provided to the Navajo Mine and RA for each sample/set of samples:

1. Names and qualifications of personnel handling sample at each stage of collection, preparation and analyses;

2. Name and qualifications of individual making interval separations and sampling of cores;

3. Dates and conditions of each stage of sample collection, transport, preparation and analyses;

4. Detailed description of core collection, storage, and preparation procedures; and

5. Laboratory procedures as specified. If procedure modifications are made, the laboratory will describe the modifications in detail and should submit statistical data correlating data with original methodology.

Additional internal laboratory QA/QC procedures on all analytical parameters will be supplied to Navajo Mine and the RA in final reports.

QUALITY CONTROL DATA

A sample is physical evidence collected from a facility or from the environment. An essential part of soil, overburden or spoil sampling programs is to control the evidence gathered. To accomplish this Navajo Mine will required that their drillers and contracted laboratory initiate and complete chain-of-custody and document control programs. Copies of program procedures will be submitted to the RA with all soil, overburden, and spoil analytical results.

Time from sample collection to completion of analyses will not exceed sixty (60) days and may have to be reduced for certain parameters; i.e., selenium.

Instrumentation

1. Detection Limits

   Detection limits will be established for each instrument immediately prior to analyses of any field samples. A log of each instruments' detection limits will be kept.

2. Working Limits

   a. Established working limits prior to beginning each test.

b. Determine the concentration that is three times the detection limits of the instrument for each analyses in the extraction solution.

c. Prepare calibration standards in graduated amounts.

ANALYTICAL CONTROLS

Calibration standards must be prepared:

1. Within an anticipated range of the samples;

2. Using the same acid or salts used in the digestion or extraction of the field samples; and

3. As a blank, and at least three calibration standards in graduated amounts for each analytical parameter.

Duplicate samples must be prepared and analyzed:

1. For samples with matrix type and concentration representative of the major samples analyzed;

2. With 10% duplication for analyses which are routinely accomplished with minimum difficulty in accuracy and precision,; i.e., pH, EC, etc. These samples should be randomly selected; and

3. With 20% duplication on analyses which are known to be difficult to accomplish with high levels of accuracy and precision; i.e., CEC, ESP, extractable selenium and boron. These samples should be randomly selected.

REPORTS

Control charts will be developed, including:

1. Chronological data tables for calibration standards, control samples, duplicate samples, and detection limit results; and

2. Chronological statistical computation of data.

Data will be presented using systematic report formats including:

1. Uniform analytical units;

2. Uniform significant figures;

3. Uniform tables for computer reader use (see below - Data Submittal Format Section); and

4. Submittal of data in hard copy and on IBM floppy in a flat ASCII file.

DATA SUBMITTAL FORMAT

Analytical results will be submitted to the RA in hard copy and on 3-1/2 and 5-1/4 IBM compatible floppy disks in flat ASCII file formats. Columns (fields) for reporting analytical results in the requested file formats will be twelve spaces in width and the following data will be reported:

1. Core Number;*

2. Northing of Core;*

3. Easting of Core;

4. Core Collar Elevation;

5. Core Sample Number;

6. Core Sample Elevation;

7. pH;

8. EC; and all other analytical parameter results.

*Location coordinates, core numbers and collar elevations will correspond to those depicted on core, soil and regraded spoil location maps (as found in the annual report).

APPENDIX 12-B

BOND CALCULATION WORKSHEETS AND TABLES

WORST CASE BOND SCENARION 2009

United States Department of the Interior
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT
WESTERN REGIONAL COORDINATING CENTER

AMENDMENT TO COLLATERAL BOND AND INDEMNITY AGREEMENT

To be attached to and form a part of the Collateral Bond and Indemnity Agreement executed by **BHP Finance (International) Inc. (on behalf of BHP Navajo Coal Company)** AS OBLIGATOR, in the sum of **NINETY MILLION FORTY-SIX THOUSAND SIX HUNDRED THIRTY-TWO DOLLARS ($ 90,046,632.00),** in favor of the United States Office of Surface Mining Reclamation and Enforcement (OSM) and executed on **September 15, 1994, amended September 19, 1994, November 14, 1995, January 23, 1996, August 8, 1997, September 8, 1997, September 22, 1999, December 9, 2004, July 27, 2005 and August 24, 2006.**

Whereas, the OSM issued Permit to Mine No. **NM-0003A** and dated on **September 25, 1989**, and Permit Renewals and Revisions numbered and dated: **NM-0003B, January 31, 1991; NM-0003C, July 20, 1993; NM-0003D, September 22, 1994; NM-0003E, September 24, 1999 and NM-0003F, September 26, 2004,** pursuant to the application of the Obligator;

Whereas, said collateral bond and indemnity agreement shall cover any and all land affected or to be affected by the mining operation under the above mentioned permit and revisions and renewals since the date of the issuance of the permit;

Now, therefore, the purpose of this rider is:

(a) To increase the amount of credit for Irrevocable Standby Letter of Credit Number 221619, issued by Bank of America, N.A., by **FIVE MILLION AND NO/100** Dollars (**$5,000,000.00**), to a new total sum of **ONE HUNDRED FIFTY-FIVE MILLION DOLLARS AND NO/100** Dollars (**$155,000,000.00**), to cover the additional cost of reclaiming all affected lands.

It is further understood and agreed that all other terms and conditions of this collateral bond and indemnity agreement shall remain unchanged.

IN WITNESS WHEREOF, the OBLIGATOR has hereunto set its signature and seal this 12th day of August, 2008.

Earl K. Moore,
(Corporation – Permittee)

BY[1]: EARL K. MOORE

TITLE: VICE PRESIDENT

STEPHANIE RICHARDSON
My Commission Expires
July 12, 2010
Affix Seal

ACKNOWLEDGMENT OF CORPORATION - OBLIGOR

On the 12th day of August, 2008, before me, a Notary Public in and for the County of Harris, in the State of Texas, appeared Earl K. Moore, to me personally known, who being by me sworn, did say that he/she is Vice President, of the corporation named and in which executed the within instrument, and that the seal affixed to said instrument is the corporate seal of said corporation, and that said instrument was signed, sealed, and delivered on behalf of said corporation by authority of its Board of Directors, and he/she, as such officer, acknowledged said instrument to be the free act and deed of said corporation for the uses and purposes of said instrument as therein set forth.

Witness my hand and official seal. ____________________
Notary Public in and for said County and State

My Commission Expires:
7-12-2010

[1] Where one signs by virtue of Power of Attorney or Corporate Resolution, such certified Power of Attorney or Corporate Resolution must be filed with this instrument.

Paperwork Reduction Act Notice

We use the information required by this form to ensure that the requirements for a collateral bond under 30 CFR 800.21 are met. You must provide the requested information to obtain or retain a benefit (a collateral bond). Under 30 CFR 842.16, the information collected is a matter of public record.

The time needed to complete this form and submit the requested information will vary depending on individual circumstances. We estimate that the average time will be 2 hours per response. This number includes the time spent reviewing instructions, learning about the regulations, gathering and maintaining information, and completing and reviewing the form. If you have comments concerning the accuracy of this estimate or suggestions for simplifying the form or instructions, you may write to the Information Collection Clearance Officer, Office of Surface Mining Reclamation and Enforcement, Room 202 SIB, 1951 Constitution Ave, NW, Washington, D.C. 20240.

Under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.), you are not required to respond to, nor will you be subject to a penalty for a failure to comply with, a collection of information unless it displays a currently valid OMB control number.

OMB Control No. 1029-0043; expires 1/31/2009

APPENDIX 12 - B

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Item	Title

WORKSHEETS

TABLES

APPENDIX 12 - B

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Item	Title

TABLES (cont'd).

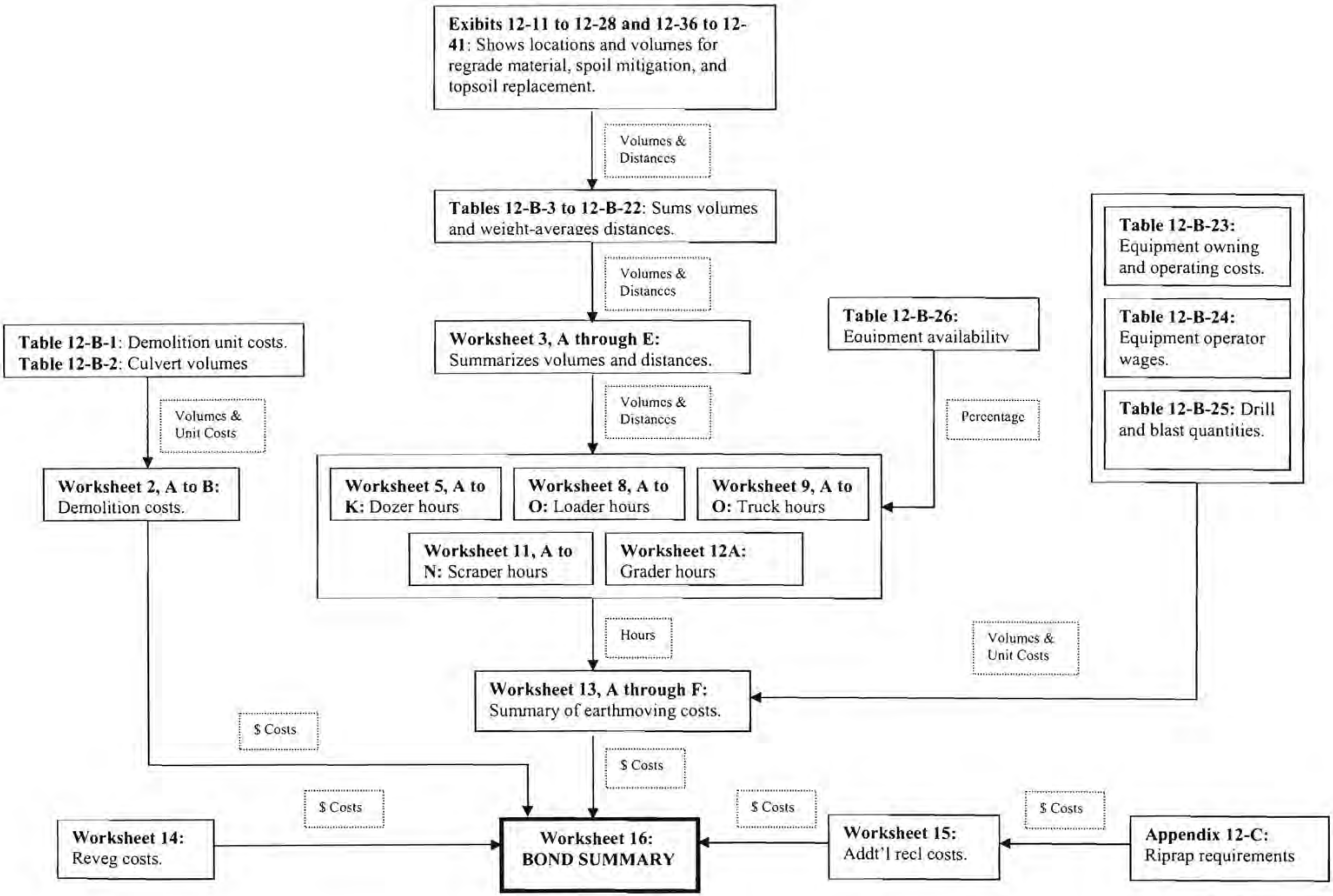
BOND CALCULATION WORKSHEETS

WORST CASE BOND SCENARIO 2009

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT
BOND AMOUNT CALCULATION

FIGURE 12-B-1

FLOWCHART



WORKSHEET NO. 1

DESCRIPTION OF WORST CASE BONDING RECLAMATION SCENARIO

Determination of Maximum Reclamation Requirements

The point at which reclamation liabilities will be greatest occurs during the first year of the five-year term ending in 2014 (see Worksheet 1, APPENDIX 12-B). The open volume of North and South Barber are at the maximum during year 1. As Hosteen and Yazzie pits progress, the final pit associated continually decreases in length.

The Yazzie, Hosteen, North Barber, South Barber, Lowe, Dixon, and Area 4 North pits will all require reclaiming at the end of 2014. Dozers will be utilized to push the maximum amount of material into the pits. Any material the dozers cannot move in a cost effective manner will be moved by scrapers or trucks and loaders. Any areas that do not pass the spoil sampling tests will be mitigated by one of the approved methods in the permit prior to topsoil placement. For the purpose of this reclamation bond calculation, 2% of the regraded area in the permanent program category will require spoil mitigation. After all spoil is regraded, final pits will be shaped to their final contours, and mitigation material will be placed where required; topsoil will be placed, revegetation will occur with a 20% failure rate and the mine facilities will be removed. Facility areas will be mitigated as required and topsoiled. At this time, the mine will be ready to begin phased bond release with the ultimate goal of total bond release. It will be necessary to move and place approximately 131,000,000 cubic yards of material during the reclamation effort. The majority (approximately 122,000,000 cubic yards) will be moved and placed during the primary grading effort. Therefore, the major effort for this reclamation bond calculation is focused on primary grading.

WORKSHEET NO. 2

STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	Length [ft]	Width [ft]	Height [ft]	Number	Construction	Building				Floors, Surfaces & Walls				Footings			
						Volume [yd3]	Unit Cost	Ref	Cost	Area [ft2]	Unit Cost	Ref	Cost	Length [ft]	Unit Cost	Ref	Cost
Area 3																	
Area 3 Guard House	16	16	11	1	Steel Building	2,688	0.26	1	$699	256	5.03	9a	$1,287	64.0	13.85	12a	$886
Area 3 Field Office	60	147	14	1	Steel Building	123,480	0.26	1	$32,105	8,820	5.03	9a	$44,330	414	13.85	12a	$5,734
Area 3 Field Office	40	80	14	1	Steel Building	44,800	0.26	1	$11,648	3,200	5.03	9a	$16,084	240	13.85	12a	$3,324
Area 3 Field Office	20	19	14	1	Steel Building	5,320	0.26	1	$1,383	380	5.03	9a	$1,910	78.0	13.85	12a	$1,080
Area 3 Field Office	32	10	14	1	Steel Building	4,480	0.26	1	$1,165	320	5.03	9a	$1,608	84.0	13.85	12a	$1,164
Area 3 Field Office	33	141	14	1	Steel Building	65,142	0.26	1	$16,937	4,653	5.03	9a	$23,386	348	13.85	12a	$4,820
Area 3 Field Office Sidewalk	900	5		1	Concrete	-	-	-	-	4,500	0.90	27	$4,050	-	-	-	-
Area 3 Parking Lot	393	168		1	Asphalt	-	-	-	-	66,024	1.05	28	$69,435	-	-	-	-
Area 3 Entrance Road	319	32		1	Asphalt	-	-	-	-	10,208	1.05	28	$10,735	-	-	-	-
Area 3 Walkway to Maint Shop	215	10		1	Asphalt	-	-	-	-	2,150	1.05	28	$2,261	-	-	-	-
Area 3 Wash Facility	80	36	32	1	Concrete Building	92,160	0.37	2	$34,099	2,880	5.03	9a	$14,475	232	13.85	12a	$3,214
Area 3 Pump House	12	12	20	1	Concrete Building	2,880	0.37	2	$1,066	144	5.03	9a	$724	48.0	13.85	12a	$665
Area 3 Shop - Ambulance	30	54	15	1	Steel Building	23,490	0.26	1	$6,107	1,620	5.03	9a	$8,142	168	13.85	12a	$2,327
Area 3 Shop - Small bays	102	151	23	1	Steel Building	354,246	0.26	1	$92,104	15,402	5.03	9a	$77,412	506	13.85	12a	$7,009
Area 3 Shop - Truck Bays	154	89.5	44	1	Steel Building	603,695	0.26	1	$156,961	13,783	5.03	9a	$69,275	487	13.85	12a	$6,746
Area 3 Shop - Lube Bays	30	89.5	25	1	Steel Building	67,125	0.26	1	$17,453	2,685	5.03	9a	$13,495	239	13.85	12a	$3,310
Area 3 Shop - Warehouse Add.	78	84	20	1	Steel Building	131,040	0.26	1	$34,070	6,552	5.03	9a	$32,931	324	13.85	12a	$4,488
Area 3 Shop - Lube Dock	103	30	15	1	Steel Building	46,350	0.26	1	$12,051	3,090	5.03	9a	$15,531	266	13.85	12a	$3,684
Area 3 Shop - Sidewalk	133	5		1	Concrete	-	-	-	-	665	0.90	27	$599	-	-	-	-
Area 3 Shop - Driveway	370	30		1	Concrete	-	-	-	-	11,100	1.51	29	$16,804	-	-	-	-
Area 3 Shop - Driveway	120	17		1	Concrete	-	-	-	-	2,040	1.51	29	$3,088	-	-	-	-
Area 3 Shop - Driveway	102	10		1	Concrete	-	-	-	-	1,020	1.51	29	$1,544	-	-	-	-
Area 3 Cable Shop	40	16	12	1	Steel Building	7,680	0.26	1	$1,997	640	5.03	9a	$3,217	1,344	13.85	12a	$18,616
Area 3 Cable Shop Sidewalk	88	8		1	Concrete	-	-	-	-	704	0.90	27	$634	-	-	-	-
Area 3 Cable Shop Pad	20	20		1	Concrete	-	-	-	-	400	5.03	9a	$2,010	-	-	-	-
Area 3 Ready Line	600	2	6	1	Concrete w/rods	7,200	5.51	30	$39,680	-	-	-	-	-	-	-	-
Area 3 Fuel Tanks		25000 gal.		4	Steel Structure	13,369	0.28	31	$3,743	-	-	-	-	-	-	-	-
Area 3 Fuel Tanks		12000 gal.		2	Steel Structure	3,209	0.28	31	$898	-	-	-	-	-	-	-	-
Fuel Tank Enclosure	82	51	3	1	Concrete(8"walls)	-	-	-	-	798	13.03	19a	$10,400	-	-	-	-
Fuel Tank Enclosure - Slab	82	51		1	Concrete	-	-	-	-	4,182	6.70	10	$28,026	266	13.85	12a	$3,684
Fuel Tank Drive Pad	82	20		1	Concrete	-	-	-	-	1,640	5.03	9a	$8,243	-	-	-	-
Dixon Water Loadout Slab	60	24	2	1	Concrete	2,160	5.51	30	$11,904	-	-	-	-	-	-	-	-
Barber Loadout Slab	72	24	1	1	Concrete	1,296	5.51	30	$7,142	-	-	-	-	-	-	-	-
Dixon ANFO Loadout ANFO Silos	55	13.5 dia.		1	Steel Structure	7,873	0.28	31	$2,204	-	-	-	-	-	-	-	-
Dixon ANFO Loadout ANFO Silos	55	13.5 dia.		1	Steel Structure	7,873	0.28	31	$2,204	-	-	-	-	-	-	-	-
Dixon ANFO Loadout Emulsion Silo	29	12 dia.		1	Steel Structure	3,280	0.28	31	$918	-	-	-	-	-	-	-	-
Dixon ANFO Loadout Fuel Tank		10000 gal.		1	Steel Structure	1,337	0.28	31	$374	-	-	-	-	-	-	-	-
Dixon ANFO Loadout Footings	48	4	4	1	Concrete	768	5.51	30	$4,233	-	-	-	-	-	-	-	-
Barber Stkp ANFO Loadout ANFO Silo	48.3	11.5 dia.		1	Steel Structure	5,017	0.28	31	$1,405	-	-	-	-	-	-	-	-
Barber Stkp ANFO Loadout Emulsion Silo	29	12 dia.		1	Steel Structure	3,280	0.28	31	$918	-	-	-	-	-	-	-	-

WORKSHEET NO. 2
STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	Length (ft)	Width (ft)	Height (ft)	Number	Construction	Building				Floors, Surfaces & Walls				Footings			
						Volume (yd3)	Unit Cost	Ref	Cost	Area (ft2)	Unit Cost	Ref	Cost	Length (ft)	Unit Cost	Ref	Cost
Barber Stkp ANFO Loadout Oil Tank		8000 gal.		1	Steel Structure	1,070	0.28	31	$299	-	-	-	-	-	-	-	-
Barber Stkp ANFO Loadout Footings (8)	32	4	4	8	Concrete	4,096	5.51	30	$22,574	-	-	-	-	-	-	-	-
Barber HW ANFO Loadout ANFO Silo	55	13.5 dia.		1	Steel Structure	7,873	0.28	31	$2,204	-	-	-	-	-	-	-	-
Barber HW ANFO Loadout Emulsion Silo	29	12 dia.		1	Steel Structure	3,280	0.28	31	$918	-	-	-	-	-	-	-	-
Barber HW ANFO Loadout Oil Tank		12000 gal.		1	Steel Structure	1,604	0.28	31	$449	-	-	-	-	-	-	-	-
Barber HW ANFO Loadout Footings (8)	32	4	4	8	Concrete	4,096	5.51	30	$22,574	-	-	-	-	-	-	-	-
Barber HW ANFO Drive Pad	18	33		1	Concrete	-	-	-	-	594	5.03	9a	$2,988	-	-	-	-
Barber HW ANFO Enclosure	23	33	5	1	Concrete(8" walls)	-	-	-	-	560	13.03	19a	$7,298	-	-	-	-
Barber HW ANFO Enclosure - Slab	23	33		1	Concrete	-	-	-	-	759	6.70	10	$5,086	112	13.85	12a	$1,551
Old Yazzie Silo Footings	32	4	4	1	Concrete	512	5.51	30	$2,822	-	-	-	-	-	-	-	-
Lowe Magazine Security Fence	2000		10	1	Chain Link/Razor Wire	-	-	-	-	-	-	-	-	2,000	4.41	24	$8,821
Lowe Magazine Load Dock	8	18	4	1	Concrete Structure	576	0.37	2	$213	144	5.03	9a	$724	52.0	13.85	12a	$720
Lowe Magazine Load Dock Walls	8	18	4	1	Concrete (8"walls)	-	-	-	-	144	13.03	19a	$1,877	-	-	-	-
A-3 Potable Water Tank	25	40 dia.		1	Steel w/ Conc Slab	31,416	0.28	31	$8,796	1,000	5.03	9a	$5,026	130	13.85	12a	$1,801
A-3 Potable Water Pump Building	36	28	12	1	Steel Building	12,096	0.26	1	$3,145	1,008	5.03	9a	$5,066	128	13.85	12a	$1,773
Safety Building	26	70	13	1	Steel Building	23,660	0.26	1	$6,152	1,820	5.03	9a	$9,148	192	13.85	12a	$2,659
Solvent Building	30	62	13	1	Steel Building	24,180	0.26	1	$6,287	1,860	5.03	9a	$9,349	184	13.85	12a	$2,549
Area 3 Welding Shop	60	120	40	1	Steel Building	288,000	0.26	1	$74,880	7,200	5.03	9a	$36,188	360	13.85	12a	$4,987
Area 3 Wash Bay Addition	16	30	13	1	Steel Building	6,240	0.26	1	$1,622	480	5.03	9a	$2,413	92.0	13.85	12a	$1,274
Area 3 Wash Bay Drains	3	10		1	Concrete	-	-	-	-	30	5.03	9a	$151	-	-	-	-
Area 3 Propane Tank	70	10 dia.		1	Steel Structure	5,498	0.28	31	$1,539	-	-	-	-	-	-	-	-
Area 3 Propane Tank Loading Dock	10	18	4	1	Concrete slab	-	-	-	-	180	5.03	9a	$905	-	-	-	-
Area 3 Maintenance Shop Addition	41	41	15	1	Steel Building	24,375	0.26	1	$6,337	1,681	5.03	9a	$8,449	164	13.85	12a	$2,272
Area 3 Oil Blending Sys Enclosure	40	27	5	1	8" Concrete Walls	-	-	-	-	670	13.03	19a	$8,732	-	-	-	-
Area 3 Oil Blending Sys Slab	40	27		1	Concrete	-	-	-	-	1,080	5.03	9a	$5,428	134	13.85	12a	$1,856
Area 3 Oil Blending Sys Drive Pad	18	40		1	Concrete	-	-	-	-	720	5.03	9a	$3,619	-	-	-	-
Area 3 Oil Blending Tank	28	11 dia.		1	Steel Structure	2,661	0.28	31	$745	-	-	-	-	-	-	-	-
Area 3 Oil Blending Tank	15	12 dia.		1	Steel Structure	1,696	0.28	31	$475	-	-	-	-	-	-	-	-
GPS Antenna Relocation Footings	4	4	4	1	Concrete	64	0.37	2	$24	-	-	-	-	-	-	-	-
Bigham Haulroad Asphalt Removal				1		-	-	-	-	253,800	1.05	28	$266,913	-	-	-	-
Area 3 Filed Office (mechanics)	32	28	13	1	Steel Building	11,648	0.26	1	$3,028	-	-	-	-	-	-	-	-
Area 3 Field Office (mechanics) Foundation	4	2.5 dia.		1	Concrete	19.6	5.51	30	$108	-	-	-	-	-	-	-	-
Dragline Outage Pad	1	82 dia.		1	Concrete	5,281	5.51	30	$29,104	-	-	-	-	-	-	-	-
Dragline Outage Building	92	92	92	1	Steel	778,688	0.13	1A	$101,229	-	-	-	-	-	-	-	-
Silo Pad				1	Concrete	-	-	-	-	39,204	5.51	30	$216,058	-	-	-	-
Area 3 Operator Simulator Pad	50	50	1	1	Concrete					2,500	5.51	30	$13,778				
Area 3 Outdoor Work Pad	40	60	2	1	Concrete	-	-	-	-	2,400	5.51	30	$13,227	-	-	-	-
North Area																	
Welding & Machine Shop	91	105.5	20	1	Steel Building	192,010	0.26	1	$49,923	9,601	5.03	9a	$48,253	393	13.85	12a	$5,444
Seed Storage Building	60	30	20	1	Steel Building	36,000	0.26	1	$9,360	1,800	5.03	9a	$9,047	180	13.85	12a	$2,493
Tire Shop	120	60	30	1	Concrete Building	216,000	0.37	2	$79,920	7,200	5.03	9a	$36,188	360	13.85	12a	$4,987

WORKSHEET NO. 2

STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	Length [ft]	Width [ft]	Height [ft]	Number	Construction	Building				Floors, Surfaces & Walls				Footings			
						Volume [yd3]	Unit Cost	Ref	Cost	Area [ft2]	Unit Cost	Ref	Cost	Length [ft]	Unit Cost	Ref	Cost
Lab/Carpentry Shop	104	70	18	1	Steel/Masonry	131,040	0.28	3	$36,891	7,280	5.03	9a	$36,590	348	13.85	12a	$4,820
Area I Ready Line	400	2	6	1	Concrete	4,800	5.51	30	$26,453	-	-	-	-	-	-	-	-
Area I Parking Lot	50	100		1	Ashpalt	-	-	-	-	5,000	1.05	28	$5,258	-	-	-	-
Old Coal Lab	30	22	14	1	Masonry Building	9,240	0.28	3	$2,587	660	5.03	9a	$3,317	104	13.85	12a	$1,441
Area I Main Shop	302	116	30	1	Steel Building	1,050,960	0.26	1	$273,250	35,032	5.03	9a	$176,075	836	13.85	12a	$11,580
Control Tower	8	18 dia.		1	Steel Building	2,036	0.26	1	$529	254	5.03	9a	$1,278	52.0	13.85	12a	$720
Substation Buildings (12 total)	25	12	12	12	Masonry Building	43,200	0.28	3	$12,096	3,600	5.03	9a	$18,094	888	13.85	12a	$12,300
Plant Conveyor				1		-	-	-	-	-	-	-	-	10,330	23.41	33	$241,830
Conveyor Footings (504 total)	7.48			504		-	-	-	-	-	-	-	-	7,540	13.85	12a	$104,438
Conveyor Transfer Tower (15 total)	15	15	19	15	Steel Structure	64,125	0.26	1	$16,673	-	-	-	-	900	25.54	15a	$22,985
Crushers (2 total)	15	18	40	2	Steel Structure	21,600	0.28	31	$6,048	-	-	-	-	132	25.54	15a	$3,371
Hoppers (2 total)	60	65	68	2	Concrete Structure	530,400	0.37	2	$196,248	-	-	-	-	-	-	-	-
Coal Plant Reclaimers (2 total)	30	116	30	2	Steel Structure	208,800	0.28	31	$58,464	-	-	-	-	-	-	-	-
Coal Plant Stackers (2 total)	30	20	53	2	Steel Structure	63,600	0.28	31	$17,808	-	-	-	-	-	-	-	-
Coal Plant Rails				1	Rails and ties	-	-	-	-	-	-	-	-	9,000	4.11	26	$36,990
Area I Fuel Tanks	32	8 dia.		1	Steel Structure	1,608	0.28	31	$450	-	-	-	-	-	-	-	-
Area I Fuel Tanks (2 total)	27	8 dia.		2	Steel Structure	2,714	0.28	31	$760	-	-	-	-	-	-	-	-
Area I Fuel Tank Enclosure	42	48	5	1	8" Concrete Walls	-	-	-	-	900	13.03	19a	$11,729	-	-	-	-
Area I Fuel Tank Enclosure Slab	42	48		1	Concrete	-	-	-	-	2,016	6.70	10	$13,510	180	13.85	12a	$2,493
Area I Fuel Tank Drive Pad	20	48		1	Concrete	-	-	-	-	960	5.03	9a	$4,825	-	-	-	-
North Water Loadout	20	4	5	1	Steel Structure	400	0.26	1	$104	-	-	-	-	-	-	-	-
North Water Loadout Drive Pad	60	24	2	1	Concrete	2,160	5.51	30	$11,904	-	-	-	-	-	-	-	-
North Potable Water Tank	25	40 dia.		1	Steel Structure	31,416	0.28	31	$8,796	1,256	5.03	9a	$6,313	126	13.85	12a	$1,740
North Potable Water Pump Building	8	12	8	1	Concrete Building	768	0.37	2	$284	96	5.03	9a	$483	40.0	13.85	12a	$554
Ramp 7 Potable Water Building	20	16	10	1	Steel Building	3,200	0.26	1	$832	320	5.03	9a	$1,608	72.0	13.85	12a	$997
Radio Towers (2 total)	2	2	180	2	Steel Structure	1,440	0.28	31	$403	-	-	-	-	-	-	-	-
Radio Tower footings (6 total)	5.5	5.5	2	6	Concrete	363	5.51	30	$2,001	-	-	-	-	-	-	-	-
Radio Tower Piers (6 total)	9	2 dia.		6	Concrete	170	5.51	30	$935	-	-	-	-	-	-	-	-
North Radio Shack	12	16	8	1	Steel Building	1,536	0.26	1	$399	192	5.03	9a	$965	56.0	13.85	12a	$776
Sand Silo	21	8 dia.		1	Steel Structure	-	-	-	-	-	-	-	-	-	-	-	-
Sand Silo Slab	10	10		1		-	-	-	-	100	5.03	9a	$503	-	-	-	-
Irrigation Pipeline (16 miles)	84,480	1.3 dia.		1	Steel	117,956	0.28	31	$33,028	-	-	-	-	-	-	-	-
Concrete thrust blocks (15 total)	6	6	6	15	Concrete	3,240	5.51	30	$17,856	-	-	-	-	-	-	-	-
Irrigation Intake Pump House	15	22	12	1	Steel Building	3,960	0.26	1	$1,030	330	5.03	9a	$1,659	74.0	13.85	12a	$1,025
Irrigation Intake Pump House Walls	72	15		1	8" Concrete Walls	-	-	-	-	1,080	13.03	19a	$14,075	-	-	-	-
Sump Floor	8	22		1	Concrete	-	-	-	-	176	5.03	9a	$885	60.0	13.85	12a	$831
Sump Walls	58	15		1	8" Concrete Walls	-	-	-	-	870	13.03	19a	$11,338	-	-	-	-
Irrigation Intake Filter Pad	18	11		1	Concrete	-	-	-	-	198	0.90	27	$178	-	-	-	-
Sidewalk	52	3.5		1	Concrete	-	-	-	-	182	0.90	27	$164	-	-	-	-
Transformer Pad	11.5	22		1	Concrete	-	-	-	-	253	5.03	9a	$1,272	67.0	13.85	12a	$928
Lake Haul Road				1		-	-	-	-	669,600	1.05	28	$704,196	-	-	-	-

WORKSHEET NO. 2

STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	Length [ft]	Width [ft]	Height [ft]	Number	Construction	Building				Floors, Surfaces & Walls				Footings			
						Volume [yd3]	Unit Cost	Ref	Cost	Area [ft2]	Unit Cost	Ref	Cost	Length [ft]	Unit Cost	Ref	Cost
Pinto Guardrails	700	12	1	1	Steel Structure	8,400	10.92	43	$91,728	-	-	-	-	-	-	-	-
Concrete Slab Under Towers/Conveyors				1	4" Concrete	-	-	-	-	30,000	3.62	8a	$108,722	-	-	-	-
Concrete Slab Under Towers/Conveyors				1	8" Concrete	-	-	-	-	40,000	7.55	10a	$302,193	-	-	-	-
Concrete Drain Pad @ West Inlet to Pond 5	165	20	1	1	8" Concrete	-	-	-	-	2,200	7.55	10a	$16,621	-	-	-	-
Other																	
Railroad Track and Ties				1		-	-	-	-	-	-	-	-	81,430	4.11	26	$334,677
Catenary (13 miles)				1	69 kV Power Line	-	-	-	-	-	-	-	-	13.0	23.41	33	$304
Catenary footings (total 542)	48			542		-	-	-	-	-	-	-	-	26,016	13.85	12a	$360,359
69 kV Power Line (41 miles)				1		-	-	-	-	-	-	-	-	41.6	23.41	33	$974
Water wells				14		-	-	-	-	-	-	-	-	14.0	382.80	35	$5,359
Road and Rail Culverts				1	Concrete & Steel	-	0.28	31	$0	-	-	-	-	-	-	-	-
8050 Dragline Outage Pad	1	63	dia.	1	Concrete	3,117	5.51	30	$17,179	-	-	-	-	-	-	-	-
8050 Dragline Outage Building	92	92	92	1	Steel	778,888	0.13	1A	$101,229	-	-	-	-	-	-	-	-
Rail Ballast Removal						27,053	18.15	45	$491,015	-	-	-	-	-	-	-	-
Concrete/Asphalt Removal						27,478	18.15	45	$498,724	-	-	-	-	-	-	-	-
TOTAL									**$2,855,704**				**$2,639,391**				**$1,266,432**
TOTAL DEMOLITION COST																	**$6,760,527**

WORKSHEET NO. 2a

STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	Length [ft]	Width [ft]	Height [ft]	Number	Construction	Building				Floors, Surfaces & Walls				Footings			
						Volume [yd^3]	Unit Cost	Ref	Cost	Area [ft^2]	Unit Cost	Ref	Cost	Length [ft]	Unit Cost	Ref	Cost
Area 4N																	
69 kV Powerline (units in MI)	6					-	-	-	-	-	-	-	-	6	7222.47	32	$43,335
Culverts					Concrete and Steel	11,025	0.28	31	$3,087	-	-	-	-	-	-	-	-
Cottonwood Crossing																	
Culvert: Concrete Box Top and Bottom (16	200	8		16	10" Concrete Walls					25,600	15	49a	388,587				
Culvert: Concrete Box Walls (16 total)	200	8		16	8" Concrete Walls					25,600	2	23	49,920				
Bridge Piers (15 total)	14	2	2	15	Concrete									210	6.03	17	$1,266
Bridge Footings (3 total)	16	4	4	3	Concrete									48	136.20	51	$6,538
Bridge Guardrails (2 total)	320	3	1	2	Steel	51,840	11	43	566,093								
Deck Sections (4-double sections)	80	8.5		4	Steel	5,440	11	43	59,405								
Abutement Walls (4)	436	5-12		4	Concrete/MSE					3,756	39	21	146,846				
Concrete Apron	90	75			Concrete					6,750	18	50a	122,966				
Wall around concrete apron (9 ft height)	180	9			Concrete					1,620	15.18	49a	$24,590				
Wall around concrete apron (3 ft height)	150	3			Concrete					450	15.18	49a	$6,831				
TOTAL									**$628,584**				**$739,741**				**$51,139**
																TOTAL A4N DEMOLITION COST	**$1,419,464**

WORKSHEET NO. 3
MATERIAL HANDLING SUMMARY SHEET

Description	Quantity	Swell Factor	Adjusted Quantity	Push/Haul Distance [ft]	Push/Haul Grade [%]	Equipment
Area 1						
Grading - Dozer	1,163,300 LCY			300	-6.67%	D11R
Topsoil - Trucks	552,932 BCY	1.142	631,448 LCY	14,730	0.30%	992G/777D
Topsoil - Scrapers	9,919 BCY	1.142	11,327 LCY	2,300	0.00%	637G
Mitigation - Trucks	49,955 BCY	1.142	57,048 LCY	10,149	1.16%	992G/777D
Revegetation	481 ac.					
Area 2						
Drill & Blast	44,889 BCY					DMM2
Grading - Dozer	13,408,649 LCY			286	2.38%	D11R
Grading - Trucks	12,482,072 LCY			10,156	-0.50%	992G/777D
Grading - Scrapers	16,736,035 LCY			1,578	0.18%	637G
Topsoil - Trucks	1,720,329 BCY	1.142	1,964,615 LCY	11,956	0.31%	992G/777D
Topsoil - Scrapers	0 BCY	1.142	0 LCY	0	0.00%	637G
Mitigation - Trucks	200,994 BCY	1.142	229,535 LCY	8,142	-1.24%	992G/777D
Mitigation - Scrapers	59,513 BCY	1.142	67,964 LCY	1,522	-2.88%	637G
Revegetation	2,285 ac.					
Area 3						
Drill & Blast	3,342,325 BCY					DMM2
Grading - Dozer	21,265,419 LCY			1,177	0.35%	D11R
Grading - Trucks	21,331,902 LCY			6,190	-1.82%	992G/777D
Grading - Scrapers	28,912,821 LCY			2,112	-3.06%	637G
Topsoil - Trucks	3,253,655 BCY	1.142	3,715,674 LCY	6,764	-0.66%	992G/777D
Topsoil - Scrapers	542,262 BCY	1.142	619,263 LCY	1,787	8.22%	637G
Mitigation - Trucks	284,534 BCY	1.142	324,938 LCY	7,776	-0.90%	992G/777D
Mitigation - Scrapers	16,776 BCY	1.142	19,158 LCY	894	14.24%	637G
Revegetation	2,926 ac.					
Other						
Backfilling Ponds	482,858 BCY	1.142	551,424 LCY	168	0.00%	D11R
Backfill Old Area 3 Diversion	26,000 BCY	1.142	29,692 LCY	55	0.00%	D11R
Backfill New Area 3 Diversion	225,000 BCY	1.142	256,950 LCY	75	0.00%	D11R
Grade Road and Railroad Fill	685,256 BCY	1.142	782,562 LCY	55	0.00%	D11R
Road and Railroad Ripping	425 ac.					16G
Contaminated Soil Disposal						
North Complex	112,000 BCY	1.142	127,904 LCY	22,300	0.48%	992G/777D
Area 3	164,500 BCY	1.142	187,859 LCY	6,200	-0.65%	992G/777D

Swell factor = 1.142 Weighted Average Between In-Situ and Stockpile Swells

WORKSHEET NO. 3a
MATERIAL HANDLING SUMMARY SHEET

Description	Quantity	Swell Factor	Adjusted Quantity	Push/Haul Distance [ft]	Push/Haul Grade [%]	Equipment
Area 4 North						
Grading - Dozer	4,570,812 LCY			287	1.94%	D11R
Grading - Trucks	2,258,797 LCY			4,052	-4.15%	992G/777D
Topsoil - Trucks	320,585 BCY	1.142	366,108 LCY	5,205	-0.49%	992G/777D
Mitigation - Trucks	47,582 BCY	1.142	54,338 LCY	8,530	-1.33%	992G/777D
Revegetation	418 ac.					
Cottonwood Crossing						
Fill Removal	101,845 BCY	1.142	116,307 LCY	4,600	-0.86%	992G/777D
Base Course Removal	6,529 BCY	1.142	7,456 LCY	4,600	-0.86%	992G/777D
Wearing Course	3,014 BCY	1.142	3,442 LCY	4,600	-0.86%	992G/777D
Other						
Backfilling Ponds	133,536 BCY	1.142	152,498 LCY	200	0.00%	D11R
Grade Road	124,574 BCY	1.142	142,264 LCY	55	0.00%	D11R
Road Ripping	77.2 ac.					16G
Concrete & Asphalt Disp.	2 BCY	1.142	3 LCY			

Swell factor = 1.142 Wt. Ave between in-situ and stkpl swells

WORKSHEET NO. 5A

PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling Ponds

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0% grade on average

168 ft typical dozer push distance

2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 1,730 LCY/hr (Normal Hourly Production) = 1,087 LCY/hr

Hours Required[2] = 551,424 LCY (volume to be moved[1]) / 1,087 LCY/hr (net hourly production) = 507.1 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5a-A
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling Ponds

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0%	grade on average
200	ft typical dozer push distance
2,700	Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 1,510 LCY/hr (Normal Hourly Production) = 949 LCY/hr

Hours Required[2] = 152,498 LCY (volume to be moved[1]) / 949 LCY/hr (net hourly production) = 160.7 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5a-B
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Dozing Roads

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0%	grade on average
55	ft typical dozer push distance
2,700	Loose clay and sand density (lb/yd^3)

Productivity Calculations[3]:

Operating Adjustment Factor	=	0.9	*	1.0	*	0.8	*	1.0	*	0.9	*	0.9	*	1.0	*	1.1	= 0.6
		operator factor		material factor		work hour factor		grade factor		weight correction factor		visibility factor		elevation factor		production factor	

Net Hourly Production	=	0.6	*	4,110 LCY/hr	=	2,584 LCY/hr
		operating adjustment factor		Normal Hourly Production		

Hours Required[2]	=	142,264 LCY	/	2,584 LCY/hr	=	55.1 hrs
		volume to be moved[1]		net hourly production		

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5a-C
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Area 4N Regrade

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

1.9% grade on average
287 ft typical dozer push distance
2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor	= 0.9	* 1.0	* 0.8	* 1.0	* 0.9	* 0.9	* 1.0	* 1.1	= 0.6
	operator factor	material factor	work hour factor	grade factor	weight correction factor	visibility factor	elevation factor	production factor	

Net Hourly Production	= 0.6	* 1,110 LCY/hr	= 666 LCY/hr
	operating adjustment factor	Normal Hourly Production	

Hours Required[2]	= 4,570,812 LCY /	666 LCY/hr	= 6,866 hrs
	volume to be moved[1]	net hourly production	

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5B

PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling old Area 3 Diversion

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0% grade on average

55 ft typical dozer push distance

2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 4,110 LCY/hr (Normal Hourly Production) = 2,584 LCY/hr

Hours Required[2] = 29,692 LCY (volume to be moved[1]) / 2,584 LCY/hr (net hourly production) = 11.5 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 5C
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling new Area 3 Diversion

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0% grade on average
75 ft typical dozer push distance
2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

$$\text{Operating Adjustment Factor} = \underset{\text{operator factor}}{0.9} * \underset{\text{material factor}}{1.0} * \underset{\text{work hour factor}}{0.8} * \underset{\text{grade factor}}{1.0} * \underset{\text{weight correction factor}}{0.9} * \underset{\text{visibility factor}}{0.9} * \underset{\text{elevation factor}}{1.0} * \underset{\text{production factor}}{1.1} = 0.6$$

$$\text{Net Hourly Production} = \underset{\text{operating adjustment factor}}{0.6} * \underset{\text{Normal Hourly Production}}{3{,}230 \text{ LCY/hr}} = 2{,}030 \text{ LCY/hr}$$

$$\text{Hours Required}^2 = \underset{\text{volume to be moved}^1}{256{,}950 \text{ LCY}} / \underset{\text{net hourly production}}{2{,}030 \text{ LCY/hr}} = 126.6 \text{ hrs}$$

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 6D

PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Dozing Road and Railroad Fills

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.0% grade on average

55 ft typical dozer push distance

2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 4,110 LCY/hr (Normal Hourly Production) = 2,584 LCY/hr

Hours Required[2] = 782,562 LCY (volume to be moved[1]) / 2,584 LCY/hr (net hourly production) = 302.9 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5E
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Area I Regrade

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

-6.7% grade on average
300 ft typical dozer push distance
2,700 Loose clay and sand density [lb/yd³]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.1 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.7

Net Hourly Production = 0.7 (operating adjustment factor) * 1,070 LCY/hr (Normal Hourly Production) = 762 LCY/hr

Hours Required[2] = 1,163,300 LCY (volume to be moved[1]) / 762 LCY/hr (net hourly production) = 1,526 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 5F
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Area 2 Regrade

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

2.4% grade on average
286 ft typical dozer push distance
2,700 Loose clay and sand density [lb/yd^3]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 1,110 LCY/hr (Normal Hourly Production) = 665 LCY/hr

Hours Required[2] = 13,408,649 LCY (volume to be moved[1]) / 665 LCY/hr (net hourly production) = 20,176 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 5G
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Area 3 Regrade

Characterization of Dozer Used (type, size, etc.)[3]

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0.4% grade on average
1,177 ft typical dozer push distance
2,700 Loose clay and sand density [lb/yd³]

Productivity Calculations[3]:

Operating Adjustment Factor = 0.9 (operator factor) * 1.0 (material factor) * 0.8 (work hour factor) * 1.0 (grade factor) * 0.9 (weight correction factor) * 0.9 (visibility factor) * 1.0 (elevation factor) * 1.1 (production factor) = 0.6

Net Hourly Production = 0.6 (operating adjustment factor) * 1,070 LCY/hr (Normal Hourly Production) = 668 LCY/hr

Hours Required[2] = 21,265,419 LCY (volume to be moved[1]) / 668 LCY/hr (net hourly production) = 31,843 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8A
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 2 Regrade

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time =	______ (loaded haul time)	+	______ (empty haul time)	+	0.65 min (basic cycle time)	=	0.65 min	
Net Bucket Capacity =	15 LCY (heaped bucket capacity)	*	0.88 (bucket fill factor)	=	13.2 LCY			
Net Hourly Production =	13.2 LCY (net bucket capacity)	/	0.65 min (cycle time)	*	50 min/hr (work hour factor)	=	1,015 LCY/hr	
Hours Required[2] =	12,482,072 LCY (volume to be moved[1])	/	1,015 LCY/hr (net hourly production)	=	12,293 hrs			

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8a-A
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 4N Regrade

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capaci [LCY]

Productivity Calculations[3]

Cycle Time = ______ (loaded haul time) + ______ (empty haul time) + 0.7 min (basic cycle time) = 0.7 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 0.88 (bucket fill factor) = 13.2 LCY

Net Hourly Production = 13.2 LCY (net bucket capacity) / 0.7 min (cycle time) * 50 min/hr (work hour factor) = 1,015 LCY/hr

Hours Required[2] = 2,258,797 LCY (volume to be moved[1]) / 1,015 LCY/h (net hourly production) = 2,225 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8B
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 3 Regrade

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = $\underset{\text{loaded haul time}}{\underline{\qquad}}$ + $\underset{\text{empty haul time}}{\underline{\qquad}}$ + $\underset{\text{basic cycle time}}{\underline{0.65 \text{ min}}}$ = 0.65 min

Net Bucket Capacity = $\underset{\text{heaped bucket capacity}}{\underline{15 \text{ LCY}}}$ * $\underset{\text{bucket fill factor}}{\underline{0.88}}$ = 13.2 LCY

Net Hourly Production = $\underset{\text{net bucket capacity}}{\underline{13.2 \text{ LCY}}}$ / $\underset{\text{cycle time}}{\underline{0.65 \text{ min}}}$ * $\underset{\text{work hour factor}}{\underline{50 \text{ min/hr}}}$ = 1,015 LCY/hr

Hours Required[2] = $\underset{\text{volume to be moved}^1}{\underline{21{,}331{,}902 \text{ LCY}}}$ / $\underset{\text{net hourly production}}{\underline{1{,}015 \text{ LCY/hr}}}$ = 21,009 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 8a-B
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 4N Topsoil

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capaci [LCY]

Productivity Calculations[3]

Cycle Time =		+		+	0.7 min	=	0.7 min	
	loaded haul time		empty haul time		basic cycle time			
Net Bucket Capacity =	15 LCY	*	1.05	=	15.8 LCY			
	heaped bucket capacity		bucket fill factor					
Net Hourly Production =	15.8 LCY	/	0.7 min	*	50 min/hr	=	1,212 LCY/hr	
	net bucket capacity		cycle time		work hour factor			
Hours Required[2] =	366,108 LCY	/	1,212 LCY/h	=	302 hrs			
	volume to be moved[1]		net hourly production					

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8C
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 1 Topsoiling

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ___ (loaded haul time) + ___ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 552,932 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 456 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8a-C
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 4N Mitigation

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capaci [LCY]

Productivity Calculations[3]

Cycle Time = $\underset{\text{loaded haul time}}{\underline{\qquad}}$ + $\underset{\text{empty haul time}}{\underline{\qquad}}$ + $\underset{\text{basic cycle time}}{\underline{0.7 \text{ min}}}$ = 0.7 min

Net Bucket Capacity = $\underset{\text{heaped bucket capacity}}{\underline{15 \text{ LCY}}}$ * $\underset{\text{bucket fill factor}}{\underline{1.05}}$ = 15.8 LCY

Net Hourly Production = $\underset{\text{net bucket capacity}}{\underline{15.8 \text{ LCY}}}$ / $\underset{\text{cycle time}}{\underline{0.7 \text{ min}}}$ * $\underset{\text{work hour factor}}{\underline{50 \text{ min/hr}}}$ = 1,212 LCY/hr

Hours Required[2] = $\underset{\text{volume to be moved}^1}{\underline{54{,}338 \text{ LCY}}}$ / $\underset{\text{net hourly production}}{\underline{1{,}212 \text{ LCY/h}}}$ = 45 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8D
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 2 Topsoiling

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ______ (loaded haul time) + ______ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 1,720,329 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 1,420 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8a-D
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Cottonwood Crossing Material Removal

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capaci [LCY]

Productivity Calculations[3]

Cycle Time = ____ (loaded haul time) + ____ (empty haul time) + 0.7 min (basic cycle time) = 0.7 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 0.88 (bucket fill factor) = 13.2 LCY

Net Hourly Production = 13.2 LCY (net bucket capacity) / 0.7 min (cycle time) * 50 min/hr (work hour factor) = 1,015 LCY/hr

Hours Required2 = 127,205 LCY (volume to be moved[1]) / 1,015 LCY/h (net hourly production) = 125 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 8E

PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 3 Topsoiling

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks

1.05 Bucket Fill Factor

15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ____ (loaded haul time) + ____ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 3,253,655 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 2,686 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8F
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 1 Mitigation

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time =		+		+	0.65 min	=	0.65 min	
	loaded haul time		empty haul time		basic cycle time			
Net Bucket Capacity =	15 LCY	*	1.05	=	15.8 LCY			
	heaped bucket capacity		bucket fill factor					
Net Hourly Production =	15.8 LCY	/	0.65 min	*	50 min/hr	=	1,212 LCY/hr	
	net bucket capacity		cycle time		work hour factor			
Hours Required[2] =	49,955 LCY	/	1,212 LCY/hr	=	41 hrs			
	volume to be moved[1]		net hourly production					

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8G
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 2 Mitigation

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ______ (loaded haul time) + ______ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 200,994 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 166 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8H
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 3 Mitigation

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
1.05 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ____ (loaded haul time) + ____ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,212 LCY/hr

Hours Required[2] = 284,534 LCY (volume to be moved[1]) / 1,212 LCY/hr (net hourly production) = 235 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 8I
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

North Area Coal Contaminated Soil Disposal

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ______ (loaded haul time) + ______ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 0.88 (bucket fill factor) = 13.2 LCY

Net Hourly Production = 13.2 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,015 LCY/hr

Hours Required[2] = 127,904 LCY (volume to be moved[1]) / 1,015 LCY/hr (net hourly production) = 126 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 8J
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 3 Coal Contaminated Soil Disposal

Characterization of Loader Used (type, size, etc.)[3]

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
0.88 Bucket Fill Factor
15 Rated Bucket Capacity [LCY]

Productivity Calculations[3]

Cycle Time = ____ (loaded haul time) + ____ (empty haul time) + 0.65 min (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) * 0.88 (bucket fill factor) = 13.2 LCY

Net Hourly Production = 13.2 LCY (net bucket capacity) / 0.65 min (cycle time) * 50 min/hr (work hour factor) = 1,015 LCY/hr

Hours Required[2] = 187,859 LCY (volume to be moved[1]) / 1,015 LCY/hr (net hourly production) = 185 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9A

PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 2 Regrade

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

10,158	ft. average haul distance
-0.5%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[2]

Loader Passes Per Truck = 67 LCY (truck capacity) / 13 LCY (loader bucket net capacity) = 5 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 5 (loader passes per truck) = 3.3 min

Number of Trucks Required = 13.0 min (truck cycle time) / 3.3 min (truck loading time) = 4 trucks (round down)

Hourly Production = 5 LCY/min (production rate) * 50 min/hr (work hour factor) = 253 LCY/hr

Net Truck Capacity = 13 LCY (loader bucket net capacity) * 5 (loader passes per truck) = 66 LCY

Truck Cycle Time = 5.7 min (haul time) + 3.1 min (return time) + 3.3 min (loading time per truck) + 1.0 min (dump and maneuver time) = 13.0 min

Production Rate = 66 LCY (net truck capacity) / 13.0 min (cycle time) = 5.1 LCY/min

Hours Required[2] = 12,482,072 LCY (volume to be moved[1]) / 253 LCY/hr (hourly production) = 49,321 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9a-A
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Regrade

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D
55 Struck Capacity [LCY]
79 Heaped Capacity [LCY]
67 Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.)

4,052 ft. average haul distance
-4.2% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 66.9 LCY (truck capacity) \ 13 LCY (loader bucket net capacity) = 5 passes

Loading Time Per Truck = 0.65 min (loader cycle time) * 5 (loader passes per truck) = 3.3 min

Number of Trucks Required = 5.3 min (truck cycle time) \ 3.3 min (truck loading time) = 1 trucks (round down)

Hourly Production = 12.4 LCY/min (production rate) * 50 min/hr (work hour factor) = 620 LCY/hr

Net Truck Capacity = 13.2 LCY (loader bucket net capacity) * 5 (loader passes per truck) = 66 LCY

Truck Cycle Time = 0.7 min (haul time) + 0.4 min (return time) + 3.25 min (loading time per truck) + 1 min (dump and maneuver time) = 5.32 min

Production Rate = 66 LCY (net truck capacity) \ 5.3 min (cycle time) = 12.4 LCY/min

Hours Required[2] = 2,258,797 LCY (volume to be moved[1]) \ 620 LCY/hr (hourly production) = 3,642 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9B
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 3 Regrade

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

6,190	ft. average haul distance
-1.8%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck =	67 LCY (truck capacity)	/	13 LCY (loader bucket net capacity)	=	5 passes					
Loading Time Per Truck =	0.7 min (loader cycle time)	*	5 (loader passes per truck)	=	3.3 min					
Number of Trucks Required =	9.6 min (truck cycle time)	/	3.3 min (truck loading time)	=	2 trucks (round down)					
Hourly Production =	7 LCY/min (production rate)	*	50 min/hr (work hour factor)	=	343 LCY/hr					

Net Truck Capacity =	13 LCY (loader bucket net capacity)	*	5 (loader passes per truck)	=	66 LCY					
Truck Cycle Time =	3.5 min (haul time)	+	1.9 min (return time)	+	3.3 min (loading time per truck)	+	1.0 min (dump and maneuver time)	=	9.6 min	
Production Rate =	66 LCY (net truck capacity)	/	9.6 min (cycle time)	=	6.9 LCY/min					
Hours Required[2] =	21,331,902 LCY (volume to be moved[1])	/	343 LCY/hr (hourly production)	=	62,103 hrs					

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9a-B
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Topsoiling

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D
55 Struck Capacity [LCY]
79 Heaped Capacity [LCY]
67 Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

5,205 ft. average haul distance
-0.5% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck =	66.9 LCY (truck capacity)	\	16 LCY (loader bucket net capacity)	= 4 passes	Net Truck Capacity =	13.2 LCY (loader bucket net capacity)	*	5 (loader passes per truck)	= 66 LCY			
Loading Time Per Truck =	0.65 min (loader cycle time)	*	5 (loader passes per truck)	= 3.3 min	Truck Cycle Time =	4.8 min (haul time)	+	2.6 min (return time)	+	3.25 min (loading time per truck)	+	1 min (dump and maneuver time) = 11.62 min
Number of Trucks Required =	5.3 min (truck cycle time)	\	3.3 min (truck loading time)	= 1 trucks (round down)	Production Rate =	66 LCY (net truck capacity)	\	5.3 min (cycle time)	= 12.4 LCY/min			
Hourly Production =	12.4 LCY/min (production rate)	*	50 min/hr (work hour factor)	= 620 LCY/hr	Hours Required[2] =	366,108 LCY (volume to be moved[1])	\	620 LCY/hr (hourly production)	= 590.4 hrs			

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9C
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 1 Topsoiling

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade, haul distance, truck capacity, etc.):

14,730	ft. average haul distance
0.3%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Number of Trucks Required = 16.3 min (truck cycle time) / 2.6 min (truck loading time) = 6 trucks (round down)

Hourly Production = 4 LCY/min (production rate) * 50 min/hr (work hour factor) = 193 LCY/hr

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Truck Cycle Time = 8.3 min (haul time) + 4.5 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 16.3 min

Production Rate = 63 LCY (net truck capacity) / 16.3 min (cycle time) = 3.9 LCY/min

Hours Required[2] = 631,448 LCY (volume to be moved[1]) / 193 LCY/hr (hourly production) = 3,277 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9a-C
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Mitigation

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D
55 Struck Capacity [LCY]
79 Heaped Capacity [LCY]
67 Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

8,530 ft. average haul distance
-1.3% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 66.9 LCY (truck capacity) \ 16 LCY (loader bucket net capacity) = 4 passes	Net Truck Capacity = 13.2 LCY (loader bucket net capacity) * 5 (loader passes per truck) = 66 LCY
Loading Time Per Truck = 0.65 min (loader cycle time) * 5 (loader passes per truck) = 3.3 min	Truck Cycle Time = 6.2 min (haul time) + 3.3 min (return time) + 3.25 min (loading time per truck) + 1 min (dump and maneuver time) = 13.81 min
Number of Trucks Required = 5.3 min (truck cycle time) \ 3.3 min (truck loading time) = 1 trucks (round down)	Production Rate = 66 LCY (net truck capacity) \ 5.3 min (cycle time) = 12.4 LCY/min
Hourly Production = 12.4 LCY/min (production rate) * 50 min/hr (work hour factor) = 620 LCY/hr	Hours Required[2] = 54,338 LCY (volume to be moved[1]) \ 620 LCY/hr (hourly production) = 87.6 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9D
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity

Area 2 Topsoiling

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

11,956	ft. average haul distance
0.3%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Truck Cycle Time = 5.7 min (haul time) + 3.6 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 13.9 min

Number of Trucks Required = 13.9 min (truck cycle time) / 2.6 min (truck loading time) = 5 trucks (round down)

Production Rate = 63 LCY (net truck capacity) / 13.9 min (cycle time) = 4.5 LCY/min

Hourly Production = 5 LCY/min (production rate) * 50 min/hr (work hour factor) = 226 LCY/hr

Hours Required[2] = 1,964,615 LCY (volume to be moved[1]) / 226 LCY/hr (hourly production) = 8,699 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9a-D
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Cottonwood Crossing Material Removal

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D
55 Struck Capacity [LCY]
79 Heaped Capacity [LCY]
67 Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

4,600 ft. average haul distance
-0.9% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck	=	66.9 LCY (truck capacity)	\	13 LCY (loader bucket net capacity)	=	5 passes
Loading Time Per Truck	=	0.65 min (loader cycle time)	*	5 (loader passes per truck)	=	3.3 min
Number of Trucks Required	=	5.3 min (truck cycle time)	\	3.3 min (truck loading time)	=	1 trucks (round down)
Hourly Production	=	12.4 LCY/min (production rate)	*	50 min/hr (work hour factor)	=	620 LCY/hr

Net Truck Capacity	=	13.2 LCY (loader bucket net capacity)	*	5 (loader passes per truck)	=	66 LCY				
Truck Cycle Time	=	2.6 min (haul time)	+	1.4 min (return time)	+	3.25 min (loading time per truck)	+	1 min (dump and maneuver time)	=	8.23 min
Production Rate	=	66 LCY (net truck capacity)	\	5.3 min (cycle time)	=	12.4 LCY/min				
Hours Required[2]	=	127,205 LCY (volume to be moved[1])	\	620 LCY/hr (hourly production)	=	205.1 hrs				

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9E
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 3 Topsoiling

Characterization of Truck Used (type, size, etc.)[3]

	Caterpillar 777D
55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade, haul distance, truck capacity, etc.):

6,190	ft. average haul distance
-1.8%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Number of Trucks Required = 9.0 min (truck cycle time) / 2.6 min (truck loading time) = 3 trucks (round down)

Hourly Production = 7 LCY/min (production rate) * 50 min/hr (work hour factor) = 352 LCY/hr

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Truck Cycle Time = 3.5 min (haul time) + 1.9 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 9.0 min

Production Rate = 63 LCY (net truck capacity) / 9.0 min (cycle time) = 7.0 LCY/min

Hours Required[2] = 3,715,674 LCY (volume to be moved[1]) / 352 LCY/hr (hourly production) = 10,556 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9F

PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 1 Mitigation

Characterization of Truck Used (type, size, etc.)[3]

	Caterpillar 777D
55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade, haul distance, truck capacity, etc.):

10,149	ft. average haul distance
1.2%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Number of Trucks Required = 12.4 min (truck cycle time) / 2.6 min (truck loading time) = 4 trucks (round down)

Hourly Production = 5 LCY/min (production rate) * 50 min/hr (work hour factor) = 254 LCY/hr

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Truck Cycle Time = 5.7 min (haul time) + 3.1 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 12.4 min

Production Rate = 63 LCY (net truck capacity) / 12.4 min (cycle time) = 5.1 LCY/min

Hours Required[2] = 57,048 LCY (volume to be moved[1]) / 254 LCY/hr (hourly production) = 224 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9G

PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 2 Mitigation

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity (LCY)
79	Heaped Capacity (LCY)
67	Adjusted Capacity (Average of Struck and Heaped) (LCY)

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

8,142	ft. average haul distance
-1.2%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Number of Trucks Required = 10.6 min (truck cycle time) / 2.6 min (truck loading time) = 4 trucks (round down)

Hourly Production = 6 LCY/min (production rate) * 50 min/hr (work hour factor) = 296 LCY/hr

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Truck Cycle Time = 4.6 min (haul time) + 2.5 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 10.6 min

Production Rate = 63 LCY (net truck capacity) / 10.6 min (cycle time) = 5.9 LCY/min

Hours Required[2] = 229,535 LCY (volume to be moved[1]) / 296 LCY/hr (hourly production) = 776 hrs

Data Sources:

1) Volume to be moved from Worksheet 2

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 9H
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 3 Mitigation

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55 Struck Capacity (LCY)
79 Heaped Capacity (LCY)
67 Adjusted Capacity (Average of Struck and Heaped) (LCY)

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

7,776 ft. average haul distance
-0.9% Grade (Loaded)
3.0% Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 16 LCY (loader bucket net capacity) = 4 passes

Net Truck Capacity = 16 LCY (loader bucket net capacity) * 4 (loader passes per truck) = 63 LCY

Loading Time Per Truck = 0.7 min (loader cycle time) * 4 (loader passes per truck) = 2.6 min

Truck Cycle Time = 4.4 min (haul time) + 2.4 min (return time) + 2.6 min (loading time per truck) + 1.0 min (dump and maneuver time) = 10.3 min

Number of Trucks Required = 10.3 min (truck cycle time) / 2.6 min (truck loading time) = 3 trucks (round down)

Production Rate = 63 LCY (net truck capacity) / 10.3 min (cycle time) = 6.1 LCY/min

Hourly Production = 6 LCY/min (production rate) * 50 min/hr (work hour factor) = 305 LCY/hr

Hours Required[2] = 324,938 LCY (volume to be moved[1]) / 305 LCY/hr (hourly production) = 1,066 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9I

PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

North Area Coal Contaminated Soil Disposal

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

22,300	ft. average haul distance
0.5%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 13 LCY (loader bucket net capacity) = 5 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 5 (loader passes per truck) = 3.3 min

Number of Trucks Required = 23.5 min (truck cycle time) / 3.3 min (truck loading time) = 7 trucks (round down)

Hourly Production = 3 LCY/min (production rate) * 50 min/hr (work hour factor) = 140 LCY/hr

Net Truck Capacity = 13 LCY (loader bucket net capacity) * 5 (loader passes per truck) = 66 LCY

Truck Cycle Time = 12.5 min (haul time) + 6.8 min (return time) + 3.3 min (loading time per truck) + 1.0 min (dump and maneuver time) = 23.5 min

Production Rate = 66 LCY (net truck capacity) / 23.5 min (cycle time) = 2.8 LCY/min

Hours Required[2] = 127,904 LCY (volume to be moved[1]) / 140 LCY/hr (work hour factor) = 913 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 9J

PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 3 Coal Contaminated Soil Disposal

Characterization of Truck Used (type, size, etc.)[3]

Caterpillar 777D

	Caterpillar 777D
55	Struck Capacity [LCY]
79	Heaped Capacity [LCY]
67	Adjusted Capacity (Average of Struck and Heaped) [LCY]

Description of Truck Use (origin, destination, grade, haul distance, truck capacity, etc.)

6,200	ft. average haul distance
-0.7%	Grade (Loaded)
3.0%	Rolling Resisance

Productivity Calculation[3]

Loader Passes Per Truck = 67 LCY (truck capacity) / 13 LCY (loader bucket net capacity) = 5 passes

Loading Time Per Truck = 0.7 min (loader cycle time) * 5 (loader passes per truck) = 3.3 min

Number of Trucks Required = 9.6 min (truck cycle time) / 3.3 min (truck loading time) = 2 trucks (round down)

Hourly Production = 7 LCY/min (production rate) * 50 min/hr (work hour factor) = 343 LCY/hr

Net Truck Capacity = 13 LCY (loader bucket net capacity) * 5 (loader passes per truck) = 66 LCY

Truck Cycle Time = 3.5 min (haul time) + 1.9 min (return time) + 3.3 min (loading time per truck) + 1.0 min (dump and maneuver time) = 9.6 min

Production Rate = 66 LCY (net truck capacity) / 9.6 min (cycle time) = 6.9 LCY/min

Hours Required[2] = 187,859 LCY (volume to be moved[1]) / 343 LCY/hr (work hour factor) = 547 hrs

Data Sources:

1) Volume to be moved from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11A
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 2 Grading

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair

24 Struck Capacity [yd^3]

34 Heaped Capacity [yd^3]

29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

1,578 ft. average haul distance

0.2% Grade (Loaded)

3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3] = 1.0 min (load time per pair) + 1.0 min (loaded trip time) + 0.6 min (maneuver and spread time) + 0.7 min (return trip time) = 3.3 min

Net Hourly Production = 29 LCY (adjusted capacity) * 50 min/hr (work hour factor) / 3.3 min (cycle time) * 2 (number of scrapers) = 885 LCY/hr

Hours Required[2] = 16,736,035 LCY (volume to be handled[1]) / 885 LCY/hr (net hourly production) = 18,900 hrs

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11B
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 3 Grading

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair

24 Struck Capacity [yd^3]

34 Heaped Capacity [yd^3]

29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

2,112 ft. average haul distance

-3.1% Grade (Loaded)

3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3] =	1.0 min	+	1.2 min	+	0.6 min	+	0.9 min	=	3.7 min
	load time per pair		loaded trip time		maneuver and spread time		return trip time		
Net Hourly Production =	29 LCY	*	50 min/hr	/	3.7 min	*	2	=	784 LCY/hr
	adjusted capacity		work hour factor		cycle time		number of scrapers		
Hours Required[2] =	28,912,821 LCY	/	784 LCY/hr	=	36,889 hrs				
	volume to be handled[1]		net hourly production						

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11C
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 1 Topsoiling

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair
24 Struck Capacity [yd^3]
34 Heaped Capacity [yd^3]
29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

2,300 ft. average haul distance
0.0% Grade (Loaded)
3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3] =	1.0 min	+	1.3 min	+	0.6 min	+	1.0 min	=	3.9 min	
	load time per pair		loaded trip time		maneuver and spread time		return trip time			
Net Hourly Production =	29 LCY	*	50 min/hr	/	3.9 min	*	2	=	753	LCY/hr
	adjusted capacity		work hour factor		cycle time		number of scrapers			
Hours Required[2] =	11,327 LCY	/	753 LCY/hr	=	15 hrs					
	volume to be handled[1]		net hourly production							

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11D
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 2 Topsoiling

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair
24 Struck Capacity [yd^3]
34 Heaped Capacity [yd^3]
29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

0 ft. average haul distance
0.0% Grade (Loaded)
3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3] =	1.0 min	+	0.0 min	+	0.6 min	+	0.0 min	=	1.6 min
	load time per pair		loaded trip time		maneuver and spread time		return trip time		

Net Hourly Production =	29 LCY	*	50 min/hr	/	1.6 min	*	2	=	1,813 LCY/hr
	adjusted capacity		work hour factor		cycle time		number of scrapers		

Hours Required[2] =	0 LCY	/	1813 LCY/hr	=	- hrs
	volume to be handled[1]		net hourly production		

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11E
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 3 Topsoiling

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair

24 Struck Capacity [yd^3]

34 Heaped Capacity [yd^3]

29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

1,787 ft. average haul distance

8.2% Grade (Loaded)

3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3] =	1.0 min	+	1.1 min	+	0.6 min	+	0.8 min	=	3.5 min
	load time per pair		loaded trip time		maneuver and spread time		return trip time		
Net Hourly Production =	29 LCY	*	50 min/hr	/	3.5 min	*	2	=	841 LCY/hr
	adjusted capacity		work hour factor		cycle time		number of scrapers		
Hours Required[2] =	619,263 LCY	/	841 LCY/hr	=	737 hrs				
	volume to be handled[1]		net hourly production						

Data Sources:

1) Acres from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 11F
PRODUCTIVITY AND HOURS REQUIRED FOR SCRAPER USE

Earthmoving Activity:

Area 2 Mitigation

Characterization of Scraper Used (type, size, etc.)3

Caterpillar 637G Scrapers Push-Pull Pair
24 Struck Capacity [yd^3]
34 Heaped Capacity [yd^3]
29 Adjusted Capacity (Average of Struck and Heaped) [yd^3]

Description of Scraper Use (origin, destination, grade, haul distance, material, etc.)

1,522 ft. average haul distance
-2.9% Grade (Loaded)
3% Rolling Resisance

Productivity Calculations[3]:

Cycle Time[3]	=	1.0 min load time per pair	+	0.9 min loaded trip time	+	0.6 min maneuver and spread time	+	0.7 min return trip time	=	3.2 min
Net Hourly Production	=	29 LCY adjusted capacity	*	50 min/hr work hour factor	/	3.2 min cycle time	*	2 number of scrapers	=	899 LCY/hr
Hours Required[2]	=	67,964 LCY volume to be handled[1]	/	899 LCY/hr net hourly production	=	76 hrs				

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 12A

PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE – GRADING

Earthmoving Activity:

Ripping Road Grades

Characterization of Grader Used (type, size capacity, etc.)[3]

Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):

9.75 Ripper width [ft]

Productivity Calculations[3]:

Contour Grading:

Hourly Productivity = 3.4 mi/hr (speed) x 9.75 ft. (effective blade width) x 5,280 ft/mi (conversion factor) / 43,560 ft²/ac (conversion factor) x 0.83 (work hour factor) x 0.90 (availability) = 3.0 ac / hr

Hours Required = 425 ac (acreage to be graded[1]) / 2.99 ac/hr (hourly productivity) = 142 hr

Scarification:

Hourly Productivity = 1.25 mi/hr (work speed) x 9.75 ft. (scarifier width) x 5,280 ft/mi (conversion factor) / 43,560 ft²/ac (conversion factor) x 0.83 (work hour factor) x 0.90 (availability) = 1.1 ac / hr

Hours Required = 425 ac (acreage to be ripped[1]) / 1.10 ac/hr (hourly productivity) = 386 hr

Total Hours Required[2] = 142 hr (grading hours required) + 386 hr (scarification hours required) = 528 hr

Data Sources:

1) Acres from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

WORKSHEET NO. 12a-A
PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE -- GRADING

Earthmoving Activity:

Ripping Road Grades

Characterization of Grader Used (type, size capacity, etc.)[3]

Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):

9.75 Ripper width [ft]

Productivity Calculations[3]:

Contour Grading:

Hourly Productivity =	3.4 mi/hr x	9.75 ft. x	5,280 ft/mi /	43,560 ft²/ac x	0.83	x	0.90	= 3.0 ac / hr
	speed	effective blade width	conversion factor	conversion factor	work hour factor		availability	

Hours Required =	77 ac	\ 2.99 ac/hr	=	26 hr
	acreage to be graded[1]	hourly productivity		

Scarification:

Hourly Productivity =	1.25 mi/hr x	9.75 ft. x	5,280 ft/mi /	43,560 ft²/ac x	0.83	x	0.90	= 1.1 ac / hr
	work speed	scarifier width	conversion factor	conversion factor	work hour factor		availability	

Hours Required =	77 ac	\ 1.10 ac/hr	=	70 hr
	acreage to be ripped[1]	hourly productivity		

Total Hours Required[2] =	25.8 hr	+ 70.2 hr	=	96 hr
	grading hours required	scarification hours required		

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 12B

PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE – GRADING

Earthmoving Activity:

Grading Areas to be Topsoiled

Characterization of Grader Used (type, size capacity, etc.)[3]

Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):

11.9 Ripper width [ft]

Productivity Calculations[3]:

Contour Grading:

Hourly Productivity =	3.4 mi/hr speed	x	11.90 ft. effective blade width	x	5,280 ft/mi conversion factor	/	43,560 ft²/ac conversion factor	x	0.83 work hour factor	x	0.90 availability	= 3.7 ac / hr

Hours Required =	5,692 ac acreage to be graded[1]	/	3.65 ac/hr hourly productivity	=	1,559 hr

Scarification:

Hourly Productivity =	1.25 mi/hr work speed	x	9.75 ft. scarifier width	x	5,280 ft/mi conversion factor	/	43,560 ft²/ac conversion factor	x	0.83 work hour factor	x	0.90 availability	= 1.1 ac / hr

Hours Required =	- ac acreage to be ripped*	/	1.10 ac/hr hourly productivity	=	- hr

Total Hours Required[2] =	1,559 hr grading hours required	+	0 hr scarification hours required	=	1,559 hr

Data Sources:

1) Acres from Worksheet 3

2) Hours required go to Worksheet 13

3) Caterpillar Performance Handbook, Edition 37

*No Ripping on Topsoiled Areas

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 12a-B
PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE -- GRADING

Earthmoving Activity:

Finish Grading Areas to be Topsoiled

Characterization of Grader Used (type, size capacity, etc.)[3]

Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):

9.75 Ripper width [ft]

Productivity Calculations[3]:

Contour Grading:

Hourly Productivity =	3.4 mi/hr x	9.75 ft. x	5,280 ft/mi /	43,560 ft^2 /ac x	0.83 x	0.90	= 3.0 ac / hr		
	speed	effective blade width	conversion factor	conversion factor	work hour factor	availability			

Hours Required =	418 ac \	2.99 ac/hr =	140 hr
	acreage to be graded[1]	hourly productivity	

Scarification:

Hourly Productivity =	1.25 mi/hr x	9.75 ft. x	5,280 ft/mi /	43,560 ft^2 /ac x	0.83 x	0.90	= 1.1 ac / hr
	work speed	scarifier width	conversion factor	conversion factor	work hour factor	availability	

Hours Required =	0 ac \	1.10 ac/hr =	0 hr
	acreage to be ripped[1]	hourly productivity	

Total Hours Required[2] =	140 hr +	0.0 hr =	140 hr
	grading hours required	scarification hours required	

Data Sources:

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 37

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13A
SUMMARY CALCULATION OF EARTHMOVING COSTS - Dozers

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]		Labor Costs [$/hr][3]		Total Hours Required[4]		Total Cost [$]
Backfilling Ponds	D11R Dozer	100%	($272	+	$ 32)	*	507	=	$ 154,326
Old Area 3 Diversion	D11R Dozer	100%	($272	+	$ 32)	*	11	=	$ 3,498
New Area 3 Diversion	D11R Dozer	100%	($272	+	$ 32)	*	127	=	$ 38,516
Road and Rail Fills	D11R Dozer	100%	($272	+	$ 32)	*	303	=	$ 92,189
Area 1 Regrade	D11R Dozer	100%	($272	+	$ 32)	*	1,526	=	$ 464,463
Area 2 Regrade	D11R Dozer	100%	($272	+	$ 32)	*	20,176	=	$ 6,140,702
Area 3 Regrade	D11R Dozer	100%	($272	+	$ 32)	*	31,843	=	$ 9,691,359
							Total Cost	**=**	**$ 16,585,053**

Equipment and Accesory Identification

1) Caterpillar D11R with Universal Blade

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)

3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 5

WORKSHEET NO. 13a-A
SUMMARY CALCULATION OF EARTHMOVING COSTS - DOZERS

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Backfilling Ponds	D11R Dozer	100%	($ 272 +	$ 32)	* 161 =	$ 48,898
Dozing Roads	D11R Dozer	100%	($ 272 +	$ 32)	* 55 =	$ 16,759
Area 4N Regrade	D11R Dozer	100%	($ 272 +	$ 32)	* 6,866 =	$2,089,797
					Total Cost =	**$2,155,454**

Equipment and Accesory Identification

1) Caterpillar D11R with Universal Blade

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2304 edition. (see Table 12-B-23)

3) Labor Cost based on 2305 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 5

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13B
SUMMARY CALCULATION OF EARTHMOVING COSTS - Loaders

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]		Total Hours Required[4]	Total Cost [$]
Area 2 Regrade	992G Loader	100%	($ 224 +	$ 32)	*	12,293 =	$ 3,149,140
	16H Grader	50%	($ 82 +	$ 32)	*	6,146 =	$ 702,951
	D9R Dozer	100%	($ 156 +	$ 32)	*	12,293 =	$ 2,314,517
	Water Truck	50%	($ 117 +	$ 32)	*	6,146 =	$ 919,108
Area 3 Regrade	992G Loader	100%	($ 224 +	$ 32)	*	21,009 =	$ 5,381,891
	16H Grader	50%	($ 82 +	$ 32)	*	10,504 =	$ 1,201,346
	D9R Dozer	100%	($ 156 +	$ 32)	*	21,009 =	$ 3,955,516
	Water Truck	50%	($ 117 +	$ 32)	*	10,504 =	$ 1,570,758
Area 1 Topsoiling	992G Loader	100%	($ 224 +	$ 32)	*	456 =	$ 116,915
	16H Grader	50%	($ 82 +	$ 32)	*	228 =	$ 26,096
	D9R Dozer	100%	($ 156 +	$ 32)	*	456 =	$ 85,929
	Water Truck	50%	($ 117 +	$ 32)	*	228 =	$ 34,123
Area 2 Topsoiling	992G Loader	100%	($ 224 +	$ 32)	*	1,420 =	$ 363,756
	16H Grader	50%	($ 82 +	$ 32)	*	710 =	$ 81,198
	D9R Dozer	100%	($ 156 +	$ 32)	*	1,420 =	$ 267,349
	Water Truck	50%	($ 117 +	$ 32)	*	710 =	$ 106,186
Area 3 Topsoiling	992G Loader	100%	($ 224 +	$ 32)	*	2,686 =	$ 687,971
	16H Grader	50%	($ 82 +	$ 32)	*	1,343 =	$ 153,569
	D9R Dozer	100%	($ 156 +	$ 32)	*	2,686 =	$ 505,637
	Water Truck	50%	($ 117 +	$ 32)	*	1,343 =	$ 200,791
						Total Cost =	$ 21,824,727

Equipment and Accesory Identification

1) Caterpillar 992G Loader with standard 15 cubic yard bucket
   Caterpillar 16H Grader, standard blade, road maintenance time = 1/2 loader time
   Caterpillar D9R Dozer with Semi-Universal Blade time = loader time
   10,000 gal. Water truck, road maintenance time = 1/2 loader time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)
3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 8 and Note 1 above

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13a-B
SUMMARY CALCULATION OF EARTHMOVING COSTS - Loaders

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Area 4N Regrade	992G Loader	100%	($ 224 +	$ 32)	* 2,225 =	$ 569,879
	16H Grader	50%	($ 82 +	$ 32)	* 1,112 =	$ 127,208
	D9R Dozer	100%	($ 156 +	$ 32)	* 2,225 =	$ 418,843
	Water Truck	50%	($ 117 +	$ 32)	* 1,112 =	$ 166,325
Area 4N Topsoil	992G Loader	100%	($ 224 +	$ 32)	* 302 =	$ 77,412
	16H Grader	50%	($ 82 +	$ 32)	* 151 =	$ 17,280
	D9R Dozer	100%	($ 156 +	$ 32)	* 302 =	$ 56,895
	Water Truck	50%	($ 117 +	$ 32)	* 151 =	$ 22,593
Area 4N Mitigation	992G Loader	100%	($ 224 +	$ 32)	* 45 =	$ 11,490
	16H Grader	50%	($ 82 +	$ 32)	* 22 =	$ 2,565
	D9R Dozer	100%	($ 156 +	$ 32)	* 45 =	$ 8,444
	Water Truck	50%	($ 117 +	$ 32)	* 22 =	$ 3,353
Cottonwood Crossing Material	992G Loader	100%	($ 224 +	$ 32)	* 125 =	$ 32,093
	16H Grader	50%	($ 82 +	$ 32)	* 63 =	$ 7,164
	D9R Dozer	100%	($ 156 +	$ 32)	* 125 =	$ 23,587
	Water Truck	50%	($ 117 +	$ 32)	* 63 =	$ 9,367
					Total Cost =	**$1,554,498**

Equipment and Accesory Identification

1) Caterpillar 992G Loader with standard 15 cubic yard bucket
   Caterpillar 16H Grader, standard blade, road maintenance time = 1/2 loader time
   Caterpillar D9R Dozer with Semi-Universal Blade time = loader time
   10,000 gal. Water truck, road maintenance time = 1/2 loader time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2304 edition. (see Table 12-B-23)
3) Labor Cost based on 2305 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 8 and Note 1 above

WORKSHEET NO. 13C

SUMMARY CALCULATION OF EARTHMOVING COSTS - Loaders

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]		Labor Costs [$/hr][3]		Total Hours Required[4]		Total Cost ($)
Area 1 Mitigation	992G Loader	100%	($ 224	+	$ 32)	*	41	=	$ 10,563
	16H Grader	50%	($ 82	+	$ 32)	*	21	=	$ 2,358
	D9R Dozer	100%	($ 156	+	$ 32)	*	41	=	$ 7,763
	Water Truck	50%	($ 117	+	$ 32)	*	21	=	$ 3,083
Area 2 Mitigation	992G Loader	100%	($ 224	+	$ 32)	*	166	=	$ 42,499
	16H Grader	50%	($ 82	+	$ 32)	*	83	=	$ 9,487
	D9R Dozer	100%	($ 156	+	$ 32)	*	166	=	$ 31,236
	Water Truck	50%	($ 117	+	$ 32)	*	83	=	$ 12,404
Area 3 Mitigation	992G Loader	100%	($ 224	+	$ 32)	*	235	=	$ 60,163
	16H Grader	50%	($ 82	+	$ 32)	*	117	=	$ 13,430
	D9R Dozer	100%	($ 156	+	$ 32)	*	235	=	$ 44,218
	Water Truck	50%	($ 117	+	$ 32)	*	117	=	$ 17,559
North Area Coal Contaminated Soil	992G Loader	100%	($ 224	+	$ 32)	*	126	=	$ 32,269
	16H Grader	50%	($ 82	+	$ 32)	*	63	=	$ 7,203
	D9R Dozer	100%	($ 156	+	$ 32)	*	126	=	$ 23,717
	Water Truck	50%	($ 117	+	$ 32)	*	63	=	$ 9,418
Area 2 Coal Contaminated Soil	992G Loader	100%	($ 224	+	$ 32)	*	185	=	$ 47,398
	16H Grader	50%	($ 82	+	$ 32)	*	93	=	$ 10,580
	D9R Dozer	100%	($ 156	+	$ 32)	*	185	=	$ 34,834
	Water Truck	50%	($ 117	+	$ 32)	*	93	=	$ 13,833
							Total Cost	**=**	**$ 434,012**

Equipment and Accesory Identification

1) Caterpillar 992G Loader with standard 15 cubic yard bucket
   Caterpillar 16H Grader, standard blade, road maintenance time = 1/2 loader time
   Caterpillar D9R Dozer with Semi-Universal Blade time = loader time
   10,000 gal. Water truck, road maintenance time = 1/2 loader time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)
3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 8 and Note 1 above

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13a-C SUMMARY CALCULATION OF EARTHMOVING COSTS - Trucks								
Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]		Labor Costs [$/hr][3]		Total Hours Required[4]	Total Cost [$]
Area 4N Regrade	777D Truck	100%	($ 157	+	$ 32)	*	3,642 =	$ 689,118
Area 4N Topsoil	777D Truck	100%	($ 157	+	$ 32)	*	590 =	$ 111,693
Area 4N Mitigation	777D Truck	100%	($ 157	+	$ 32)	*	88 =	$ 16,578
Cottonwood Crossing Material	777D Truck	100%	($ 157	+	$ 32)	*	205 =	$ 38,808
							Total Cost =	$ 856,196

Equipment and Accesory Identification

1) Caterpillar 777D Dump Truck, mechanical drive, standard bed

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2304 edition. (see Table 12-B-23)

3) Labor Cost based on 2305 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 9

WORKSHEET NO. 13D

SUMMARY CALCULATION OF EARTHMOVING COSTS - Trucks

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]		Labor Costs [$/hr][3]		Total Hours Required[4]		Total Cost [$]
Area 2 Regrade	777D Truck	100%	($ 157	+	$ 32)	*	49,321	=	$ 9,331,020
Area 3 Regrade	777D Truck	100%	($ 157	+	$ 32)	*	62,103	=	$ 11,749,249
Area 1 Topsoiling	777D Truck	100%	($ 157	+	$ 32)	*	3,277	=	$ 619,998
Area 2 Topsoiling	777D Truck	100%	($ 157	+	$ 32)	*	8,699	=	$ 1,645,728
Area 3 Topsoiling	777D Truck	100%	($ 157	+	$ 32)	*	10,566	=	$ 1,998,927
Area 1 Mitigation	777D Truck	100%	($ 157	+	$ 32)	*	224	=	$ 42,429
Area 2 Mitigation	777D Truck	100%	($ 157	+	$ 32)	*	776	=	$ 146,771
Area 3 Mitigation	777D Truck	100%	($ 157	+	$ 32)	*	1,066	=	$ 201,588
North Area Coal Contaminated Soil	777D Truck	100%	($ 157	+	$ 32)	*	913	=	$ 172,677
Area 3 Coal Contaminated Soil	777D Truck	100%	($ 157	+	$ 32)	*	547	=	$ 103,562
							Total Cost =		**$ 26,011,951**

Equipment and Accessory Identification

1) Caterpillar 777D Dump Truck, mechanical drive, standard bed

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)

3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 9

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13a-D
SUMMARY CALCULATION OF EARTHMOVING COSTS - Motor Graders

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Ripping Roads	16H Grader, ri	100%	($ 87 +	$ 32) *	96 =	$ 11,473
Finish Grading Areas to be Topsoiled	16H Grader	100%	($ 82 +	$ 32) *	140 =	$ 15,993
					Total Cost =	**$ 27,466**

Equipment and Accesory Identification

1) Caterpillar 16H Motor Grader with Ripper Blade

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2304 edition. (see Table 12-B-23)

3) Labor Cost based on 2305 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 12

WORKSHEET NO. 13E

SUMMARY CALCULATION OF EARTHMOVING COSTS - Scrapers

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Area 2 Grading	637G Scraper	100%	($ 209	+ $ 32)	* 18,900	= $ 4,556,580
	637G Scraper	100%	($ 209	+ $ 32)	* 18,900	= $ 4,556,580
	16H Grader	13%	($ 82	+ $ 32)	* 2,363	= $ 270,194
	Water Truck	13%	($ 117	+ $ 32)	* 2,363	= $ 353,278
Area 3 Grading	637G Scraper	100%	($ 209	+ $ 32)	* 36,889	= $ 8,893,390
	637G Scraper	100%	($ 209	+ $ 32)	* 36,889	= $ 8,893,390
	16H Grader	13%	($ 82	+ $ 32)	* 4,611	= $ 527,355
	Water Truck	13%	($ 117	+ $ 32)	* 4,611	= $ 689,516
Area 1 Topsoiling	637G Scraper	100%	($ 209	+ $ 32)	* 15	= $ 3,626
	637G Scraper	100%	($ 209	+ $ 32)	* 15	= $ 3,626
	16H Grader	13%	($ 82	+ $ 32)	* 2	= $ 215
	Water Truck	13%	($ 117	+ $ 32)	* 2	= $ 281
Area 2 Topsoiling	637G Scraper	100%	($ 209	+ $ 32)	* -	= $ -
	637G Scraper	100%	($ 209	+ $ 32)	* -	= $ -
	16H Grader	13%	($ 82	+ $ 32)	* -	= $ -
	Water Truck	13%	($ 117	+ $ 32)	* -	= $ -
Area 3 Topsoiling	637G Scraper	100%	($ 209	+ $ 32)	* 737	= $ 177,611
	637G Scraper	100%	($ 209	+ $ 32)	* 737	= $ 177,611
	16H Grader	13%	($ 82	+ $ 32)	* 92	= $ 10,532
	Water Truck	13%	($ 117	+ $ 32)	* 92	= $ 13,770
					Total Cost =	**$ 29,127,554**

Equipment and Accesory Identification

1) Caterpillar 637G Scraper Push-Pull Pair

Caterpillar 16H Grader, standard blade, road meintenance time = 1/8 scraper time

10,000 gal. Water truck, road maintenance time = 1/8 scraper time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)

3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 8 and Note 1 above

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13F
SUMMARY CALCULATION OF EARTHMOVING COSTS - Scrapers

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Area 2 Mitigation	637G Scraper	100%	($209 +	$ 32)	* 76 =	$ 18,221
	637G Scraper	100%	($209 +	$ 32)	* 76 =	$ 18,221
	16H Grader	13%	($ 82 +	$ 32)	* 9 =	$ 1,080
	Water Truck	13%	($117 +	$ 32)	* 9 =	$ 1,413
					Total Cost =	**$ 38,936**

Equipment and Accesory Identification

1) Caterpillar 992G Loader with standard 15 cubic yard bucket
Caterpillar 16H Grader, standard blade, road maintenance time = 1/8 scraper time
10,000 gal. Water truck, road maintenance time = 1/8 scraper time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)
3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 8 and Note 1 above

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13G

SUMMARY CALCULATION OF EARTHMOVING COSTS - Motor Graders

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]		Labor Costs [$/hr][3]		Total Hours Required[4]		Total Cost [$]
Ripping Roads	16H Grader, ripping	100%	($ 87	+	$ 32)	*	528	= $	63,111
Finish Grading Areas to be Topsoiled	16H Grader	100%	($ 82	+	$ 32)	*	1,559	= $	178,286
							Total Cost =	**$**	**241,397**

Equipment and Accesory Identification

1) Caterpillar 16H Motor Grader with Ripper Blade

Data Sources.

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)

3) Labor Cost based on 2005 contract with ACME Inc. (see Table 12-B-24)

4) Total Hours Required from Worksheet 12

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 13H
SUMMARY CALCULATION OF EARTHMOVING COSTS - Drilling

Project	Equipment Type[1]	Ratio	Equipment Unit Costs [$/hr][2]	Labor Costs [$/hr][3]	Total Hours Required[4]	Total Cost [$]
Area 2 Highwall	DMM2 Drill	100%	($ 285 +	$ 193) *	12 =	$ 5,504
Area 3 Highwall	DMM2 Drill	100%	($ 285 +	$ 193) *	857 =	$ 409,838
					Total Cost =	**$ 415,343**

Equipment and Accesory Identification

1) Ingersoll-Rand DMM2 Crawler-type Drill

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2007 edition. (see Table 12-B-23)

3) Total Yardage Drilled and Blasted from Worksheet 15

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 14A
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:

Area 1

Description of Revegetation Activities

20% Contingency for vegetation failure:

Costs For Seeding =	577 ac	* (	383 $/ac.	+	1281.5 $/ac.	) =	$ 961,046
	Acreage to be reseeded		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation		

Reseeding 20% of permenent program lands that were revegged during or before 1999:

Costs For Reseeding =	19 ac	* (	383 $/ac.	+	1281.5 $/ac.	) =	$ 31,622
	Acreage to be reseeded		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation		

Other Revegetation Activity for this Area (e.g. Soil Sampling):

TOTAL REVEGETATION COST = $ 992,667

Data Sources:

Navajo Mine records for contractor planting costs

Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling

Irrigation costs are included with seeding, fertilizing and mulching costs

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 14a
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:

Area 4 North

Description of Revegetation Activities

20% Contingency for vegetation failure:

Costs For Seeding	= 502 ac (Acreage to be reseeded)	* (	382.8 $/ac. (cost for seedbed preparation)	+	1281.5 $/ac. (cost for seeding, fertilizing, mulching, and irrigation)	) = $	835,484

Reseeding 20% of permanent program lands that were revegged during or before 1996:

Costs For Reseeding	= 0 ac (Acreage to be reseeded)	* (	382.8 $/ac. (cost for seedbed preparation)	+	1281.5 $/ac. (cost for seeding, fertilizing, mulching, and irrigation)	) = $	-

Other Revegetation Activity for this Area (e.g. Soil Sampling):

None Required

TOTAL REVEGETATION COST = $ 835,484

Data Sources:

Navajo Mine records for contractor planting costs

Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling

Irrigation costs are included with seeding, fertilizing and mulching costs

[35] cost for seedbed preparation ID

[36] cost for seeding, fertilizing, mulching, and irrigation ID

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 14B
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:

Area 2

Description of Revegetation Activities

20% Contingency for vegetation failure:

Costs For Seeding =	2,742 ac	*	(383 $/ac.	+	1281.5 $/ac.	)	=	$4,563,451
	Acreage to be reseeded		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation			

Reseeding 20% of permenent program lands that were revegged during or before 1999:

Costs For Reseeding =	6 ac	*	(383 $/ac.	+	1281.5 $/ac.	)	=	$ 10,685
	Acreage to be reseeded		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation			

Other Revegetation Activity for this Area (e.g. Soil Sampling):

TOTAL REVEGETATION COST = $4,574,135

Data Sources:

Navajo Mine records for contractor planting costs

Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling

Irrigation costs are included with seeding, fertilizing and mulching costs

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 14C
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:

Area 3

Description of Revegetation Activities

20% Contingency for vegetation failure:

Costs For Seeding	=	3,511 ac Acreage to be reseeded	* (	383 $/ac. cost for seedbed preparation	+	1281.5 $/ac. cost for seeding, fertilizing, mulching, and irrigation	) =	$ 5,843,249

Reseeding 20% of permenent program lands that were revegged during or before 1999:

Costs For Reseeding	=	155 ac Acreage to be reseeded	* (	383 $/ac. cost for seedbed preparation	+	1281.5 $/ac. cost for seeding, fertilizing, mulching, and irrigation	) =	$ 257,500

Other Revegetation Activity for this Area (e.g. Soil Sampling):

TOTAL REVEGETATION COST = $6,100,749

Data Sources:

Navajo Mine records for contractor planting costs

Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling

Irrigation costs are included with seeding, fertilizing and mulching costs

Project: Navajo Mine
Date: May-2009

WORKSHEET NO. 14D
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:

Roads

Description of Revegetation Activities

20% Contingency for vegetation failure:

Costs For Seeding =	510 ac	* (	383 $/ac.	+	1281.5 $/ac.	) =	$ 848,285
	Acreage to be reseeded		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation		

Reseeding 20% of permenant program lands that were revegged during or before 1999:

Costs For Reseeding =	0 ac	* (	383 $/ac.	+	1281.5 $/ac.	) =	$ -
	Acreage to be reseeded*		cost for seedbed preparation		cost for seeding, fertilizing, mulching, and irrigation		

Other Revegetation Activity for this Area (e.g. Soil Sampling):

TOTAL REVEGETATION COST = $ 848,285

Data Sources:

Navajo Mine records for contractor planting costs

Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling

Irrigation costs are included with seeding, fertilizing and mulching costs

WORKSHEET NO. 15A
PRODUCTIVITY AND HOURS FOR DRILL USE

Earthmoving Activity:

Blasting Material Prior to Dozing - Area 2

Characterization of Drill Used

Drill Model IR DMM2 Drill

Drill Bit Diameter	11 [in]	Burden	26 [ft]	1,233 Volume Shot per hole [bcy]
Drill Rod Length	35 [ft]	Bench Height	40 [ft]	
Penetration Rate	228 [ft/hr]	Spacing	32 [ft]	

Description of Activity:

Drilling holes to provide space for explosives

Calculation:

Cycles per Hour = 60 min (time available) / (10.5 min (drill time) + 1.8 min (rod feed time) + 0.4 min (rod pull time) + 2.0 min (misc)) = 4.1 cycles/hr

Operating Delays = 30.0 min (lunch) + 15.0 min (shift change) + 10.0 min (blasting) + 6.0 min (service time) + 5.0 min (moving) + 5 min (misc.) = 71 min
= 14.8% of a shift
= 85.2% operational utilization

Effective Pit Utilization (EPU) = 85.2% (operational utilization) * 90.0% (availability) = 76.7%

Maximum Penetration Rate = 40 ft (bench height) * 4.1 cycles/hr (cycles per hour) * 76.7% EPU (pit utilization) = 126.5 ft/hr

Maximum Production:

per Scheduled Shift: = 26 ft (burden) * 32 ft (spacing) * 126.5 ft/hr (max. penetration rate) * 8.0 hr/shift (hours in a shift) / 27 ft^3/yd^3 (conversion factor) = 31,184 bcy/shift

per Scheduled Hour = 31,184 bcy/shift (max. production per sched. shift) / 8 hr/shift (conversion factor) = 3,898 bcy/hr

Drill Hours Required = 44,889 bcy (volume to be blasted) / 3,898 bcy/hr (production rate) = 12 hr

WORKSHEET NO. 15B

PRODUCTIVITY AND HOURS FOR DRILL USE

Earthmoving Activity:

Blasting Material Prior to Dozing - Area 3

Characterization of Drill Used

Drill Model IR DMM2 Drill

Drill Bit Diameter	11 [in]	Burden	26 [ft]	1,233 Volume Shot per hole [bcy]
Drill Rod Length	35 [ft]	Bench Height	40 [ft]	
Penetration Rate	228 [ft/hr]	Spacing	32 [ft]	

Description of Activity:

Drilling holes to provide space for explosives

Calculation:

Cycles per Hour = 60 min (time available) / (10.5 min (drill time) + 1.6 min (rod feed time) + 0.4 min (rod pull time) + 2.0 min (misc.)) = 4.1 cycles/hr

Operating Delays = 30.0 min (lunch) + 15.0 min (shift change) + 10.0 min (blasting) + 6.0 min (service time) + 5.0 min (moving) + 5 min (misc.) = 71 min
= 14.8% of a shift
= 85.2% operational utilization

Effective Pit Utilization (EPU) = 85.2% (operational utilization) * 90.0% (availability) = 76.7%

Maximum Penetration Rate = 40 ft (bench height) * 4.1 cycles/hr (cycles per hour) * 76.7% EPU (pit utilization) = 126.5 ft/hr

Maximum Production:

per Scheduled Shift: = 26 ft (burden) * 32 ft (spacing) * 126.5 ft/hr (max. penetration rate) * 6.0 hr/shift (hours in a shift) / 27 ft^3/yd^3 (conversion factor) = 31,184 bcy/shift

per Scheduled Hour = 31,184 bcy/shift (max. production per sched. shift) / 8 hr/shift (conversion factor) = 3,898 bcy/hr

Drill Hours Required = 3,342,325 bcy (volume to be blasted) / 3,898 bcy/hr (production rate) = 857 hr

WORKSHEET NO. 15C

PRODUCTIVITY AND COSTS FOR BLASTING ACTIVITIES

Earthmoving Activity:

Blasting Material Prior to Dozing - Area 2

Characterization of Blasting Parameters

Ingersoll Rand DMM2 Drill

Burden	26 [ft]	Powder Factor [lb/bcy]	0.9 [lb/bcy]
Bench Height	40 [ft]	Volume Shot per hole [bcy]	1,233 [bcy]
Spacing	32 [ft]		

Description of Activity:

ANFO used with boosters and primacord for explosive load

Calculation:

Total ANFO Required = $\frac{44{,}889 \text{ bcy}}{\text{volume to be blasted}} * \frac{0.9 \text{ lb/bcy}}{\text{powder factor}}$ = 40,400 lb

Miscellaneous Powder Supplies = $\frac{40{,}400 \text{ lb}}{\text{ANFO required}} * \frac{5\%}{\text{contingency factor}}$ = 2,020 lb

Cord Cost per Hole = $\left(\frac{26 \text{ ft}}{\text{burden}} + \frac{32 \text{ ft}}{\text{spacing}} + \frac{40 \text{ ft}}{\text{bench height}}\right) * \frac{10\%}{\text{waste factor}} * \frac{0.10 \text{ \$/ft}}{\text{cord unit cost}}$ = 10 $/hole

ANFO Cost per Hole = $\frac{1{,}233 \text{ bcy}}{\text{volume shot per hole}} * \frac{0.9 \text{ lb/bcy}}{\text{powder factor}} * \frac{0.14 \text{ \$/lb}}{\text{ANFO unit cost}}$ = 160 $/hole

Primer Cost per Hole = $\frac{1}{\text{primers per hole}} * \frac{4.45 \text{ \$/ea}}{\text{primer unit cost}}$ = 4.45 $/hole

Volumetric Blasting Cost = $\left(\frac{10 \text{ \$/hole}}{\text{cord cost per hole}} + \frac{160 \text{ \$/hole}}{\text{ANFO cost per hole}} + \frac{4.45 \text{ \$/hole}}{\text{primer cost per hole}}\right) / \frac{1{,}233 \text{ bcy}}{\text{volume shot per hole}}$ = 0.14 $/bcy

Total Blasting Cost = $\frac{0.14 \text{ \$/bcy}}{\text{volumetric blasting cost}} * \frac{44{,}889 \text{ bcy}}{\text{volume to be blasted}}$ = $ 6,376

WORKSHEET NO. 15D
PRODUCTIVITY AND COSTS FOR BLASTING ACTIVITIES

Earthmoving Activity:

Blasting Material Prior to Dozing - Area 3

Characterization of Blasting Parameters

Ingersoll Rand DMM2 Drill

26	Burden [ft]	0.9	Powder Factor [lb/bcy]
32	Spacing [ft]	1,233	Volume Shot per hole [bcy]
40	Bench Height [ft]		

Description of Activity:

ANFO used with boosters and primacord for explosive load

Calculation:

Total ANFO Required = 44,889 bcy (volume to be blasted) * 0.9 lb/bcy (powder factor) = 40,400 lb

Miscellaneous Powder Supplies = 40,400 lb (ANFO required) * 5% (contingency factor) = 2,020 lb

Cord Cost per Hole =(26 ft (burden) + 32 ft (spacing) + 40 ft (bench height))* 10% (waste factor) * 0.10 $/ft (cord unit cost) = 10 $/hole

ANFO Cost per Hole = 1,233 bcy (volume shot per hole) * 0.9 lb/bcy (powder factor) * 0.14 $/lb (ANFO unit cost) = 160 $/hole

Primer Cost per Hole = 1 (primers per hole) * 4.45 $/ea (primer unit cost) = 4.45 $/hole

Volumetric Blasting Cost =(10 $/hole (cord cost per hole) + 160 $/hole (ANFO cost per hole) + 4.45 $/hole (primer cost per hole))/ 1,233 bcy (volume shot per hole) = 0.14 $/bcy

Total Blasting Cost = 0.14 $/bcy (volumetric blasting cost) * 3,342,325 bcy (volume to be blasted) = $ 474,739

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WORKSHEET NO. 15E
Other Reclamation Activity Costs

Earthmoving Activity:

Rip-Rap for Channels and Drop Structures

Calculation:

See detailed calculations in Appendix 12-C

Cost for Area 2:	$ 1,413,318		
Cost for Area 3:	$ 178,606		
Total:	$ 1,591,924	Inflated Cost for Areas 2 & 3:	$ 1,591,924

WORKSHEET NO. 15a OTHER RECLAMATION ACTIVITY COSTS	
Earthmoving Activity:	
Rip-Rap for Channels and Drop Structures	
Calculation:	
See detailed calculations in Appendix 12-C	
Cost for Area 4N:	$178,606
Inflated Cost for Area 4N:	$178,606

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WORKSHEET NO. 16
AREAS 1-3 RECLAMATION BOND SUMMARY SHEET

			2009 Estimate		
1	Total Facility and Structure Removal Costs	$	6,760,527		
2	Total Earthmoving Costs	$	94,678,973		
3	Total Revegetation Costs		$12,515,837		
4	Total Other Reclamation Activities Costs	$	2,073,039		
5	Subtotal: Total Direct Costs			$	116,028,376
6	Mobilization and Demobilization (at 1.0% of Item 5)		1.0%	$	1,160,284
7	Contingencies (at 2.0% of Item 5)		2.0%	$	2,320,568
8	Engineering Redesign Fee (at 1.8% of Item 5)		1.8%	$	2,088,511
9	Contractor Profit and Overhead (at 15.0% of Item 5)		15.0%	$	17,404,256
10	Reclamation Management Fee (at 3.9% of Item 5)		3.9%	$	4,525,107
	GRAND TOTAL BOND AMOUNT *(Sum of Items 5 through 10)*			**$**	**143,527,101**

WORKSHEET NO. 16a
AREA 4 NORTH RECLAMATION BOND SUMMARY SHEET

			2009 Estimate		
1	Total Facility and Structure Removal Costs	$	1,419,464		
2	Total Earthmoving Costs	$	4,593,614		
3	Total Revegetation Costs	$	835,484		
4	Total Other Reclamation Activities Costs	$	178,606		
5	Subtotal: Total Direct Costs			$	7,027,168
6	Mobilization and Demobilization (at 1.0% of Item 5)		1.0%	$	70,272
7	Contingencies (at 2.0% of Item 5)		2.0%	$	140,543
8	Engineering Redesign Fee (at 1.8% of Item 5)		1.8%	$	126,489
9	Contractor Profit and Overhead (at 15.0% of Item 5)		15.0%	$	1,054,075
10	Reclamation Management Fee (at 3.9% of Item 5)		3.9%	$	274,060
	GRAND TOTAL BOND AMOUNT *(Sum of Items 5 through 10)*			**$**	**8,692,606**

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WORKSHEET NO. 16
NAVAJO MINE RECLAMATION BOND SUMMARY SHEET

			2008 Estimate		
1	Total Facility and Structure Removal Costs	$	8,224,864		
2	Total Earthmoving Costs	$	99,330,498		
3	Total Revegetation Costs		$13,527,793		
4	Total Other Reclamation Activities Costs	$	2,251,645		
5	Subtotal: Total Direct Costs			$	123,334,799
6	Mobilization and Demobilization (at 1.0% of Item 5)		1.0%	$	1,233,348
7	Contingencies (at 2.0% of Item 5)		2.0%	$	2,466,696
8	Engineering Redesign Fee (at 1.8% of Item 5)		1.8%	$	2,220,026
9	Contractor Profit and Overhead (at 15.0% of Item 5)		15.0%	$	18,500,220
10	Reclamation Management Fee (at 3.9% of Item 5)		3.9%	$	4,810,057
	GRAND TOTAL BOND AMOUNT *(Sum of Items 5 through 10)*			**$**	**152,565,146**

TABLE 12-B-1
DEMOLITION UNIT COSTS

Means Reference Number (1)			ID	Item	Unit	2009 Bare Costs (1)	2009 Unit Costs
02 41	16.13	12	1	Large urban buildings, steel	CF	$0.26	$0.26
02 41	16.13	5000	1a	Large urban buildings, steel, no interior walls reduce by 50%	CF	$0.13	$0.13
02 41	16.13	0050	2	Large urban buildings, concrete	CF	$0.37	$0.37
02 41	16.13	5000	2a	Large urban buildings, concrete, no interior walls reduce by 50%	CF	$0.19	$0.19
02 41	16.13	0080	3	Large Urban buildings, masonry	CF	$0.28	$0.28
02 41	16.13	5000	3a	Large Urban buildings, masonry, no interior walls reduce by 50%	CF	$0.14	$0.14
02 41	16.13	0100	4	Large urban buildings, mixture of types	CF	$0.28	$0.28
02 41	16.13	0500	5	Small urban buildings, steel	CF	$0.28	$0.28
02 41	16.13	5000	5a	Small urban buildings, steel, no interior walls reduce by 50%	CF	$0.14	$0.14
02 41	16.13	0600	6	Small urban buildings, concrete	CF	$0.35	$0.35
02 41	16.13	5000	6a	Small urban buildings, concrete, no interior walls reduce by 50%	CF	$0.18	$0.18
02 41	16.13	0650	7	Small Urban buildings, masonry	CF	$0.28	$0.28
02 41	16.13	5000	7a	Small Urban buildings, masonry, no interior walls reduce by 50%	CF	$0.14	$0.14
02 41	16.17	0240	8	Floor, 4" concrete slab, plain	SF	$3.19	$3.41
02 41	16.17	0280	8a	Floor, 4" concrete slab, mesh reinforced	SF	$3.40	$3.62
02 41	16.17	0300	8b	Floor, 4" concrete slab, mesh reinforced, rods	SF	$4.00	$4.22
02 41	16.17	0400	9	Floor, 6" concrete slab, plain	SF	$4.25	$4.59
02 41	16.17	0420	9a	Floor, 6" concrete slab, mesh reinforced	SF	$4.69	$5.03
02 41	16.17	0440	9b	Floor, 6" concrete slab, mesh reinforced, rods	SF	$5.33	$5.67
02 41	16.17	0420	10	Floor, 8"concrete slab, mesh reinforced	SF	$6.25	$6.70
02 41	16.17	0440	10a	Floor, 8"concrete slab, mesh reinforced, rods	SF	$7.11	$7.55
1 41	16.16	0439	11	Floor, 12"concrete slab, mesh reinforces rods	SF	$10.66	$11.33
02 41	16.17	1000	12	Footings, concrete, 1' x 2'	LF	$11.37	$12.71
02 41	16.17	2600	12a	Footings, concrete, 1' x 2', average reinforcing + 10%	LF	$12.51	$13.85
02 41	16.17	1080	13	Footings, concrete, 1.5' x 2'	LF	$13.65	$15.67
02 41	16.17	2600	13a	Footings, concrete, 1.5' x 2', average reinforcing + 10%	LF	$15.02	$17.03
02 41	16.17	1120	14	Footings, concrete 1.5' x 3'	LF	$17.10	$20.13
02 41	16.17	2600	14a	Footings, concrete, 1.5' x 3', average reinforcing + 10%	LF	$18.81	$21.84
02 41	16.17	1140	15	Footings, concrete, 2' x 3'	LF	$19.55	$23.58
02 41	16.17	2600	15a	Footings, concrete, 2' x 3', average reinforcing + 10%	LF	$21.51	$25.54
02 41	16.17	1140	16	Footings, concrete, 2' x 6'	LF	$39.10	$47.17
02 41	16.17	2600	16a	Footings, concrete, 2' x 6', average reinforcing + 10%	LF	$43.01	$51.08
02 41	16.17	1140	51	Footings, concrete, 2' x16', average reinforcing + 10%	LF	$114.69	$136.20
02 41	16.17	2400	17	Walls, concrete, 3.5" thick	SF	$5.83	$6.03
02 41	16.17	2400	18	Walls, concrete, 6" thick	SF	$10.00	$10.34
02 41	16.17	2600	18a	Walls, concrete, 6" thick, Average reinforcing + 10%	SF	$11.00	$11.34
02 41	16.17	2420	19	Walls, concrete, 8" thick	SF	$11.44	$11.89
02 41	16.17	2600	19a	Walls, concrete, 8" thick, Average reinforcing + 10%	SF	$12.58	$13.03
02 41	16.17	2440	49	Walls, concrete, 10" thick	SF	$13.29	$13.85
02 41	16.17	2600	49a	Walls, concrete, 10" thick, Average reinforcing + 10%	SF	$14.62	$15.18
02 41	16.17	2500	50	Walls, concrete, 12" thick	SF	$15.95	$16.62

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TABLE 12-B-2
CULVERT VOLUMES FOR DEMOLITION AND REMOVAL

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft^3]
CP-1	48	76	955
CP-2	48	76	955
CP-3	48	100	1,257
CP-4	48	68	855
CP-5	84	311	11,969
CP-6	60	218	4,280
CP-7	42	158	1,520
CP-8	30	81	398
CP-9	30	48	236
CP-10	24	120	377
CP-103	30	124	609
CP-11	24	107	336
CP-12	24	101	317
CP-13	30	73	358
CP-14	30	129	633
CP-15	24	108	339
CP-16	60	153	3,004
CP-17	108	187	11,896
CP-18	90	305	13,474
CP-19	30	203	996
CP-20	24	262	823
CP-22	48	282	3,544
CP-23	58	146	2,679
CP-24	58	146	2,679
CP-31	48	150	1,885
CP-32	48	150	1,885
CP-33	48	150	1,885
CP-34	48	150	1,885
CP-35A	24	147	462
CP-35B	24	147	462
CP-36	48	70	880
CP-37	24	160	503
CP-49	12	140	110
CP-50	30	140	687
CP-50	30	140	687
CP-51	36	134	947
CP-52	42	137	1,318
CP-53	42	141	1,357
CP-54	18	178	315
CP-55	42	204	1,963
CP-56	48	170	2,136
CP-57	18	174	307

TABLE 12-B-2
CULVERT VOLUMES FOR DEMOLITION AND REMOVAL

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft³]
CP-58	18	140	247
CP-59	18	142	251
CP-60	18	230	406
CP-61	30	140	687
CP-62	18	128	226
CP-63A	16	40	56
CP-63B	15	133	163
CP-69	72	83	2,347
CP-74	76	110	3,465
CP-75A	7	106	30
CP-75B	7	106	30
CP-76	24	89	280
CP-77	36	231	1,633
CP-83	24	155	487
CP-84	16	48	64
CP-85	16	65	86
CP-86	15	14	17
CP-87	16	19	25
CP-88	15	22	27
CP-91	18	70	124
CP-92	30	50	245
CP-92	30	50	245
CP-93	48	230	2,890
CP-94	12	31	24
CP-95	24	26	82
CP-96	18	144	254
CP-97	24	140	440
CP-98	16	80	112
CP-99	16	80	112
CP-100	24	60	188
CP-101	12	40	31
CP-102	24	50	157
CP-103	30	124	609
CP-104	36	161	1,138
CP-106	10	75	41
CP-107	10	75	41
CP-108	30	28	137
CP-111	96	175	8,796
CP-119	18	95	168
CP-120	18	79	140
CP-122	24	54	170
CP-123	24	50	157

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TABLE 12-B-2
CULVERT VOLUMES FOR DEMOLITION AND REMOVAL

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft³]
CP-124	24	50	157
CP-129	24	148	465
CP-130	24	142	446
CP-131	24	142	446
CP-132	24	132	415
CP-137	24	226	710
CP-138	24	168	528
CP-139	24	154	484
CP-140	24	100	314
CP-141	24	122	383
CP-142	24	192	603
CP-143	24	226	710
CP-144	42	168	1,616
CP-150	24	120	377
CP-152	60	93	1,826
CP-153	30	93	457
CP-154	24	72	226
CP-155	24	72	226
CP-156	24	72	226
CP-155	24	72	226
CP-156	24	72	226
CP-169	18	40	71
CP-170	18	48	85
CP-174	18	35	62
CP-175	16	40	56
CP-176	16	35	49
CP-177	30	40	196
CP-178	16	36	50
CP-179	16	40	56
CP-180	16	40	56
CP-181A	16	33	46
CP-181B	16	33	46
CP-185	24	130	408
CP-186	24	206	647
CP-187	24	206	647
CP-189	16	40	56
CP-190	16	40	56
CP-202	18	30	53
CP-203	18	30	53
CP-204	18	61	108
DD-01	30	36	177
DD-02	30	53	260

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TABLE 12-B-2
CULVERT VOLUMES FOR DEMOLITION AND REMOVAL

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft^3]
DD-03	30	53	260
DD-04	16	65	91
DD-05	42	29	279
DD-07	15	325	399
DD-08	15	90	110
DD-09	15	87	107
DD-10	15	105	129
DD-11	15	408	501
DD-12	15	68	83
DD-13	15	206	253
DD-14	15	153	188
DD-15	15	154	189
DD-16	15	160	196
DD-17	15	126	155
DD-18	15	170	209
DD-19	15	55	67
DD-20	15	55	67
DD-21	15	68	83
DD-22	15	250	307
DD-23	16	52	73
DD-24	10	45	25
DD-25	9	68	30
DD-29	16	73	102
DD-30	4	334	29
		Total	-

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TABLE 12-B-2a
CULVERT VOLUMES FOR DEMOLITION AND REMOVAL

CULVERT ID	Diameter [in]	Length [ft]	Volume [ft^3]
CP-191	24	208	653
CP-192	24	126	396
CP-193	24	124	390
CP-194	30	124	609
CP-195	42	200	1,924
CP-196	30	124	609
CP-197	42	130	1,251
CP-198	30	124	609
CP-199	30	120	589
CP-200	60	124	2,435
CP-201	30	146	717
DD-28	30	172	844
		Total	**11,025**

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TABLE 12-B-3
BACKFILLING OF PONDS AND IMPOUNDMENTS

Pond	Pond Volume [ac-ft]	Pond Volume [bcy][1]	Dam[2] Bottom [ft]	Dam[2] Top [ft]	Dam[2] Height [ft]	Dam[2] Length [ft]	Dam[2] Volume [bcy][1]	Dozer Push Distance [ft]	Backfill Volume[3] [bcy][1]
Barber Loadout	19.0	30,653	-	-	-	-	Incised	200	30,653
Lowe Loadout Pond	18.0	29,040	-	-	-	-	Incised	200	29,040
North Sewage Pond	6.9	11,132	-	-	-	-	Incised	200	11,132
A-3 Sewage Pond	4.3	6,937	70	45	5	750	7,986	125	6,937
Barber Stockpile Pond #2	8.0	12,939	160	40	13	100	4,615	200	4,615
Barber Stockpile Pond #3	3.7	6,034	-	-	-	-	Incised	150	6,034
South Barber Pond	9.8	15,811	-	-	-	-	Incised	300	15,811
Emma's Pond	9.7	15,585	80	2	6	1000	9,111	100	9,111
Hosteen Stockpile Pond #1	10.7	17,279	140	30	10	450	14,167	125	14,167
Hosteen Stockpile Pond #2	13.0	20,941	200	20	14	300	17,111	300	17,111
Hosteen Stockpile Pond #3	7.4	11,874	-	-	-	-	Incised	200	11,874
Lowe Stockpile Pond	5.6	9,035	120	25	15	400	16,111	100	9,035
North Pinto Pond	5.4	8,647	100	30	6	350	5,056	160	5,056
Northwest Dixon Pond	5.9	9,488	-	-	-	-	Incised	200	9,488
Southwest Dixon Pond	3.0	4,840	-	-	-	-	Incised	125	4,840
Vinnel Pond	9.8	15,746	-	-	-	-	Incised	250	15,746
Block-C Pond 1	5.1	8,147	-	-	-	-	Incised	150	8,147
Block-C Pond 2	6.0	9,712	-	-	-	-	Incised	100	9,712
Block-C Pond 3	13.3	21,457	-	-	-	-	Incised	150	21,457
Block-C Pond 4	15.9	25,652	-	-	-	-	Incised	200	25,652
Lowehole-3 Pond No. 2	9.8	15,811	-	-	-	-	Incised	150	15,811
N. Pond 1 (Cells A,B,C)	29.3	47,271	-	-	-	-	Incised	200	47,271
CR Pond 4	12.9	20,860	-	-	-	-	Incised	150	20,860
Pond #5	2.3	3,711	-	-	-	-	Incised	100	3,711
South Dixon Pond 1	12.1	19,570	-	-	-	-	Incised	150	19,570
South Dixon Pond 2	4.6	7,421	-	-	-	-	Incised	150	7,421
South Dixon Pond 3	4.6	7,421	-	-	-	-	Incised	100	7,421
Mason Pond	4.7	7,502	-	-	-	-	Incised	125	7,502
Lowehole-3 Pond No. 3	4.8	7,663	-	-	-	-	Incised	125	7,663
Employee's Coal Dump Pond	2.6	4,162	-	-	-	-	Incised	100	4,162
Lowe Permanent Impoundment No.	7.2	11,600	-	-	-	-	Incised	100	11,600
Lowe Railroad Impoundment #1	19.2	30,976	-	-	-	-	Incised	200	30,976
Lowe Railroad Impounment #2	11.1	17,908	-	-	-	-	Incised	200	17,908
South Dixon Pond 7	9.4	15,165	-	-	-	-	Incised	200	15,165
	TOTAL	507,990	Weighted Average Push Distance [ft]					180	482,858

(1) BCY = Bank cubic yards

(2) Dam volume is the trapezoidal cross-sectional area times the length.

(3) Backfill volume is the smaller of the dam volume or pond volume.
This assumes that either the pond is filled or the dam is removed and pushed into the pond.

Project: Navajo Mine
Date: May-2009

TABLE 12-B-3a
BACKFILLING OF PONDS AND IMPOUNDMENTS

Pond	Pond Volume [ac-ft]	Pond Volume [bcy][1]	Dam[2] Bottom [ft]	Dam[2] Top [ft]	Dam[2] Height [ft]	Dam[2] Length [ft]	Dam[2] Volume [bcy][1]	Dozer Push Distance [ft]	Backfill Volume[3] [bcy][1]
Pond 1	8.0	12,907	-	-	-	-	Incised	200	12,907
Pond 2	4.9	7,825	-	-	-	-	Incised	200	7,825
Pond 3	1.5	2,452	-	-	-	-	Incised	200	2,452
Pond 4	7.8	12,649	-	-	-	-	Incised	200	12,649
Pond 5	26.5	42,673	-	-	-	-	Incised	200	42,673
Pond 6	17.6	28,346	-	-	-	-	Incised	200	28,346
Pond 7	9.3	14,939	-	-	-	-	Incised	200	14,939
Pond 8	4.3	6,953	-	-	-	-	Incised	200	6,953
Pond 9	3.0	4,792	-	-	-	-	Incised	200	4,792
	TOTAL	**133,536**					**Weighted Average Push Distance (ft)**	**200.0**	**133,536**

(1) BCY = Bank cubic yards
(2) Dam volume is the trapezoidal cross-sectional area times the length.
(3) Backfill volume is the smaller of the dam volume or pond volume.
This assumes that either the pond is filled or the dam is removed and pushed into the pond.

TABLE 12-B-4
ROAD RIPPING

Description	Length [ft]	Width [ft]	Area [acres]	Equipment
Area 3 By-pass Road	3,970	70	6.38	Cat 16G Motor Grader
Area 3 Main Access Road	5,160	60	7.11	Cat 16G Motor Grader
Barber By-pass Road	6,300	70	10.12	Cat 16G Motor Grader
Barber Haulroad	11,000	60	15.15	Cat 16G Motor Grader
Barber Hosteen Bypass	5,600	60	7.71	Cat 16G Motor Grader
Big Fill Road	19,450	60	26.79	Cat 16G Motor Grader
Bighan Ramp 10 Road	5,225	70	8.40	Cat 16G Motor Grader
Block B Access Road	13,220	82	24.89	Cat 16G Motor Grader
Burns By-Pass Road	520	40	0.48	Cat 16G Motor Grader
Burn's Pass Road	3,500	65	5.22	Cat 16G Motor Grader
Coal Plant Road	3,780	40	3.47	Cat 16G Motor Grader
Dixon Haul Road	8,150	70	13.10	Cat 16G Motor Grader
Doby Road	6,175	60	8.51	Cat 16G Motor Grader
Employee Coal Dump Access Road	270	35	0.22	Cat 16G Motor Grader
Gorman Road	4,900	60	6.75	Cat 16G Motor Grader
Hosteen Haul Road Modification (widen)			3.20	Cat 16G Motor Grader
Hosteen Haulroad	7,000	60	14.94	Cat 16G Motor Grader
Hosteen Ready Line	400	200	1.84	Cat 16G Motor Grader
Hosteen Yazzie Haulroad	11,700	60	16.12	Cat 16G Motor Grader
Irrigation Access Roads	79,200	10	18.18	Cat 16G Motor Grader
Lowe Boxcut Road	5,720	70	9.19	Cat 16G Motor Grader
Lowe Bypass Road	5,910	30	4.07	Cat 16G Motor Grader
Lowe Power Line Access Road			0.25	Cat 16G Motor Grader
Lowe Stockpile Road Modification	600	22	0.30	Cat 16G Motor Grader
Lynch Skyline Road	2,050	65	3.06	Cat 16G Motor Grader
Mason Road	5,225	70	8.40	Cat 16G Motor Grader
Neck Road	8,500	120	23.42	Cat 16G Motor Grader
Pinto Reroute	4,500	70	7.23	Cat 16G Motor Grader
Pinto Road	6,500	60	8.95	Cat 16G Motor Grader
Pinto Road	1,000	60	1.38	Cat 16G Motor Grader
Power Line Access Roads	183,500	10	42.47	Cat 16G Motor Grader
Railroad Access Roads	81,300	30	55.99	Cat 16G Motor Grader
Railroad Grade	81,300	20	37.53	Cat 16G Motor Grader
Re-aligned Ramp 7 Road	5,225	30	3.60	Cat 16G Motor Grader
Topsoil haulroad (Dixon)	3,585	60	4.94	Cat 16G Motor Grader
Yazzie Silo Access Road	350	30	0.24	Cat 16G Motor Grader
Yazzie Skyline Road	6,450	65	9.62	Cat 16G Motor Grader
Yazzie Spoil Side Road	3,450	70	5.54	Cat 16G Motor Grader
Total			**424.75**	

Project: Navajo Mine
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TABLE 12-B-4a
ROAD RIPPING

Description	Length [ft]	Width [ft]	Area [acres]	Equipment
Haul Roads	28,825	80	52.94	Cat 16G Motor Grader
Ancilary Roads	17,625	60	24.28	Cat 16G Motor Grader
Total			**77.22**	

Project: Navajo Mine
Date: May-2009

TABLE 12-B-5
AREA 1 BOND REGRADE EARTHMOVING - Dozers

Cut Block	Fill Block	Total Volume [yd^3]	Permanent Program %	Permanent Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Pinto Pit	Pinto Pit	1,163,300	100%	1,163,300	5,430	5,410	300	300	-6.7%	
	TOTAL	**1,163,300**		**1,163,300**			**Weighted Average**	**300**	**-6.7%**	

Total yards go to Worksheet 3

TABLE 12-B-6
AREA 2 BOND REGRADE EARTHMOVING - Dozers

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
D 01	D 01	1,757	100%	1,757	5,407	5,414	-	200	3.5%	Internal
D 02	D 02	1,005	100%	1,005	5,423	5,423	-	200	0.0%	Internal
D 03	D 03	21	100%	21	5,400	5,394	-	200	-2.8%	Internal
D 04	D 04	453	100%	453	5,384	5,381	-	200	-1.8%	Internal
D 05	D 05	222	100%	222	5,417	5,418	-	200	0.5%	Internal
D 06	D 06	1,200	100%	1,200	5,410	5,383	-	200	-13.8%	Internal
D 07	D 07	8,749	100%	8,749	5,470	5,376	-	200	-20.0%	Internal
D 09	D 09	113,269	100%	113,269	5,363	5,354	-	200	-4.4%	Internal
D 10	D 10	64,945	100%	64,945	5,405	5,382	-	200	-11.6%	Internal
D 11	D 11	3,943	100%	3,943	5,353	5,378	-	200	12.6%	Internal
D 12	D 12	11,849	100%	11,849	5,299	5,311	-	200	5.8%	Internal
D 13	D 13	16,940	100%	16,940	5,240	5,329	-	200	20.0%	Internal
D 14	D 14	12,620	100%	12,620	5,318	5,316	-	200	-1.1%	Internal
D 15	D 15	1,243	100%	1,243	5,342	5,317	-	200	-12.2%	Internal
D 16	D 16	2,088	100%	2,088	5,288	5,323	-	200	17.3%	Internal
D 17	D 17	5,861	100%	5,861	5,356	5,344	-	200	-5.9%	Internal
P 01	P 01	55,513	100%	55,513	5,296	5,320	-	200	12.0%	Internal
P 02	P 02	333,012	100%	333,012	5,308	5,314	-	200	2.7%	Internal
P 03	P 03	400,938	100%	400,938	5,347	5,371	-	200	11.9%	Internal
P 04	P 04	53,269	100%	53,269	5,482	5,439	-	200	-20.0%	Internal
P 05	P 05	9,625	100%	9,625	5,430	5,440	-	200	4.9%	Internal
P 06	P 06	8,775	100%	8,775	5,485	5,502	-	200	8.5%	Internal
R 01	R 01	45,758	100%	45,758	5,263	5,339	-	200	20.0%	Internal
R 02	R 02	154,945	100%	154,945	5,405	5,331	-	200	-20.0%	Internal
R 03	R 03	29,585	100%	29,585	5,316	5,347	-	200	15.7%	Internal
R 04	R 04	13,210	100%	13,210	5,351	5,352	-	200	0.6%	Internal
R 05	R 05	153,355	100%	153,355	5,367	5,457	-	200	20.0%	Internal
R 06	R 06	28,294	100%	28,294	5,397	5,352	-	200	-20.0%	Internal
T 01	T 01	2,481	100%	2,481	5,309	5,283	-	200	-13.2%	Internal
T 02	T 02	33	100%	33	5,410	5,301	-	200	-20.0%	Internal
T 03	T 03	396	100%	396	5,319	5,410	-	200	20.0%	Internal
T 04	T 04	39,420	100%	39,420	5,427	5,333	-	200	-20.0%	Internal
T 05	T 05	11,434	100%	11,434	5,448	5,447	-	200	-0.5%	Internal
T 06	T 06	38,524	100%	38,524	5,387	5,439	-	200	20.0%	Internal
T 07	T 07	46,379	100%	46,379	5,396	5,383	-	200	-6.8%	Internal
T 08	T 08	23,988	100%	23,988	5,415	5,403	-	200	-6.1%	Internal
T 09	T 09	28,917	100%	28,917	5,429	5,391	-	200	-19.0%	Internal
T 10	T 10	7,644	100%	7,644	5,411	5,386	-	200	-12.7%	Internal
HOS BLUFF 01	DS BLUFF 01	48,191	100%	48,191	5,386	5,411	-	200	12.3%	Internal
HOS BLUFF 02	DS BLUFF 02	10,432	100%	10,432	5,321	5,422	-	200	20.0%	Internal
HOS TRI	HOS TRI	54,734	100%	54,734	5,530	5,321	-	200	-20.0%	Internal
D 01	P 01	251,894	100%	251,894	5,407	5,320	2,087	300	-4.2%	External
D 02	P 01	231,712	100%	231,712	5,423	5,320	420	300	-20.0%	External
D 03	P 02	78,005	100%	78,005	5,400	5,314	2,542	300	-3.4%	External
D 04	R 01	562,454	100%	562,454	5,384	5,339	535	300	-8.4%	External
D 05	R 01	472,235	100%	472,235	5,417	5,339	1,195	300	-6.5%	External
D 06	P 03	1,245,545	100%	1,245,545	5,410	5,371	737	300	-5.3%	External
D 07	P 04	2,262,047	100%	2,262,047	5,470	5,439	657	300	-4.7%	External
D 08	P 04	600,679	100%	600,679	5,356	5,439	1,209	300	6.9%	External
D 09	R 02	316,184	100%	316,184	5,363	5,331	1,762	300	-1.8%	External
D 10	P 05	158,658	100%	158,658	5,405	5,440	1,478	300	2.4%	External
D 10	R 02	623,048	100%	623,048	5,405	5,331	1,938	300	-3.8%	External
D 11	P 05	480,461	100%	480,461	5,353	5,440	2,051	300	4.3%	External
D 11	R 03	1,248,077	100%	1,248,077	5,353	5,347	1,162	300	-0.5%	External
D 12	P 06	21,492	100%	21,492	5,299	5,502	1,545	300	13.1%	External
D 12	R 03	392,596	100%	392,596	5,299	5,347	2,227	300	2.2%	External
D 13	P 06	1,185,148	100%	1,185,148	5,240	5,502	518	300	20.0%	External
D 15	R 05	442,640	100%	442,640	5,342	5,457	1,280	300	9.0%	External
D 16	R 06	734,211	100%	734,211	5,288	5,352	602	300	10.6%	External
D 17	R 06	254,061	100%	254,061	5,356	5,352	907	300	-0.4%	External
	TOTAL	**13,408,649**		**13,408,649**			**Weighted Average**	**286**	**0.9%**	

Total yards go to Worksheet 3

TABLE 12-B-7
AREA 3 BOND REGRADE EARTHMOVING - Dozers

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
D-01	D-01	3,126	100%	3,126	5,361	5,362	-	300	0.2%	Internal
D-02	D-02	462	100%	462	5,400	5,301	-	300	-20.0%	Internal
D-04	D-04	325	100%	325	5,394	5,378	-	300	-5.1%	Internal
D-05	D-05	4,421	100%	4,421	5,335	5,349	-	300	4.6%	Internal
D-06	D-06	3,269	100%	3,269	5,374	5,355	-	300	-6.3%	Internal
D-07	D-07	1,514	100%	1,514	5,339	5,367	-	300	9.4%	Internal
D-08	D-08	212	100%	212	5,363	5,358	-	300	-1.6%	Internal
D-09	D-09	90	100%	90	5,332	5,341	-	300	2.9%	Internal
D-10	D-10	3,242	100%	3,242	5,371	5,359	-	300	-4.2%	Internal
D-11	D-11	2,113	100%	2,113	5,349	5,353	-	300	1.5%	Internal
D-12	D-12	835	100%	835	5,202	5,291	-	300	20.0%	Internal
D-13	D-13	310	100%	310	5,348	5,298	-	300	-16.7%	Internal
D-14	D-14	768	100%	768	5,305	5,280	-	300	-8.4%	Internal
D-15	D-15	14	100%	14	5,328	5,281	-	300	-15.5%	Internal
D-16	D-16	7	100%	7	5,328	5,279	-	300	-16.1%	Internal
DX-PS	DX-PS	707,706	100%	707,706	5,378	5,376	-	300	-0.8%	Internal
F-01	F-01	240	100%	240	5,384	5,356	-	300	-9.4%	Internal
F-02	F-02	37,245	100%	37,245	5,375	5,361	-	300	-4.7%	Internal
F-03	F-03	180,363	100%	180,363	5,300	5,370	-	300	20.0%	Internal
F-04	F-04	92,597	100%	92,597	5,413	5,355	-	300	-19.3%	Internal
P-02	P-02	112	100%	112	5,314	5,377	-	300	20.0%	Internal
P-03	P-03	3,463	100%	3,463	5,274	5,385	-	300	20.0%	Internal
P-04	P-04	36,694	100%	36,694	5,222	5,337	-	300	20.0%	Internal
R-01	R-01	124	100%	124	5,374	5,366	-	300	-3.0%	Internal
R-02	R-02	3,614	100%	3,614	5,381	5,384	-	300	1.1%	Internal
R-03	R-03	1,260	100%	1,260	5,278	5,390	-	300	20.0%	Internal
R-04	R-04	49,727	100%	49,727	5,565	5,295	-	300	-20.0%	Internal
R-05	R-05	3,966	100%	3,966	5,459	5,342	-	300	-20.0%	Internal
R-06	R-06	29,121	100%	29,121	5,362	5,265	-	300	-20.0%	Internal
R-07	R-07	41,315	100%	41,315	5,309	5,272	-	300	-12.3%	Internal
S-05	S-05	5,411	100%	5,411	5,390	5,372	-	300	-5.8%	Internal
S-06	S-06	787	100%	787	5,627	4,904	-	300	-20.0%	Internal
S-07	S-07	12,895	100%	12,895	5,328	5,340	-	300	3.9%	Internal
S-08	S-08	336	100%	336	5,245	5,312	-	300	20.0%	Internal
S-09	S-09	33,884	100%	33,884	5,299	5,270	-	300	-9.8%	Internal
S-10	S-10	32	100%	32	5,332	5,283	-	300	-16.1%	Internal
TP-01	TP-01	1,408	100%	1,408	5,401	5,433	-	300	10.7%	Internal
TP-02	TP-02	18,497	100%	18,497	5,382	5,395	-	300	4.3%	Internal
TP-03	TP-03	91,443	100%	91,443	5,452	5,453	-	300	0.3%	Internal
TP-04	TP-04	439	100%	439	5,374	5,367	-	300	-2.3%	Internal
TP-06	TP-06	3,594	100%	3,594	5,368	5,363	-	300	-1.7%	Internal
TP-07	TP-07	103	100%	103	5,331	5,330	-	300	-0.3%	Internal
TP-08	TP-08	17,285	100%	17,285	5,300	5,302	-	300	0.7%	Internal
TP-09	TP-09	3,065	100%	3,065	5,420	5,441	-	300	7.0%	Internal
TP-10	TP-10	531,361	100%	531,361	5,374	5,328	-	300	-15.3%	Internal
TP-11	TP-11	5,577	100%	5,577	5,355	5,367	-	300	4.0%	Internal
TP-12	TP-12	20,751	100%	20,751	5,408	5,392	-	300	-5.3%	Internal
TP-13	TP-13	4,991	100%	4,991	5,350	5,344	-	300	-2.0%	Internal
TP-14	TP-14	14,899	100%	14,899	5,387	5,360	-	300	-9.0%	Internal
TP-15	TP-15	5,454	100%	5,454	5,458	5,456	-	300	-0.7%	Internal
TP-16	TP-16	2,465	100%	2,465	5,411	5,399	-	300	-4.0%	Internal
TP-18	TP-18	7,163	100%	7,163	5,332	5,333	-	300	0.3%	Internal
TP-19	TP-19	23,455	100%	23,455	5,288	5,290	-	300	0.7%	Internal
TP-20	TP-20	867	100%	867	5,298	5,290	-	300	-2.7%	Internal
D-01	R-01	250,957	100%	250,957	5,361	5,366	426	512	1.0%	External
D-02	R-01	686,198	100%	686,198	5,400	5,366	1,200	1,440	-2.9%	External
D-03	R-02	1,207,107	100%	1,207,107	5,400	5,384	1,012	1,214	-1.6%	External
D-04	P-01	422,124	100%	422,124	5,394	5,232	1,582	1,899	-10.2%	External
D-05	R-03	2,269,276	100%	2,269,276	5,335	5,390	412	495	13.2%	External
D-06	R-03	1,679,203	100%	1,679,203	5,374	5,390	465	558	3.4%	External
D-07	P-01	124,385	100%	124,385	5,339	5,232	564	677	-19.1%	External
D-08	R-04	412,481	100%	412,481	5,363	5,295	2,312	2,774	-2.9%	External
D-09	R-04	1,630,449	100%	1,630,449	5,332	5,295	772	926	-4.8%	External
D-10	R-04	1,381,763	100%	1,381,763	5,371	5,295	967	1,160	-7.9%	External
D-11	R-05	1,924,134	100%	1,924,134	5,349	5,342	1,338	1,606	-0.5%	External
D-12	P-04	2,660,950	100%	2,660,950	5,202	5,337	1,392	1,671	9.7%	External
D-13	R-06	514,109	100%	514,109	5,348	5,265	745	894	-11.1%	External
D-15	P-04	2,059,994	100%	2,059,994	5,328	5,337	1,521	1,825	0.6%	External
D-16	R-07	2,027,871	100%	2,027,871	5,328	5,272	1,186	1,423	-4.7%	External
	TOTAL	21,265,419		21,265,419			Weighted Average	1,177	0.4%	

Project: Navajo Mine
Date: May-2009

TABLE 12-B-7a

AREA 4N BOND REGRADE EARTHMOVING - Dozers

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
D01	D01	5,648	100%	5,648	5,420	5,428	-	200	4.1%	Internal
D02	D02	3,651	100%	3,651	5,429	5,313	-	200	-6.0%	Internal
D03	D03	163,624	100%	163,624	5,398	5,447	-	200	6.0%	Internal
D04	D04	2,038	100%	2,038	5,310	5,329	-	200	6.0%	Internal
D05	D05	8,872	100%	8,872	5,333	5,355	-	200	6.0%	Internal
D06	D06	49,550	100%	49,550	5,331	5,366	-	200	6.0%	Internal
D07	D07	117,100	100%	117,100	5,269	5,387	-	200	6.0%	Internal
D08	D08	71,885	100%	71,885	5,283	5,314	-	200	6.0%	Internal
D09	D09	21,838	100%	21,838	5,352	5,336	-	200	-6.0%	Internal
D10	D10	2,690	100%	2,690	5,504	5,315	-	200	-6.0%	Internal
P02	P02	13	100%	13	5,364	5,383	-	200	6.0%	Internal
P03	P03	32	100%	32	5,282	5,340	-	200	6.0%	Internal
R01	R01	151	100%	151	5,423	5,423	-	200	0.0%	Internal
R02	R02	1,881	100%	1,881	5,341	5,434	-	200	6.0%	Internal
R03	R03	40,327	100%	40,327	5,355	5,336	-	200	-6.0%	Internal
R04	R04	1,879	100%	1,879	5,311	5,321	-	200	5.2%	Internal
R05	R05	18,316	100%	18,316	5,309	5,295	-	200	-6.0%	Internal
T01	T01	1,859	100%	1,859	5,383	5,349	-	200	-6.0%	Internal
T02	T02	81,603	100%	81,603	5,527	5,233	-	200	-6.0%	Internal
T03	T03	21,974	100%	21,974	5,453	5,294	-	200	-6.0%	Internal
D01	R01	156,501	100%	156,501	5,420	5,423	274	300	1.3%	External
D01	R02	54,568	100%	54,568	5,420	5,434	167	300	6.0%	External
D02	R02	84,414	100%	84,414	5,429	5,434	365	300	1.2%	External
D03	P01	419,187	100%	419,187	5,398	5,267	367	300	-6.0%	External
D04	R03	256,438	100%	258,438	5,310	5,336	311	300	6.0%	External
D05	R03	256,438	100%	256,438	5,333	5,336	344	300	0.7%	External
D06	P02	266,846	100%	266,846	5,331	5,383	339	300	6.0%	External
D07	R04	595,523	100%	595,523	5,269	5,321	344	300	6.0%	External
D08	R04	1,055,998	100%	1,055,998	5,283	5,321	310	300	6.0%	External
D09	P03	323,738	100%	323,738	5,352	5,340	430	300	-2.9%	External
D10	R05	486,228	100%	486,228	5,504	5,295	409	300	-6.0%	External
	TOTAL	4,570,812		4,570,812			Weighted Average	287	1.9%	

Total yards go to Worksheet 3

Project: Navajo Mine
Date: May-2009

TABLE 12-B-9

AREA 2 BOND REGRADE EARTHMOVING - Trucks and Loaders

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
T 02	P 01	961,308	100%	961,308	5,410	5,320	4,590	5,600	-2.0%	
T 03	P 01	98,353	100%	98,353	5,319	5,320	6,461	7,800	0.0%	
T 04	P 01	1,171,633	100%	1,171,633	5,427	5,320	7,543	9,100	-1.4%	
D 06	P 01	943,132	100%	943,132	5,410	5,320	11,527	13,900	-0.8%	
T 05	P 01	2,053,818	100%	2,053,818	5,448	5,320	11,107	13,400	-1.2%	
T 06	P 01	1,131,761	100%	1,131,761	5,387	5,320	14,656	17,600	-0.5%	
T 06	P 02	1,433,122	100%	1,433,122	5,387	5,314	8,941	10,800	-0.8%	
T 07	P 02	1,532,650	100%	1,532,650	5,396	5,314	10,269	12,400	-0.8%	
HOS BLUFF 02	P 05	821,974	100%	821,974	5,321	5,440	4,643	5,600	2.6%	
T 10	HOS BLUFF 01	1,763,183	100%	1,763,183	5,411	5,411	3,887	4,700	0.0%	
D 15	HOS BLUFF 01	518,911	100%	518,911	5,342	5,411	2,921	3,600	2.4%	
D 10	HOS BLUFF 01	52,227	100%	52,227	5,405	5,411	2,644	3,200	0.2%	
Triangle PS	P 02	3,041,142	100%	3,041,142	5,530	5,314	13,279	16,000	-1.6%	Not included in material movement costs. In the bond scenario, all the material is located in final resting place.
Overlook PS	P 02	854,857	100%	854,857	5,386	5,314	14,096	17,000	-0.5%	
Overlook PS	R 01	28,252	100%	28,252	5,386	5,339	10,840	13,100	-0.4%	
Overlook PS	P 04	2,338,931	100%	2,338,931	5,386	5,439	5,778	7,000	0.9%	
Overlook PS	R 02	3,594,589	100%	3,594,589	5,386	5,331	3,535	4,300	-1.6%	
	TOTAL	**12,482,072**		**12,482,072**		**Weighted Average**		**10,156**	**-0.5%**	

Total yards go to Worksheet 3

Assumptions: Distance is adjusted to accomodate haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-10
AREA 3 BOND REGRADE EARTHMOVING - Trucks and Loaders

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
TP-01	R-01	117,217	100%	117,217	5,401	5,366	9,964	12,000	-0.4%	
TP-02	R-01	509,853	100%	509,853	5,382	5,366	8,941	10,800	-0.2%	
TP-03	R-01	90,601	100%	90,601	5,452	5,366	6,480	7,800	-1.3%	
TP-04	R-01	49,773	100%	49,773	5,374	5,366	5,068	6,100	-0.2%	
TP-06	P-01	218,832	100%	218,832	5,368	5,232	5,864	7,100	-2.3%	
TP-07	P-01	21,668	100%	21,668	5,331	5,232	6,920	8,400	-1.4%	
TP-08	P-01	241,185	100%	241,185	5,300	5,232	6,354	7,700	-1.1%	
TP-09	P-01	848,698	100%	848,698	5,420	5,232	3,941	4,800	-4.8%	
S-02	P-01	1,737,502	100%	1,737,502	5,402	5,232	3,112	3,800	-5.5%	
TP-12	P-01	484,192	100%	484,192	5,408	5,232	4,247	5,100	-4.2%	
TP-10	P-01	1,638,589	100%	1,638,589	5,374	5,232	7,683	9,300	-1.9%	
S-06	P-01	5,434,035	100%	5,434,035	5,627	5,232	5,015	6,100	-6.0%	
TP-16	R-05	369,815	100%	369,815	5,411	5,342	6,511	7,900	-1.1%	
TP-15	R-05	35,645	100%	35,645	5,458	5,342	5,252	6,400	-2.2%	
S-08	P-02	986,117	100%	986,117	5,245	5,377	3,963	4,800	3.3%	
F-04	TP-05	68,385	100%	68,385	5,413	5,381	13,733	16,500	-0.2%	
D-13	P-02	1,514,488	100%	1,514,488	5,348	5,377	4,405	5,300	0.7%	
TP-14	TP-11	29,349	100%	29,349	5,387	5,367	3,262	4,000	-0.6%	
F-04	TP-11	1,961	100%	1,961	5,413	5,367	7,787	9,400	-0.6%	
F-04	TP-17	161,302	100%	161,302	5,413	5,326	3,289	4,000	-2.7%	
D-14	P-02	1,600,357	100%	1,600,357	5,305	5,377	5,064	6,100	1.4%	
D-14	P-03	1,348,271	100%	1,348,271	5,305	5,385	4,002	4,900	2.0%	
S-09	P-03	2,475,635	100%	2,475,635	5,299	5,385	5,593	6,800	1.5%	
TP-19	R-07	124,798	100%	124,798	5,288	5,272	3,365	4,100	-0.5%	
S-10	P-03	1,223,632	100%	1,223,632	5,332	5,385	5,053	6,100	1.1%	
Dixon PS	R-01	335,352	100%	335,352	5,378	5,366	13,445	16,200	-0.1%	
Dixon PS	R-02	4,254,773	100%	4,254,773	5,378	5,384	11,840	14,300	0.0%	
Dixon PS	F-03	2,673,127	100%	2,673,127	5,378	5,370	4,989	6,000	-0.2%	Not included in material movement costs. In the bond scenario, all the material is located in final resting place.
Dixon PS	P-01	1,037,831	100%	1,037,831	5,378	5,232	8,773	10,600	-1.7%	
Dixon PS	R-07	1,221,942	100%	1,221,942	5,378	5,272	4,784	5,800	-2.2%	
Dixon PS	TP-05	11,896	100%	11,896	5,378	5,381	16,688	20,100	0.0%	
TOTAL		**21,331,902**		**21,331,902**			**Weighted Average**	**6,190.09**	**-1.8%**	

Assumptions: Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-10a
AREA 4N BOND REGRADE EARTHMOVING - Trucks and Loaders

Cut Block	Fill Block	Total Volume [yd^3]	Permanent Program %	Permanent Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Inter-Block Yards										
D04	P01	560,882	100%	560,882	5,310	5,267	2,072	2,487	-2.1%	
T02	P01	1,152,932	100%	1,152,932	5,527	5,267	4,213	5,055	-6.0%	
T03	P02	544,983	100%	544,983	5,453	5,383	2,951	3,541	-2.4%	
	TOTAL	2,258,797		2,258,797			Weighted Average	4,052	-4.2%	

Total yards go to Worksheet 3

Assumptions:

Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-11
AREA 1 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT- Trucks

Cut Block	Fill Block	Area [acres]	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Doby #1	TP1	147.6	172,663	5,360	5,343	15,091	20,200	-0.1%	Adj. Distance Reflects Haul Route
Doby #1	TP2	16.0	18,767	5,360	5,394	13,817	20,000	0.2%	Adj. Distance Reflects Haul Route
Doby #1	TP3	9.5	11,088	5,360	5,377	13,615	20,700	0.1%	Adj. Distance Reflects Haul Route
Doby #1	TP4	20.5	23,978	5,360	5,380	11,961	17,300	0.1%	Adj. Distance Reflects Haul Route
Doby #1	TP5	15.1	17,608	5,360	5,436	10,900	14,500	0.5%	Adj. Distance Reflects Haul Route
Doby #1	TP6	44.8	52,399	5,360	5,411	10,575	17,700	0.3%	Adj. Distance Reflects Haul Route
Doby #1	TP7	169.7	198,550	5,360	5,395	6,721	9,900	0.4%	Adj. Distance Reflects Haul Route
Doby #1	TP8	4	4,430	5,360	5,330	7,951	9,100	-0.3%	Adj. Distance Reflects Haul Route
Doby #1	TP9	44	51,675	5,360	5,482	6,600	8,100	1.5%	Adj. Distance Reflects Haul Route
Doby #1	TP10	2	1,774	5,360	5,350	14,470	17,000	-0.1%	Adj. Distance Reflects Haul Route
	TOTAL	**472.7**	**552,932**			**Weighted Average**	**14,730**	**0.3%**	

Total yards and acres go to Worksheet 3

Assumptions:

8.7 inches of topsoil to be replaced in Area 1

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodated haulage routes

TABLE 12-B-12

AREA 2 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT - Trucks and Loaders

Cut Block	Fill Block	Area (acres)	Topsoil Volume [yd³]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
DBR13_TS_W	BLUFF 02	64.2	48,338	5,347	5,422	7,263	8,800	1.0%	
DBR13_TS_W	R 05	63.5	47,781	5,347	5,457	8,033	9,700	1.4%	
DBR13_TS_W	TP 24	8.5	6,406	5,347	5,300	7,729	9,300	-0.6%	
DBR13_TS_W	R 04	48.2	36,322	5,347	5,352	8,769	10,600	0.1%	
DBR13_TS_W	D 14	20.5	15,459	5,347	5,316	8,694	10,500	-0.4%	
DBR13_TS_W	D 15	15.8	11,893	5,347	5,317	9,001	10,900	-0.3%	
DBR13_TS_W	T 11	21.4	16,129	5,347	5,384	8,506	10,300	0.4%	
DBR13_TS_W	T 10	30.3	22,846	5,347	5,386	9,515	11,500	0.4%	
DBR13_TS_W	P 06	20.7	15,586	5,347	5,502	10,612	12,800	1.5%	
DBR13_TS_W	D 13	18.2	13,729	5,347	5,329	10,262	12,400	-0.2%	
DBR13_TS_W	D 12	11.0	8,313	5,347	5,311	9,901	11,900	-0.4%	
DBR13_TS_W	D 16	10.6	7,982	5,347	5,323	8,465	10,200	-0.3%	
DBR13_TS_W	D 17	6.6	4,940	5,347	5,344	9,829	11,800	0.0%	
DBR13_TS_W	R 06	41.1	30,975	5,347	5,352	8,927	10,800	0.1%	
DBR13_TS_W	R 03	55.8	42,003	5,347	5,347	9,391	11,300	0.0%	
DBR13_TS_W	D 11	30.3	21,344	5,347	5,378	10,116	12,200	0.3%	
DBR12_TS_E	D 11	30.3	1,491	5,356	5,378	13,072	15,700	0.2%	
DBR12_TS_E	BLUFF 01	43.2	32,548	5,356	5,411	11,956	14,400	0.5%	
DBR12_TS_E	T 08	32.6	24,569	5,356	5,403	13,987	16,800	0.3%	
DBR12_TS_E	T 09	44.3	33,318	5,356	5,391	13,462	16,200	0.3%	
DBR12_TS_E	P 05	11.9	8,973	5,356	5,440	13,617	16,400	0.6%	
DBR12_TS_E	D 10	35.2	26,475	5,356	5,382	14,110	17,000	0.2%	
DBR12_TS_E	D 09	28.1	21,192	5,356	5,354	14,832	17,800	0.0%	
DBR12_TS_E	R 02	85.9	64,894	5,356	5,331	15,475	18,600	-0.2%	
DBR12_TS_E	HOS TRI	38.9	29,253	5,356	5,321	13,071	15,700	-0.3%	
DBR12_TS_E	TP 02	38.7	29,109	5,356	5,330	6,314	7,600	-0.4%	
DBR12_TS_E	TP 01	52.7	39,680	5,356	5,270	5,874	7,100	-1.5%	
DBR12_TS_E	TP 04	48.9	36,819	5,356	5,375	13,707	16,500	0.1%	
DBR12_TS_E	TP 03	50.2	3,357	5,356	5,290	14,180	17,100	-0.5%	
Yazzie Y	TP 03	50.2	34,401	5,270	5,290	7,124	8,600	0.3%	
Yazzie Y	TP 05	54.8	41,234	5,270	5,296	10,483	12,600	0.2%	
Yazzie Y	T 07	62.7	47,184	5,270	5,383	6,045	7,300	1.9%	
Yazzie Y	D 08	5.7	4,282	5,270	5,330	5,817	7,000	1.0%	
Yazzie Y	D 07	24.4	18,358	5,270	5,376	7,357	8,900	1.4%	
Yazzie Y	T 06	53.5	40,248	5,270	5,439	7,456	9,000	2.3%	
Yazzie Y	P 04	40.8	30,730	5,270	5,439	7,010	8,500	2.4%	
Yazzie Y	TP 06	5.4	4,046	5,270	5,370	11,775	14,200	0.8%	
Yazzie Y	TP 07	31.2	23,523	5,270	5,360	10,243	12,300	0.9%	
Yazzie Y	T 05	51.8	38,979	5,270	5,447	10,930	13,200	1.8%	
Yazzie Y	D 06	31.2	23,490	5,270	5,383	10,617	12,800	1.1%	
Yazzie Y	D 05	10.7	8,037	5,270	5,418	12,772	15,400	1.2%	
Yazzie Y	D 04	17.6	13,279	5,270	5,381	13,504	16,300	0.8%	
Yazzie Y	R 01	35.0	26,342	5,270	5,339	13,176	15,900	0.5%	
Yazzie Y	P 03	92.1	24,378	5,270	5,371	11,226	13,500	0.9%	
HSR1_TS_S	TP 08	7.2	5,455	5,418	5,370	3,577	4,300	-1.3%	
HSR1_TS_S	P 03	92.1	44,962	5,418	5,371	7,929	9,600	-0.6%	
HSR1_TS_S	D 03	2.9	2,150	5,418	5,394	9,954	12,000	-0.2%	
HSR1_TS_S	T 04	44.6	33,571	5,418	5,333	10,336	12,500	-0.8%	
HSR1_TS_S	T 03	7.7	5,834	5,418	5,410	11,302	13,600	-0.1%	
HSR1_TS_S	T 02	19.8	14,879	5,418	5,301	13,150	15,800	-0.9%	
HSR1_TS_S	P 02	119.3	23,526	5,418	5,314	12,302	14,800	-0.8%	
BBR3_TS_S	P 02	119.3	9,541	5,353	5,314	3,963	4,800	-1.0%	
BBR5_TS_S	TP 17	53.1	39,977	5,425	5,340	5,135	6,200	-1.6%	
BBR5_TS_S	TP 09	69.5	52,295	5,425	5,300	7,783	9,400	-1.6%	
BBR5_TS_S	TP 10	30.3	22,846	5,425	5,320	6,653	8,000	-1.6%	
BBR5_TS_S	TP 11	27.1	20,369	5,425	5,390	2,868	3,500	-1.2%	
BBR5_TS_S	TP 12	3.2	2,433	5,425	5,400	6,156	7,400	-0.4%	
BBR5_TS_S	TP 13	19.0	10,427	5,425	5,380	5,849	7,100	-0.8%	
LWR1_RG_N	TP 13	19.0	3,893	5,298	5,380	14,914	17,900	0.6%	
LWR1_RG_N	TP 14	54.6	41,121	5,298	5,400	14,366	17,300	0.7%	
LWR1_RG_N	TP 15	15.6	11,741	5,298	5,440	13,995	16,800	1.0%	
LWR1_RG_N	TP 16	20.2	15,190	5,298	5,440	11,715	14,100	1.2%	
LWR1_RG_N	P 02	119.3	56,772	5,298	5,314	14,248	17,100	0.1%	
LWR1_RG_N	T 01	18.5	13,910	5,298	5,283	9,474	11,400	-0.2%	**After exhausting Topsoil Stockpiles in Areas 1 and 2, used material from Area 3 to topsoil remaining blocks. Volume taken from Area 3 stockpiles considered for Area 3 calculation.
LWR1_RG_N	D 01	14.3	10,756	5,298	5,414	8,578	10,300	1.4%	
LWR1_RG_N	D 02	14.6	11,027	5,298	5,423	9,124	11,000	1.4%	
LWR1_RG_N	P 01	91.4	68,813	5,298	5,320	9,396	11,300	0.2%	
LWR1_RG_N	TP 18	63.0	47,410	5,298	5,410	9,438	11,400	1.2%	
LWR1_RG_N	TP 19	8.9	6,720	5,298	5,424	8,909	10,700	1.4%	
LWR1_RG_N	TP 20	16.9	12,743	5,298	5,445	7,985	9,600	1.8%	
LWR1_RG_N	TP 21	20.8	15,681	5,298	5,455	9,232	11,100	1.7%	
LWR1_RG_N	TP 22	37.9	28,569	5,298	5,460	9,962	12,000	1.6%	
LWR1_RG_N	TP 23	10.2	7,692	5,298	5,495	8,919	10,800	2.2%	
	TOTAL	2,715	1,720,329			Weighted Average	11,956	0.3%	

Total yards and acres go to Worksheet 3

Assumptions:

5.6 inches of topsoil to be replaced in Area 2

Project: Navajo Mine
Date: May-2009

TABLE 12-B-13
AREA 3 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT- Trucks and Loaders

Cut Block	Fill Block	Area (acres)	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
LWR1_TS_W	R-01	25.8	33,616	5,332	5,366	4,647	5,576	0.6%	
LWR1_TS_W	D-01	9.7	12,707	5,332	5,362	4,223	5,067	0.6%	
LWR1_TS_W	D-02	9.7	12,615	5,332	5,301	5,553	6,664	-0.5%	
LWR1_TS_W	R-02	36.7	47,806	5,332	5,384	6,455	7,746	0.7%	
LWR1_TS_W	S-02	25.3	33,044	5,332	5,357	5,409	6,491	0.4%	
LWR1_TS_W	F-01	8.6	11,277	5,332	5,358	5,918	7,102	0.3%	
LWR1_TS_W	D-03	11.7	15,231	5,332	5,366	6,658	7,989	0.4%	
LWR1_TS_W	S-03	4.2	5,458	5,332	5,366	6,477	7,772	0.4%	
LWR1_TS_W	D-04	6.4	8,365	5,332	5,378	6,938	8,326	0.6%	
LWR1_TS_W	D-05	42.9	45,188	5,332	5,349	4,815	5,778	0.3%	
LWR4_TS_E	D-05	42.9	10,751	5,280	5,349	2,918	3,501	2.0%	
LWR4_TS_E	R-03	59.3	57,656	5,280	5,390	2,985	3,581	3.1%	
LWR4_TS_N	F-02	47.4	81,802	5,257	5,361	2,515	3,018	3.4%	
LWR4_TS_N	D-07	2.7	3,513	5,257	5,387	3,077	3,692	3.0%	
LWR4_TS_N	D-08	5.4	7,073	5,257	5,358	3,273	3,928	2.6%	
LWR4_TS_N	D-10	20.1	28,258	5,257	5,359	3,059	3,671	2.8%	
LWR4_TS_N	P-01	95.7	109,349	5,257	5,232	3,630	4,356	-0.6%	
LWR4_TS_N	S-06	147.7	102,088	5,257	4,904	3,830	4,596	-7.7%	
DXR1_TS_S	S-06	147.7	90,480	5,444	4,904	2,855	3,427	-15.8%	
DXR1_TS_S	F-03	93.3	121,663	5,444	5,370	5,310	6,372	-1.2%	
DXR1_TS_S	P-02	20.2	26,357	5,444	5,377	5,713	6,856	-1.0%	
DXR1_TS_S	P-03	28.2	36,734	5,444	5,385	6,886	8,263	-0.7%	
DXR1_TS_S	D-11	32.9	42,942	5,444	5,353	3,098	3,717	-2.5%	
DXR1_TS_S	S-07	32.3	42,085	5,444	5,340	5,036	6,043	-1.7%	
DXR1_TS_S	R-05	53.6	69,911	5,444	5,342	4,425	5,310	-1.9%	
DXR1_TS_S	F-04	58.8	33,824	5,444	5,355	6,116	7,339	-1.2%	
DXR2_TS_W	F-04	58.8	42,818	5,390	5,355	6,228	7,473	-0.5%	
DXR2_TS_W	S-08	13.1	17,143	5,390	5,312	6,116	7,340	-1.1%	
DXR2_TS_W	D-13	19.0	24,811	5,390	5,298	6,525	7,830	-1.2%	
DXR2_TS_W	D-14	22.6	29,457	5,390	5,280	6,882	8,259	-1.3%	
DXR2_TS_W	R-06	27.5	35,876	5,390	5,265	5,934	7,121	-1.8%	
DXR2_TS_W	D-12	26.9	35,026	5,390	5,291	7,477	8,973	-1.1%	
DXR2_TS_W	S-09	85.9	112,006	5,390	5,270	5,499	6,599	-1.8%	
DXR2_TS_W	S-10	74.8	75,028	5,390	5,283	7,338	8,805	-1.2%	
DXR4_TS_N	S-10	74.8	22,530	5,329	5,263	4,926	5,911	-0.8%	
DXR4_TS_N	D-15	18.8	24,493	5,329	5,281	6,025	7,230	-0.7%	
DXR4_TS_N	D-16	15.1	19,635	5,329	5,279	5,200	6,240	-0.8%	
DXR4_TS_N	R-07	112.3	146,388	5,329	5,272	4,194	5,033	-1.1%	
DXR4_TS_N	P-04	82.6	107,772	5,329	5,337	6,529	7,834	0.1%	
DXR4_TS_N	DX-PS	276.7	190,558	5,329	5,376	7,847	9,417	0.5%	
DXR1_RG_W	DX-PS	276.7	170,331	5,412	5,376	11,348	13,618	-0.3%	Regolith Stockpile
LWR1_RG_N	TP-01	5.8	7,512	5,298	5,406	7,154	8,585	1.3%	Regolith Stockpile
LWR1_RG_N	TP-02	38.7	50,426	5,298	5,410	6,000	7,200	1.6%	Regolith Stockpile
LWR1_RG_N	TP-03	67.4	87,876	5,298	5,470	3,110	3,731	4.6%	Regolith Stockpile
LWR1_RG_N	TP-06	27.4	35,743	5,298	5,351	2,733	3,279	1.6%	Regolith Stockpile
LWR1_RG_N	TP-07	2.7	3,472	5,298	5,326	2,605	3,126	0.9%	Regolith Stockpile
LWR1_RG_N	TP-08	21.1	27,509	5,298	5,308	3,604	4,324	0.2%	Regolith Stockpile
LWR1_RG_N	TP-09	29.4	38,381	5,298	5,393	4,658	5,590	1.7%	Regolith Stockpile
LWR1_RG_N	TP-10	309.4	403,441	5,298	5,341	5,063	6,075	0.7%	Regolith Stockpile
LWR1_RG_N	TP-11	50.7	66,180	5,298	5,389	7,663	9,195	1.0%	Regolith Stockpile
LWR1_RG_N	TP-12	88.3	115,199	5,298	5,371	7,063	8,476	0.9%	Regolith Stockpile
LWR4_RG_N	TP-14	21.7	28,267	5,424	5,360	3,844	4,372	-1.5%	Regolith Stockpile
LWR4_RG_N	TP-15	12.3	16,033	5,424	5,370	4,460	5,352	-1.0%	Regolith Stockpile
LWR4_RG_N	TP-16	32.6	42,540	5,424	5,401	5,083	6,100	-0.4%	Regolith Stockpile
LWR4_RG_N	TP-17	117.0	152,561	5,424	5,340	7,014	8,417	-1.0%	Regolith Stockpile
DXR1_RG_W	TP-19	39.8	51,966	5,412	5,264	5,612	6,734	-2.2%	Regolith Stockpile
DXR1_RG_W	TP-20	3.7	4,888	5,412	5,285	10,072	12,086	-1.1%	Regolith Stockpile
	TOTAL	3,123	3,253,655			Weighted Average	6,764	-0.7%	

Total yards and acres go to Worksheet 3

Assumptions:

9.7 inches of topsoil to be replaced in Area III
Centroid distance is measured from the stockpile centroid to the reclaim centroid
Distance is adjusted to accommodate haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-13a

AREA 4N BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT- Trucks and Loaders

Cut Block	Fill Block	Area [acres]	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
DXR4_TS_N	D01	4.3	3,275	5,329	5,428	8,931	10,271	1.1%	
DXR4_TS_N	D02	4.5	3,420	5,329	5,313	8,414	9,677	-0.2%	
DXR4_TS_N	D03	25.6	19,621	5,329	5,447	6,838	7,864	1.7%	
DXR4_TS_N	D04	6.5	5,003	5,329	5,329	4,988	5,737	0.0%	
DXR4_TS_N	D05	8.5	6,480	5,329	5,355	4,480	5,152	0.6%	
DXR4_TS_N	D06	14.6	11,173	5,329	5,368	4,215	4,847	0.9%	
DXR4_TS_N	D07	17.8	13,635	5,329	5,367	2,910	3,347	1.3%	
DXR4_TS_N	D08	18.5	14,199	5,329	5,314	3,004	3,454	-0.5%	
DXR4_TS_N	D09	8.3	6,366	5,329	5,338	4,208	4,840	0.2%	
DXR4_TS_N	D10	12.2	9,342	5,329	5,315	3,990	4,589	-0.3%	
DXR4_TS_N	P01	35.1	26,884	5,329	5,267	7,039	8,095	-0.9%	
DXR4_TS_N	P02	35.6	27,304	5,329	5,383	4,545	5,226	1.2%	
DXR4_TS_N	P03	29.6	22,668	5,329	5,340	4,627	5,322	0.2%	
DXR4_TS_N	R01	3.5	2,694	5,329	5,423	9,199	10,579	1.0%	
DXR4_TS_N	R02	2.3	1,762	5,329	5,434	8,778	10,095	1.2%	
DXR4_TS_N	R03	10.0	7,686	5,329	5,336	4,753	5,466	0.1%	
DXR4_TS_N	R04	12.7	9,725	5,329	5,321	2,957	3,401	-0.3%	
DXR4_TS_N	R05	15.2	11,657	5,329	5,295	3,830	4,404	-0.9%	
DXR4_TS_N	T01	25.7	19,679	5,329	5,349	6,551	7,534	0.3%	
DXR4_TS_N	T02	85.8	65,757	5,329	5,233	3,278	3,769	-2.9%	
DXR4_TS_N	T03	42.1	32,255	5,329	5,294	3,050	3,508	-1.1%	
	TOTAL	418	320,585		Weighted Average		5,205	-0.5%	

Total yards and acres go to Worksheet 3

Assumptions:

5.7 inches of topsoil to be replaced in Area 4N

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-14
AREA 1 BOND RECLAMATION MITIGATION MATERIAL MOVEMENT - Trucks

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Doby #13 Stockpile	M1	147.6	15,599	5,350	5,343	13,541	15,000	0.0%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M2	16.0	1,696	5,350	5,394	13,357	15,000	0.3%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M3	9.5	1,002	5,350	5,377	13,602	19,000	0.1%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M4	20.5	2,166	5,350	5,380	10,926	19,000	0.2%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M5	15.1	1,591	5,350	5,436	8,805	9,100	0.9%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M6	44.8	4,734	5,350	5,411	7,000	15,000	0.4%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M7	169.7	17,938	5,350	5,395	4,747	5,000	0.9%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M8	3.8	400	5,350	5,330	4,073	4,200	-0.5%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M9	44.2	4,669	5,350	5,482	1,473	1,600	8.3%	Adj. Dist. reflects haul route
Doby #13 Stockpile	M10	1.5	160	5,350	5,370	13,408	19,000	0.1%	Adj. Dist. reflects haul route
	TOTAL	**473**	**49,955**			**Weighted Average**	**10,149**	**1.2%**	

Total yards go to Worksheet No. 3

Assumptions:

2% of all reclaim acres require mitigation

4 feet total of mitigation material and topsoil

8.7 inches of topsoil to be replaced in Area 1

TABLE 12-B-15

AREA 2 BOND RECLAMATION MITIGATION MATERIAL MOVEMENT - Trucks

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Barber	D 01	14.3	1,629	5,414	5,414	13,036	15,700	0.0%	
Barber	T 01	18.5	2,106	5,414	5,283	11,375	13,700	-1.2%	
Barber	D 02	14.6	1,670	5,414	5,423	11,500	13,900	0.1%	
Barber	P 01	91.4	10,420	5,414	5,320	11,106	13,400	-0.8%	
Barber	T 02	19.8	2,253	5,414	5,301	6,586	8,000	-1.7%	
Barber	T 03	7.7	883	5,414	5,410	4,752	5,800	-0.1%	
Barber	T 04	44.6	5,084	5,414	5,333	3,596	4,400	-2.3%	
Barber	D 03	2.9	326	5,414	5,394	2,878	3,500	-0.7%	
Barber	P 02	119.3	13,604	5,414	5,314	5,403	6,500	-1.9%	
Barber	D 04	17.6	2,011	5,414	5,381	2,745	3,300	-1.2%	
Barber	R 01	35.0	3,989	5,414	5,339	2,597	3,200	-2.9%	
Hosteen	T 08	32.6	3,719	5,444	5,403	3,108	3,800	-1.3%	
Hosteen	T 09	44.3	5,045	5,444	5,391	2,728	3,300	-2.0%	
Hosteen	P 05	11.9	1,359	5,444	5,440	2,893	3,500	-0.1%	
Hosteen	D 11	30.3	3,458	5,444	5,378	3,090	3,800	-2.1%	
Hosteen	R 03	55.8	6,360	5,444	5,347	3,808	4,600	-2.6%	
Hosteen	D 12	11.0	1,259	5,444	5,311	3,841	4,700	-3.5%	
Hosteen	D 14	20.5	2,341	5,444	5,316	5,121	6,200	-2.5%	
Hosteen	R 04	48.2	5,500	5,444	5,352	4,722	5,700	-1.9%	
Hosteen	D 15	15.8	1,801	5,444	5,317	5,585	6,800	-2.3%	
Hosteen	R 05	63.5	7,235	5,444	5,457	5,712	6,900	0.2%	
Hosteen	HOS TRI	38.9	4,430	5,444	5,321	3,795	4,600	-3.2%	
Hosteen	D 13	18.2	2,079	5,444	5,329	4,875	5,900	-2.4%	
Hosteen	T 11	21.4	2,442	5,444	5,384	6,284	7,600	-1.0%	
Hosteen	T 10	30.3	3,459	5,444	5,386	6,053	7,300	-1.0%	
Hosteen	P 06	20.7	2,360	5,444	5,502	4,457	5,400	1.3%	
Hosteen	D 16	10.6	1,209	5,444	5,323	6,874	8,300	-1.8%	
Hosteen	D 17	6.6	748	5,444	5,344	6,846	8,300	-1.5%	
Hosteen	R 06	41.1	4,691	5,444	5,352	7,020	8,500	-1.3%	
Hosteen	BLUFF 02	64.2	7,320	5,444	5,422	5,904	7,100	-0.4%	
Hosteen	BLUFF 01	43.2	4,929	5,444	5,411	4,437	5,400	-0.8%	
Hosteen	TP 01	52.7	6,009	5,444	5,270	10,317	12,400	-1.7%	
Hosteen	TP 02	38.7	4,408	5,444	5,330	10,703	12,900	-1.1%	
Hosteen	TP 03	50.2	5,718	5,444	5,290	6,702	8,100	-2.3%	
Hosteen	TP 04	48.9	5,575	5,444	5,375	5,187	6,300	-1.3%	
Hosteen	TP 05	54.8	6,244	5,444	5,296	6,246	7,500	-2.4%	
Barber	TP 06	5.4	613	5,414	5,370	5,276	6,400	-0.8%	
Barber	TP 07	31.2	3,562	5,414	5,360	3,837	4,700	-1.4%	
Hosteen	TP 08	7.2	826	5,444	5,370	2,636	3,200	-2.8%	
Barber	TP 09	69.5	7,919	5,414	5,300	6,121	7,400	-1.9%	
Barber	TP 10	30.3	3,459	5,414	5,320	5,318	6,400	-1.8%	
Barber	TP 11	27.1	3,084	5,414	5,390	9,086	11,000	-0.3%	
Barber	TP 12	3.2	368	5,414	5,400	4,607	5,600	-0.3%	
Barber	TP 13	19.0	2,168	5,414	5,380	5,026	6,100	-0.7%	
Barber	TP 14	54.6	6,227	5,414	5,400	6,963	8,400	-0.2%	
Barber	TP 15	15.6	1,778	5,414	5,440	6,330	7,600	0.4%	
Barber	TP 16	20.2	2,300	5,414	5,440	10,839	13,100	0.2%	
Barber	TP 17	53.1	6,054	5,414	5,340	9,798	11,800	-0.8%	
Barber	TP 18	63.0	7,179	5,414	5,410	13,092	15,800	0.0%	
Barber	TP 19	8.9	1,018	5,414	5,424	12,725	15,300	0.1%	
Barber	TP 20	16.9	1,930	5,414	5,445	14,950	18,000	0.2%	
Barber	TP 21	20.8	2,375	5,414	5,455	10,903	13,100	0.4%	
Barber	TP 22	37.9	4,326	5,414	5,460	9,870	11,900	0.5%	
Barber	TP 23	10.2	1,165	5,414	5,495	10,549	12,700	0.8%	
Hosteen	TP 24	8.5	970	5,444	5,300	6,445	7,800	-2.2%	
	TOTAL	**1,763**	**200,994**			**Weighted Average**	**8,142**	**-1.2%**	

Total yards and acres go to Worksheet 3

Assumptions:

2% of all reclaim acres require mitigation

4 feet total of mitigation and topsoil

5.8 inches of topsoil to be replaced in Area 2

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodate haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-16
AREA 3 BOND RECLAMATION MITIGATION MATERIAL MOVEMENT - Trucks

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd³]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
LWR1_RG_N	D-01	9.7	1,003	5,298	5,362	3,577	4,292	1.5%	
LWR1_RG_N	D-02	9.7	996	5,298	5,301	5,042	6,051	0.1%	
LWR1_RG_N	D-03	11.7	1,203	5,298	5,368	6,605	7,926	0.9%	
LWR1_RG_N	D-04	6.4	661	5,298	5,378	7,061	8,473	1.0%	
LWR1_RG_N	D-05	42.9	4,417	5,298	5,349	5,361	6,433	0.8%	
LWR4_RG_N	D-06	44.7	4,600	5,424	5,355	3,934	4,721	-1.5%	
LWR4_RG_N	D-07	2.7	277	5,424	5,367	5,865	7,038	-0.8%	
LWR4_RG_N	D-08	5.4	559	5,424	5,358	5,669	6,803	-1.0%	
LWR4_RG_N	D-09	21.7	2,235	5,424	5,341	2,884	3,461	-2.4%	
LWR4_RG_N	D-10	20.1	2,074	5,424	5,359	4,507	5,408	-1.2%	
LWR4_RG_N	D-11	32.9	3,391	5,424	5,353	5,109	6,131	-1.2%	
LWR4_RG_N	D-12	26.9	2,766	5,424	5,291	9,100	10,920	-1.2%	
DXR1_RG_W	D-13	19.0	1,959	5,412	5,298	8,229	9,875	-1.2%	
DXR1_RG_W	D-14	22.6	2,326	5,412	5,280	8,566	10,279	-1.3%	
DXR1_RG_W	D-15	18.8	1,934	5,412	5,281	9,997	11,996	-1.1%	
DXR1_RG_W	D-16	15.1	1,551	5,412	5,279	9,480	11,376	-1.2%	
DXR1_RG_W	DX-PS	276.7	28,499	5,412	5,376	11,348	13,618	-0.3%	
LWR4_RG_N	F-01	8.6	891	5,424	5,356	5,803	6,964	-1.0%	
LWR4_RG_N	F-02	47.4	4,880	5,424	5,361	5,121	6,145	-1.0%	
LWR4_RG_N	F-03	93.3	9,608	5,424	5,370	6,630	7,956	-0.7%	
DXR1_RG_W	F-04	58.8	6,052	5,412	5,355	7,943	9,532	-0.6%	
LWR4_RG_N	P-01	95.7	9,855	5,424	5,232	6,429	7,714	-2.5%	
LWR4_RG_N	P-02	20.2	2,081	5,424	5,377	6,578	7,894	-0.6%	
LWR4_RG_N	P-03	28.2	2,901	5,424	5,385	8,089	9,707	-0.4%	
DXR1_RG_W	P-04	82.6	8,511	5,412	5,337	10,029	12,035	-0.6%	
LWR1_RG_N	R-01	25.8	2,655	5,298	5,366	3,843	4,612	1.5%	
LWR1_RG_N	R-02	36.7	3,775	5,298	5,384	5,949	7,139	1.2%	
LWR1_RG_N	R-03	59.3	6,103	5,298	5,390	5,550	6,659	1.4%	
LWR4_RG_N	R-04	107.5	11,075	5,424	5,295	3,601	4,322	-3.0%	
LWR4_RG_N	R-05	53.6	5,521	5,424	5,342	6,288	7,546	-1.1%	
DXR1_RG_W	R-06	27.5	2,833	5,412	5,265	7,623	9,148	-1.6%	
DXR1_RG_W	R-07	112.3	11,560	5,412	5,272	8,603	10,324	-1.4%	
LWR1_RG_N	S-02	25.3	2,609	5,298	5,357	5,461	6,553	0.9%	
LWR1_RG_N	S-03	4.2	431	5,298	5,366	6,631	7,957	0.9%	
LWR4_RG_N	S-05	67.9	8,992	5,424	5,372	3,905	4,686	-1.1%	
LWR4_RG_N	S-06	147.7	15,207	5,424	4,904	4,344	5,212	-10.0%	
DXR1_RG_W	S-07	32.3	3,323	5,412	5,340	6,570	7,884	-0.9%	
DXR1_RG_W	S-08	13.1	1,354	5,412	5,312	7,829	9,395	-1.1%	
DXR1_RG_W	S-09	85.9	8,845	5,412	5,270	7,066	8,479	-1.7%	
DXR1_RG_W	S-10	74.8	7,704	5,412	5,283	8,966	10,759	-1.2%	
LWR1_RG_N	TP-01	5.8	593	5,298	5,406	7,154	8,585	1.3%	
LWR1_RG_N	TP-02	38.7	3,982	5,298	5,410	6,000	7,200	1.6%	
LWR1_RG_N	TP-03	67.4	6,940	5,298	5,470	3,110	3,731	4.6%	
LWR1_RG_N	TP-06	27.4	2,823	5,298	5,351	2,733	3,279	1.6%	
LWR1_RG_N	TP-07	2.7	274	5,298	5,326	2,605	3,126	0.9%	
LWR1_RG_N	TP-08	21.1	2,172	5,298	5,308	3,604	4,324	0.2%	
LWR1_RG_N	TP-09	29.4	3,031	5,298	5,393	4,658	5,590	1.7%	
LWR1_RG_N	TP-10	309.4	31,859	5,298	5,341	5,063	6,075	0.7%	
LWR1_RG_N	TP-11	50.7	5,226	5,298	5,389	7,663	9,195	1.0%	
LWR1_RG_N	TP-12	88.3	9,097	5,298	5,371	7,063	8,476	0.9%	
DXR1_RG_W	TP-13	44.2	4,550	5,412	5,352	4,033	4,840	-1.2%	
DXR1_RG_W	TP-14	21.7	2,232	5,412	5,360	3,107	3,729	-1.4%	
DXR1_RG_W	TP-17	117.0	12,048	5,412	5,340	5,131	6,158	-1.2%	
DXR1_RG_W	TP-19	39.8	4,104	5,412	5,264	5,612	6,734	-2.2%	
DXR1_RG_W	TP-20	3.7	386	5,412	5,285	10,072	12,086	-1.1%	
	TOTAL	2,762.8	284,534			Weighted Average	7,776	-0.9%	

Total yards and acres go to Worksheet 3
Assumptions:
- 2% of all reclaim acres require mitigation
- 4 feet total of mitigation and topsoil
- 9.7 inches of topsoil to be replaced in Area III
- Centroid distance is measured from the stockpile centroid to the reclaim centroid
- Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-16a

AREA 4N BOND RECLAMATION MITIGATION MATERIAL MOVEMENT - Trucks

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
DXR1_RG_W	D01	0.09	486	5,412	5,428	9,169	10,545	0.2%	
DXR1_RG_W	D02	0.09	508	5,412	5,313	8,673	9,974	-1.1%	
DXR1_RG_W	D03	0.51	2,912	5,412	5,447	7,719	8,877	0.5%	
DXR1_RG_W	D04	0.13	742	5,412	5,329	6,631	7,625	-1.3%	
DXR1_RG_W	D05	0.17	962	5,412	5,355	6,542	7,524	-0.9%	
DXR1_RG_W	D06	0.29	1,658	5,412	5,366	7,305	8,401	-0.6%	
DXR1_RG_W	D07	0.36	2,024	5,412	5,367	6,768	7,784	-0.7%	
DXR1_RG_W	D08	0.37	2,107	5,412	5,314	7,139	8,210	-1.4%	
DXR1_RG_W	D09	0.17	945	5,412	5,336	8,475	9,746	-0.9%	
DXR1_RG_W	D10	0.24	1,387	5,412	5,315	8,392	9,651	-1.2%	
DXR1_RG_W	P01	0.70	3,990	5,412	5,267	8,059	9,268	-1.8%	
DXR1_RG_W	P02	0.71	4,053	5,412	5,383	7,623	8,767	-0.4%	
DXR1_RG_W	P03	0.59	3,364	5,412	5,340	8,904	10,240	-0.8%	
DXR1_RG_W	R01	0.07	400	5,412	5,423	9,433	10,848	0.1%	
DXR1_RG_W	R02	0.05	261	5,412	5,434	9,004	10,354	0.2%	
DXR1_RG_W	R03	0.20	1,141	5,412	5,336	6,597	7,587	-1.2%	
DXR1_RG_W	R04	0.25	1,443	5,412	5,321	6,971	8,017	-1.3%	
DXR1_RG_W	R05	0.30	1,730	5,412	5,295	8,287	9,530	-1.4%	
DXR1_RG_W	T01	0.51	2,921	5,412	5,349	7,349	8,452	-0.9%	
DXR1_RG_W	T02	1.72	9,760	5,412	5,233	6,352	7,305	-2.8%	
DXR1_RG_W	T03	0.84	4,787	5,412	5,294	7,381	8,488	-1.6%	
	TOTAL	**8.4**	**47,582**			**Weighted Average**	**8,530**	**-1.3%**	

Total yards and acres go to Worksheet 3

Assumptions:

2% of all reclaim acres require mitigation

4 feet total of mitigation and topsoil

5.7 inches of topsoil to be replaced in Area 4N

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodated haulage routes

TABLE 12-B-17

AREA 2 BOND REGRADE EARTHMOVING - Scrapers

Cut Block	Fill Block	Total Volume [yd3]	Permanent Program %	Permanent Volume [yd3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
D 01	D 01	5,271	100%	5,271	5,407	5,414	-	1,000	0.7%	Internal
D 02	D 02	3,016	100%	3,016	5,423	5,423	-	1,000	0.0%	Internal
D 03	D 03	64	100%	64	5,400	5,394	-	1,000	-0.6%	Internal
D 04	D 04	1,360	100%	1,360	5,384	5,381	-	1,000	-0.4%	Internal
D 05	D 05	665	100%	665	5,417	5,418	-	1,000	0.1%	Internal
D 06	D 06	3,600	100%	3,600	5,410	5,383	-	1,000	-2.8%	Internal
D 07	D 07	26,247	100%	26,247	5,470	5,376	-	1,000	-6.0%	Internal
D 09	D 09	339,806	100%	339,806	5,363	5,354	-	1,000	-0.9%	Internal
D 10	D 10	194,834	100%	194,834	5,405	5,382	-	1,000	-2.3%	Internal
D 11	D 11	11,828	100%	11,828	5,353	5,378	-	1,000	2.5%	Internal
D 12	D 12	35,546	100%	35,548	5,299	5,311	-	1,000	1.2%	Internal
D 13	D 13	50,821	100%	50,821	5,240	5,329	-	1,000	6.0%	Internal
D 14	D 14	37,860	100%	37,860	5,318	5,316	-	1,000	-0.2%	Internal
D 15	D 15	3,728	100%	3,728	5,342	5,317	-	1,000	-2.4%	Internal
D 16	D 16	6,264	100%	6,264	5,288	5,323	-	1,000	3.5%	Internal
D 17	D 17	17,582	100%	17,582	5,356	5,344	-	1,000	-1.2%	Internal
P 01	P 01	168,540	100%	166,540	5,296	5,320	-	1,000	2.4%	Internal
P 02	P 02	999,036	100%	999,036	5,308	5,314	-	1,000	0.5%	Internal
P 03	P 03	1,202,815	100%	1,202,815	5,347	5,371	-	1,000	2.4%	Internal
P 04	P 04	159,807	100%	159,807	5,482	5,439	-	1,000	-4.2%	Internal
P 05	P 05	28,875	100%	28,875	5,430	5,440	-	1,000	1.0%	Internal
P 06	P 06	26,325	100%	28,325	5,485	5,502	-	1,000	1.7%	Internal
R 01	R 01	137,275	100%	137,275	5,263	5,339	-	1,000	6.0%	Internal
R 02	R 02	464,836	100%	464,836	5,405	5,331	-	1,000	-6.0%	Internal
R 03	R 03	88,754	100%	88,754	5,316	5,347	-	1,000	3.1%	Internal
R 04	R 04	39,630	100%	39,630	5,351	5,352	-	1,000	0.1%	Internal
R 05	R 05	460,066	100%	460,066	5,367	5,457	-	1,000	6.0%	Internal
R 06	R 06	84,881	100%	84,881	5,397	5,352	-	1,000	-4.5%	Internal
T 01	T 01	7,443	100%	7,443	5,309	5,283	-	1,000	-2.6%	Internal
T 02	T 02	100	100%	100	5,410	5,301	-	1,000	-6.0%	Internal
T 03	T 03	1,188	100%	1,188	5,319	5,410	-	1,000	6.0%	Internal
T 04	T 04	118,259	100%	118,259	5,427	5,333	-	1,000	-6.0%	Internal
T 05	T 05	34,302	100%	34,302	5,448	5,447	-	1,000	-0.1%	Internal
T 06	T 06	115,572	100%	115,572	5,387	5,439	-	1,000	5.2%	Internal
T 07	T 07	139,137	100%	139,137	5,396	5,383	-	1,000	-1.4%	Internal
T 08	T 08	71,965	100%	71,965	5,415	5,403	-	1,000	-1.2%	Internal
T 09	T 09	86,752	100%	86,752	5,429	5,391	-	1,000	-3.8%	Internal
T 10	T 10	22,933	100%	22,933	5,411	5,386	-	1,000	-2.5%	Internal
HOS BLUFF 01	HOS BLUFF 01	144,574	100%	144,574	5,386	5,411	-	1,000	2.5%	Internal
HOS BLUFF 02	HOS BLUFF 02	31,297	100%	31,297	5,321	5,422	-	1,000	6.0%	Internal
HOS TRI	HOS TRI	164,202	100%	164,202	5,530	5,321	-	1,000	-6.0%	Internal
T 01	P 01	426,001	100%	426,001	5,309	5,320	524	700	2.0%	External
T 11	R 06	1,613,512	100%	1,613,512	5,422	5,352	1,133	1,400	-6.0%	External
T 10	R 06	128,896	100%	128,896	5,411	5,352	996	1,200	-5.9%	External
T 10	P 06	1,320,760	100%	1,320,760	5,411	5,502	1,666	2,000	5.4%	External
T 10	HOS TRI	220,738	100%	220,738	5,411	5,321	2,456	3,000	-3.7%	External
T 08	R 03	579,643	100%	579,643	5,415	5,347	1,218	1,500	-5.6%	External
T 09	R 03	1,282,473	100%	1,282,473	5,429	5,347	1,283	1,600	-6.0%	External
R 04	R 03	2,520,678	100%	2,520,678	5,351	5,347	1,995	2,400	-0.2%	External
R 04	HOS BLUFF 01	1,357,192	100%	1,357,192	5,351	5,411	1,289	1,600	4.6%	External
D 14	HOS BLUFF 01	955,508	100%	955,508	5,318	5,411	1,914	2,300	4.8%	External
HOS BLUFF 02	HOS BLUFF 01	734,128	100%	734,128	5,321	5,411	1,506	1,900	6.0%	External
D 11	HOS BLUFF 01	45,048	100%	45,048	5,353	5,411	1,421	1,800	4.1%	External
D 12	HOS BLUFF 01	16,400	100%	16,400	5,299	5,411	1,920	2,400	5.8%	External
Overlook PS	HOS BLUFF 01	151,352	100%	151,352	5,386	5,411	-	1,000	2.5%	**See comment in 12-B-9
	TOTAL	16,736,035		16,736,035			Weighted Average	1,578	0.2%	

Total yards go to Worksheet 3

Assumptions: Distance is adjusted to accomodate haulage routes

TABLE 12-B-18
AREA 3 BOND REGRADE EARTHMOVING - Scrapers

Cut Block	Fill Block	Total Volume	Permanent	Permanent	Cut Elevation	Fill Elevation	Centroid	Adjusted	Grade	Comments
D-01	D-01	9,377	100%	9,377	5,381	5,382	-	1,000	0.1%	Internal
D-02	D-02	1,386	100%	1,386	5,400	5,301	-	1,000	-8.0%	Internal
D-04	D-04	975	100%	975	5,394	5,378	-	1,000	-1.5%	Internal
D-05	D-05	13,264	100%	13,264	5,335	5,349	-	1,000	1.4%	Internal
D-06	D-06	9,808	100%	9,808	5,374	5,355	-	1,000	-1.9%	Internal
D-07	D-07	4,543	100%	4,543	5,339	5,367	-	1,000	2.8%	Internal
D-08	D-08	636	100%	636	5,383	5,358	-	1,000	-0.5%	Internal
D-09	D-09	269	100%	269	5,332	5,341	-	1,000	0.9%	Internal
D-10	D-10	9,725	100%	9,725	5,371	5,359	-	1,000	-1.3%	Internal
D-11	D-11	8,339	100%	8,339	5,349	5,353	-	1,000	0.4%	Internal
D-12	D-12	2,505	100%	2,505	5,202	5,291	-	1,000	6.0%	Internal
D-13	D-13	929	100%	929	5,348	5,298	-	1,000	-5.0%	Internal
D-14	D-14	2,303	100%	2,303	5,305	5,280	-	1,000	-2.5%	Internal
D-15	D-15	43	100%	43	5,328	5,281	-	1,000	-4.6%	Internal
D-16	D-16	20	100%	20	5,328	5,279	-	1,000	-4.8%	Internal
DX-PS	DX-PS	2,123,119	100%	2,123,119	5,378	5,376	-	1,000	-0.2%	Internal
F-01	F-01	720	100%	720	5,384	5,356	-	1,000	-2.8%	Internal
F-02	F-02	111,735	100%	111,735	5,375	5,361	-	1,000	-1.4%	Internal
F-03	F-03	541,089	100%	541,089	5,300	5,370	-	1,000	8.0%	Internal
F-04	F-04	277,790	100%	277,790	5,413	5,355	-	1,000	-5.8%	Internal
P-02	P-02	336	100%	336	5,314	5,377	-	1,000	6.0%	Internal
P-03	P-03	10,388	100%	10,388	5,274	5,385	-	1,000	8.0%	Internal
P-04	P-04	110,081	100%	110,081	5,222	5,337	-	1,000	8.0%	Internal
R-01	R-01	372	100%	372	5,374	5,388	-	1,000	-0.9%	Internal
R-02	R-02	10,843	100%	10,843	5,381	5,384	-	1,000	0.3%	Internal
R-03	R-03	3,779	100%	3,779	5,278	5,390	-	1,000	6.0%	Internal
R-04	R-04	149,182	100%	149,182	5,565	5,295	-	1,000	-6.0%	Internal
R-05	R-05	11,899	100%	11,899	5,459	5,342	-	1,000	-8.0%	Internal
R-06	R-06	87,362	100%	87,362	5,362	5,265	-	1,000	-8.0%	Internal
R-07	R-07	123,944	100%	123,944	5,309	5,272	-	1,000	-3.7%	Internal
S-05	S-05	16,234	100%	16,234	5,390	5,372	-	1,000	-1.7%	Internal
S-06	S-06	2,361	100%	2,361	5,627	4,904	-	1,000	-6.0%	Internal
S-07	S-07	38,685	100%	38,685	5,328	5,340	-	1,000	1.2%	Internal
S-08	S-08	1,009	100%	1,009	5,245	5,312	-	1,000	8.0%	Internal
S-09	S-09	101,653	100%	101,653	5,299	5,270	-	1,000	-3.0%	Internal
S-10	S-10	96	100%	96	5,332	5,283	-	1,000	-4.8%	Internal
TP-01	TP-01	4,225	100%	4,225	5,401	5,433	-	1,000	3.2%	Internal
TP-02	TP-02	55,490	100%	55,490	5,382	5,395	-	1,000	1.3%	Internal
TP-03	TP-03	274,328	100%	274,328	5,452	5,453	-	1,000	0.1%	Internal
TP-04	TP-04	1,317	100%	1,317	5,374	5,367	-	1,000	-0.7%	Internal
TP-06	TP-06	10,783	100%	10,783	5,368	5,363	-	1,000	-0.5%	Internal
TP-07	TP-07	309	100%	309	5,331	5,330	-	1,000	-0.1%	Internal
TP-08	TP-08	51,856	100%	51,856	5,300	5,302	-	1,000	0.2%	Internal
TP-09	TP-09	9,194	100%	9,194	5,420	5,441	-	1,000	2.1%	Internal
TP-10	TP-10	1,594,082	100%	1,594,082	5,374	5,328	-	1,000	-4.6%	Internal
TP-11	TP-11	16,732	100%	16,732	5,355	5,367	-	1,000	1.2%	Internal
TP-12	TP-12	82,252	100%	82,252	5,408	5,392	-	1,000	-1.6%	Internal
TP-13	TP-13	14,974	100%	14,974	5,350	5,344	-	1,000	-0.6%	Internal
TP-14	TP-14	44,698	100%	44,698	5,387	5,360	-	1,000	-2.7%	Internal
TP-15	TP-15	16,362	100%	16,362	5,458	5,456	-	1,000	-0.2%	Internal
TP-16	TP-16	7,395	100%	7,395	5,411	5,399	-	1,000	-1.2%	Internal
TP-18	TP-18	21,488	100%	21,488	5,332	5,333	-	1,000	0.1%	Internal
TP-19	TP-19	70,365	100%	70,365	5,288	5,290	-	1,000	0.2%	Internal
TP-20	TP-20	2,600	100%	2,600	5,298	5,290	-	1,000	-0.8%	Internal
F-01	P-01	393,224	100%	393,224	5,384	5,232	2,774	3,400	-5.5%	External
S-03	P-01	417,122	100%	417,122	5,371	5,232	1,958	2,400	-6.0%	External
TP-12	R-03	674,259	100%	674,259	5,408	5,390	2,402	2,900	-0.8%	External
S-05	P-01	3,487,695	100%	3,487,695	5,390	5,232	2,525	3,100	-6.0%	External
F-02	P-01	1,066,507	100%	1,066,507	5,375	5,232	1,513	1,900	-8.0%	External
TP-13	R-04	585,288	100%	585,288	5,350	5,295	2,562	3,100	-2.1%	External
S-06	R-04	5,219,714	100%	5,219,714	5,627	5,295	1,734	2,100	-8.0%	External
DX-PS	P-04	328,284	100%	326,284	5,378	5,337	1,337	1,700	-3.1%	External
TP-14	TP-18	26,388	100%	26,396	5,387	5,333	1,885	2,300	-2.9%	External
S-07	R-05	878,725	100%	878,725	5,328	5,342	1,249	1,500	1.1%	External
F-04	R-05	1,414,814	100%	1,414,814	5,413	5,342	1,724	2,100	-4.1%	External
S-10	P-04	5,284,278	100%	5,284,278	5,332	5,337	2,115	2,600	0.3%	External
S-10	R-07	3,041,316	100%	3,041,316	5,332	5,272	1,670	2,100	-3.6%	External
TP-20	R-07	53,983	100%	53,983	5,298	5,272	1,473	1,800	-1.8%	External
	TOTAL	28,912,821		28,912,821		Weighted Average		2,112	-3.1%	

Assumptions: Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-18a
AREA 3 BOND REGRADE EARTHMOVING - Scrapers

Cut Block	Fill Block	Total Volume [yd³]	Permanent Program %	Permanent Volume [yd³]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Inter-Block Scraper Yards										
D01	D01	16,945	100%	16,945	5,420	5,428	-	1,000	0.8%	Internal
D02	D02	10,952	100%	10,952	5,429	5,313	-	1,000	-6.0%	Internal
D03	D03	490,872	100%	490,872	5,398	5,447	-	1,000	4.9%	Internal
D04	D04	6,114	100%	6,114	5,310	5,329	-	1,000	1.8%	Internal
D05	D05	26,616	100%	26,616	5,333	5,355	-	1,000	2.2%	Internal
D06	D06	148,650	100%	148,650	5,331	5,366	-	1,000	3.5%	Internal
D07	D07	351,300	100%	351,300	5,269	5,367	-	1,000	6.0%	Internal
D08	D08	215,655	100%	215,655	5,283	5,314	-	1,000	3.2%	Internal
D09	D09	65,513	100%	65,513	5,352	5,336	-	1,000	-1.6%	Internal
D10	D10	8,071	100%	8,071	5,504	5,315	-	1,000	-6.0%	Internal
P02	P02	38	100%	38	5,364	5,383	-	1,000	1.9%	Internal
P03	P03	97	100%	97	5,282	5,340	-	1,000	5.7%	Internal
R01	R01	452	100%	452	5,423	5,423	-	1,000	0.0%	Internal
R02	R02	5,642	100%	5,642	5,341	5,434	-	1,000	6.0%	Internal
R03	R03	120,982	100%	120,982	5,355	5,336	-	1,000	-1.9%	Internal
R04	R04	5,636	100%	5,636	5,311	5,321	-	1,000	1.0%	Internal
R05	R05	54,949	100%	54,949	5,309	5,295	-	1,000	-1.4%	Internal
T01	T01	5,577	100%	5,577	5,383	5,349	-	1,000	-3.4%	Internal
T02	T02	244,809	100%	244,809	5,527	5,233	-	1,000	-6.0%	Internal
T03	T03	65,922	100%	65,922	5,453	5,294	-	1,000	-6.0%	Internal
D02	P01	457,565	100%	457,565	5,429	5,267	1,717	2,100	-6.0%	External
D05	P02	405,785	100%	405,785	5,333	5,383	1,670	2,100	3.0%	External
D10	P03	935,321	100%	935,321	5,504	5,340	858	3,000	-6.0%	External
T01	P01	2,573,627	100%	2,573,627	5,383	5,267	726	900	-6.0%	External
T02	P02	5,481,359	100%	5,481,359	5,527	5,383	1,338	1,700	-6.0%	External
T03	P03	3,895,164	100%	3,895,164	5,453	5,340	1,577	1,900	-6.0%	External
T03	R04	28,967	100%	28,967	5,453	5,321	922	3,000	-6.0%	External
	TOTAL	**15,622,580**		**15,622,580**			**Weighted Average**	**1,638**	**-4.8%**	

Assumptions: Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-19
AREA 1 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT - Scrapers

Cut Block	Fill Block	Area [acres]	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Airport #1	TP 1	8.5	9,919	5,350	5,350	2,000	2,300	0.0%	Adj. Distance Reflects Haul Route
	TOTAL	**8.5**	**9,919**			**Weighted Average**	**2,300**	**0.0%**	

Total yards and acres go to Worksheet 3

Assumptions:

8.7 inches of topsoil to be replaced in Area 1

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-20
AREA 2 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT- Scrapers

Cut Block	Fill Block	Area [acres]	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
									All topsoil handled by trucks.
	TOTAL	-	-			Weighted Average	-	0.0%	

Total yards and acres go to Worksheet 3

Assumptions:

5.6 inches of topsoil to be replaced in Area 2

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodate haulage routes

TABLE 12-B-21
AREA 3 BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT- Scrapers

Cut Block	Fill Block	Area [acres]	Topsoil Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
LWR4_TS_N	R-03	59.3	19,624	5,257	5,390	1,694	2,033	6.5%	
LWR4_TS_N	D-06	44.7	58,251	5,257	5,355	1,307	1,568	6.3%	
LWR4_TS_N	S-05	67.9	88,536	5,257	5,372	1,200	1,440	8.0%	
LWR4_TS_N	D-09	21.7	28,303	5,257	5,341	1,594	1,913	4.4%	
LWR4_TS_N	R-04	107.5	140,244	5,257	5,295	2,181	2,617	1.5%	
LWR2_TS_E	P-01	95.7	15,445	5,343	5,232	957	1,148	-9.7%	
LWR1_RG_N	TP-04	4.4	5,759	5,298	5,360	1,737	2,084	3.0%	Regolith Stockpile
LWR1_RG_N	TP-05	86.3	112,557	5,298	5,435	373	447	30.6%	Regolith Stockpile
LWR4_RG_N	TP-13	44.2	57,620	5,424	5,352	2,214	2,657	-2.7%	Regolith Stockpile
DXR1_RG_W	TP-18	27.3	35,547	5,412	5,330	2,249	2,699	-3.0%	Regolith Stockpile
	TOTAL	**500**	**542,262**			**Weighted Average**	**1,787**	**8.2%**	

Total yards and acres go to Worksheet 3

Assumptions:

9.7 inches of topsoil to be replaced in Area III

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodated haulage routes

Project: Navajo Mine
Date: May-2009

TABLE 12-B-22
AREA 3 BOND RECLAMATION MITIGATION MATERIAL MOVEMENT- Scrapers

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
LWR1_RG_N	TP-04	4.4	455	5,298	5,360	1,737	2,084	3.0%	
LWR1_RG_N	TP-05	86.3	8,888	5,298	5,435	373	447	30.6%	
DXR1_RG_W	TP-15	12.3	1,266	5,412	5,370	1,295	1,554	-2.7%	
DXR1_RG_W	TP-16	32.6	3,359	5,412	5,401	134	160	-6.9%	
DXR1_RG_W	TP-18	27.3	2,807	5,412	5,330	2,249	2,699	-3.0%	
	TOTAL	**162.9**	**16,776**			**Weighted Average**	**894**	**14.2%**	

Total yards and acres go to Worksheet 3
Assumptions:
2% of all reclaim acres require mitigation
4 feet total of mitigation and topsoil
9.7 inches of topsoil to be replaced in Area III
Centroid distance is measured from the stockpile centroid to the reclaim centroid
Distance is adjusted to accomodated haulage routes

TABLE 12-B-22a

AREA 2 BOND RECLAMATION MITIGATION MATERIAL MOVEMENT - Scrapers

Cut Block	Fill Block	Area [acres]	Mitigation Volume [yd^3]	Cut Elevation [ft]	Fill Elevation [ft]	Centroid Distance [ft]	Adjusted Distance [ft]	Grade [%]	Comments
Barber	D 05	10.7	1,217	5,414	5,418	1,871	2,300	0.2%	
Barber	D 06	31.2	3,557	5,414	5,383	702	900	-4.4%	
Barber	T 05	51.8	5,903	5,414	5,447	91	200	6.0%	
Barber	P 03	92.1	10,500	5,414	5,371	1,115	1,400	-3.8%	
Hosteen	D 07	24.4	2,780	5,444	5,376	1,835	2,300	-3.7%	
Hosteen	T 06	53.5	6,095	5,444	5,439	1,352	1,700	-0.4%	
Hosteen	D 08	5.7	648	5,444	5,330	1,838	2,300	-6.0%	
Hosteen	T 07	62.7	7,145	5,444	5,383	513	700	-6.0%	
Hosteen	P 04	40.8	4,653	5,444	5,439	2,147	2,600	-0.2%	
Hosteen	D 09	28.1	3,209	5,444	5,354	1,283	1,600	-6.0%	
Hosteen	D 10	35.2	4,009	5,444	5,382	1,977	2,400	-3.2%	
Hosteen	R 02	85.9	9,797	5,444	5,331	1,572	1,900	-6.0%	
	TOTAL	**522**	**59,513**			**Weighted Average**	**1,522**	**-2.9%**	

Total yards and acres go to Worksheet 3

Assumptions:

2% of all reclaim acres require mitigation

4 feet total of mitigation and topsoil

5.6 inches of topsoil to be replaced in Area 2

Centroid distance is measured from the stockpile centroid to the reclaim centroid

Distance is adjusted to accomodate haulage routes

TABLE 12-B-23

EQUIPMENT OWNERSHIP AND OPERATING COSTS

Equipment Model		Ownership Costs ($/hr)			Overhaul Costs ($/hr)				Field Repair and Fuel Costs ($/hr)												2009 Total ($/hr)
		Depreciation	Depreciation Multiplier	Adjusted Depreciation	Labor	Labor Multiplier	Adjusted Labor	O/H Parts	Labor	Labor Multiplier	Adjusted Labor	Parts	Fuel	Fuel Multiplier	Adjusted Fuel	Lube	Tires	Tire Multiplier	Adjusted Tires	GEC (2)	
D9R Dozer	Semi-U Blade	$ 25.29	0.83	$ 21.08	$ 8.70	0.84	$ 7.29	$ 21.10	$ 10.18	0.84	$ 8.53	$ 20.55	$ 56.86	0.56	$ 31.65	$ 10.31	$ -	1.00	$ -	$ 3.09	$ 156.08
D10R Dozer	Semi-U Blade	$ 34.24	0.83	$ 28.53	$ 8.70	0.84	$ 7.29	$ 28.27	$ 10.18	0.84	$ 8.53	$ 27.53	$ 79.56	0.56	$ 44.29	$ 14.15	$ -	1.00	$ -	$ 4.14	$ 182.73
D11R Dozer	U Blade	$ 67.81	0.83	$ 56.59	$ 8.70	0.84	$ 7.29	$ 51.61	$ 10.18	0.84	$ 8.53	$ 50.26	$ 117.81	0.56	$ 65.58	$ 24.07	$ -	1.00	$ -	$ 8.22	$ 272.15
637G Scraper		$ 39.27	0.83	$ 32.73	$ 12.72	0.84	$ 10.65	$ 27.49	$ 19.09	0.84	$ 15.99	$ 27.09	$ 117.83	0.56	$ 65.60	$ 21.09	$ 6.48	1.00	$ 6.48	$ 1.18	$ 208.89
992G Loader		$ 83.57	0.83	$ 69.64	$ 5.30	0.84	$ 4.44	$ 17.83	$ 6.47	0.84	$ 5.42	$ 18.45	$ 100.24	0.56	$ 55.80	$ 21.04	$ 27.90	1.00	$ 27.90	$ 2.66	$ 223.97
777D Truck		$ 42.09	0.83	$ 35.08	$ 19.51	0.84	$ 16.34	$ 15.22	$ 11.98	0.84	$ 10.04	$ 9.39	$ 74.29	0.56	$ 41.36	$ 15.25	$ 14.32	1.00	$ 14.32	$ -	$ 158.99
16H Grader		$ 23.31	0.83	$ 19.43	$ 3.82	0.84	$ 3.20	$ 11.06	$ 3.18	0.84	$ 2.66	$ 10.72	$ 36.12	0.56	$ 20.11	$ 7.39	$ 6.82	1.00	$ 6.82	$ 0.86	$ 82.17
Water Truck	10,000 gal	$ 30.57	0.83	$ 25.48	$ 7.00	0.84	$ 5.86	$ 8.14	$ 16.97	0.84	$ 14.21	$ 11.85	$ 60.77	0.56	$ 33.83	$ 9.93	$ 10.03	1.00	$ 10.03	$ -	$ 117.33
Small Backhoe	Cat 446B	$ 5.92	0.83	$ 4.93	$ 2.65	0.84	$ 2.22	$ 2.50	$ 3.50	0.84	$ 2.93	$ 2.21	$ 15.71	0.56	$ 8.75	$ 2.46	$ 1.76	1.00	$ 1.76	$ 0.27	$ 28.03
Grader Ripper		$ 2.11	0.83	$ 1.76	$ 0.04	0.84	$ 0.03	$ 0.88	$ 0.85	0.84	$ 0.71	$ 0.97	$ -	0.56	$ -	$ 0.16	$ -	1.00	$ -	$ 0.81	$ 5.12
16H Grader, ripping		$ 25.42	0.83	$ 21.18	$ 3.86	0.84	$ 3.23	$ 11.71	$ 4.03	0.84	$ 3.38	$ 11.89	$ 36.12	0.56	$ 20.11	$ 7.46	$ 6.82	1.00	$ 6.82	$ 1.89	$ 87.29
Pickup Truck	1 ton 4x4	$ 3.36	0.83	$ 2.80	$ 0.64	0.84	$ 0.54	$ 0.73	$ 0.81	0.84	$ 0.68	$ 0.70	$ 19.27	0.56	$ 10.73	$ 2.13	$ 0.54	1.00	$ 0.54	$ -	$ 18.84
Mechanic truck	1.75 ton 4x4	$ 4.73	0.83	$ 3.94	$ 0.64	0.84	$ 0.54	$ 1.02	$ 0.81	0.84	$ 0.68	$ 0.99	$ 17.11	0.56	$ 9.53	$ 2.00	$ 0.76	1.00	$ 0.76	$ -	$ 19.45
DMM2 Drill		$ 42.48	0.83	$ 35.40	$ 43.74	0.84	$ 36.64	$ 23.44	$ 81.87	0.84	$ 68.41	$ 40.84	$ 104.39	0.56	$ 58.11	$ 17.86	$ -	1.00	$ -	$ 4.08	$ 284.78

The Total $/hr are used in Worksheet 13

1) CRG - PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 1st Half 2009 edition.

2) GEC - Ground Engaging Components

Multipliers are calculated as follows:

Depreciation:	Assume two shifts per day		
	Assume 90% availability on all equipment		0.83
Labor - Heavy Equipment Mechanic: Field Repair and Fuel Costs			
((0.08)(CRG Wages) + Local Wages) / CRG Wages			
	CFG Wages	$42.50 /hr	
	Local Wages	$32.20 /hr	
			0.84
Parts:	No adjustment		1
Fuel (Diesel):	CFG Cost	$3.68 /gal	
	Local Cost	$2.18 /gal	
	Fuel Multiplier		0.56
Lube:	No adjustment		1
Tires:	No adjustment		1
GEC:	No adjustment		1
Inflation:			7.0%

TABLE 12-B-24
EQUIPMENT OPERATOR WAGE RATES

Equipment Operator	Operator Rates [$/hr][1]
D9R Dozer	$32.20
D10R Dozer	$32.20
D11R Dozer	$32.20
16H Grader	$32.20
637G Scraper	$32.20
992G Loader	$32.20
777D Truck	$32.20
Water Truck	$32.20
Tractor	$32.20
Track Hoe	$32.20
Small Backhoe	$32.20
Small Dumptruck	$32.20
Drill Operator	$32.20
Blast Laborer	$32.20
Blast Foremen	$32.20
Pickup Truck	$20.27

1) Labor Rates including burden, excluding Profit&Overhead, from ACME Inc. contract in force for 2008.

TABLE 12-B-25 DRILL AND BLAST QUANTITIES			
Area	Volume [yd^3]	Equipment	Comments
Area 2	44,889	Ingersoll-Rand DM22	rilling and Blasting Area 2 pit highwalls - Hosteen Triangle
Area 3	3,342,325	Ingersoll-Rand DM22	Drilling and Blasting Area 3 pit highwalls - Dixon Prestrip
Total	**3,387,214**		

TABLE 12-B-26
BOND EQUIPMENT AVAILABILITIES

EQUIPMENT	AVERAGE AVAILABILITY
Front-End Loaders	90.0%
Haul Trucks	90.0%
Dozers	90.0%
Scrapers	90.0%
Drills	90.0%
Motor Graders	90.0%

APPENDIX 12-C

TOPOGRAPHY CHANNEL STABILIZATION
FOR BOND RECLAMATION
BOND SCENARIO 2014

BHP Navajo Coal Company

Navajo Mine

Fruitland, New Mexico

April 2009

TOPOGRAPHY CHANNEL STABILIZATION
FOR BOND RECLAMATION
BOND SCENARIO 2014

Introduction

Protective lining requirements were developed for the stabilization of the drainage channels associated with Bond Reclamation Topography at the Navajo Mine. A cost estimate for the materials and installation is also provided for use in reclamation bond determination.

Hydrology and channel designs are based on procedures outlined in Reclamation Surface Stabilization Design Handbook for the Navajo Mine (Navajo Mine, 1992). Peak flow estimates were developed at 38 prediction points within the Area II, Area III and Area IV North mining areas (see EXHIBITS 12C-1, 12C-2, and 12-30B). Prediction Points 0 through 20 are located in Area II, 21 through 25 are located in Area III, and prediction points 26 through 31 are in Area IV North. The peak discharges were used to evaluate the channel stability at each prediction point. Protective lining requirements were developed based on channel slope, expected peak flow rates and channel dimensions. The cost estimates for materials and installation were developed using unit costs associated with recent placement of riprap and gabions at Navajo Mine.

Hydrology

Peak flow estimates were developed using the SEDCAD 4.0 computer model. The estimates are based on the 100 yr–6 hr storm event for intermittent and perennial streams (watersheds > 640 acres); and the 10 yr–6 hr storm event for ephemeral streams (watersheds < 640 acres). Each lined channel was designed to be stable and to safely pass the peak discharge during the applicable design storm event.

Watersheds were developed and measured from USGS topographic quad sheets and topography of the bond reclamation areas. Soil types and the associated hydrologic soil group classification for the undisturbed portions of the watersheds were taken from the San Juan County Soil Survey, Eastern Part (USDA-SCS, 1980). The watershed data for each prediction point is presented in TABLE A. The watershed areas are on a drawing in APPENDIX A.

Curve numbers for the undisturbed soils were taken from Table 11-16 in the Navajo Mine PAP. Curve numbers for the reclaimed areas were taken from Table 11-16B (Area II), Table 11-16C (Area III), and Table 11-16C (Area IV) in the Navajo Mine PAP.

Hydrologic curve numbers were developed as an aerially weighted average of the curve numbers for undisturbed and disturbed soils occurring within the watersheds.

The time of concentration (T_c) for each prediction point was determined by the Modified Kirpich method. The SEDCAD 4.0 hydrology data sheets are located in APPENDIX A.

Channel Proportioning

The prediction points were located at the drainages entering the reclaimed areas along the highwall and on channel slopes greater than 2% for watersheds within the reclaimed area. The main channels with slopes less than 2% will be constructed using an earth channel design. Channel slopes and lengths were measured from the bond reclamation topography.

The SEDCAD 4.0 computer model was used to proportion the channels and compute the riprap sizes. Channel side slopes of 3:1 were used in the designs. A minimum freeboard of 1.0 foot was used. FIGURE 1 shows a typical riprap/gabion channel section listing the hydraulic dimensions. The lengths of entrance and exit aprons were calculated as 5 times the exit channel flow depth with a minimum length of 15 feet. Riprap layer thickness was designed as 1.5 times the D_{50} of the riprap. A minimum riprap size of D_{50} equal to 0.5 feet was used. A filter fabric was utilized

in lieu of a graded sand and gravel filter beneath the riprap. Channel hydraulic dimensions for each prediction point is presented in TABLE B for Area II and TABLE C for Area III and Area IV North. The SEDCAD 4.0 channel proportioning sheets are located in APPENDIX A.

The availability of rock size greater than D_{50} equal to 9-inch is very limited in the local area. Therefore, if results from the hydraulic analysis specifies rip-rap size of D_{50} equal to 12-inch or greater, gabions filled with either D_{50} equal 4-inch or 6-inch rock will be used in lieu of the size specified. If a gabion structure is required the design of the structure is attach to the Sedcad output reports.

Cost Estimate

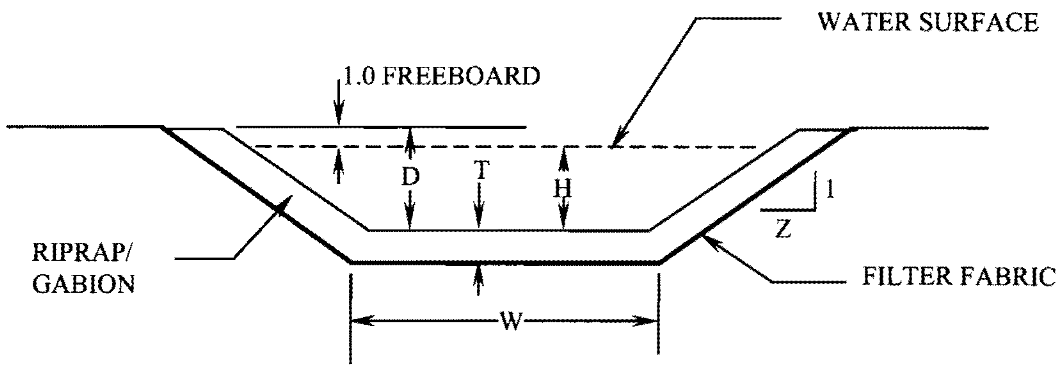
The riprap and gabion cost are based on the cost of material, labor, and equipment associated with recent riprap/gabion placement at the Navajo Mine.

Riprap/Gabion Cost

	Unit Cost ($/cu yd)
Riprap Material in place	67.85
Gabion installed	119.00

The cost for placing the filter fabric was developed by using the cost of geotextile fabric (200-lb tensile strength) from RS Means "Heavy Construction Cost Data – 2009".

The estimated material and installation costs for each reach of riprap or gabion lined channel are presented in TABLE D for Area II and TABLE E for Area III. Channel lengths include apron lengths.



D = Channel Depth

H = Flow Depth

T = Riprap/Gabion Layer Thickness

W = Channel Bottom Width

Z = Side Slope (Z:1)

FIGURE 1

TYPICAL CHANNEL SECTION

TABLE A
WATERSHED DATA

Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	Soil Classification, Hydrologic Soil Group, and Curve Number (CN)			
						Soil Type	% of Area	Hydrologic Gp.	CN
PP0	23.9	2,072.0	5,465	5,277	188	Ba	100	D	91
PP1	370.9	10,307.0	5,625	5,285	340	Ba	100	D	91
PP1A[(1)]	27,705.5	62,720.0	5,890	5,190	700	Refer to Appendix 11-BB			
PP2	8.6	1,002.0	5,403	5,280	123	Ba	100	D	91
PP3	14.0	1,299.0	5,435	5,318	117	Ba	100	D	91
PP3A	7.2	1,064.0	5,435	5,330	105	Ba	100	D	91
PP3B	64.5	3,542.0	5,530	5,320	210	Ba	100	D	91
PPBC	12.9	1,186.0	5,465	5,320	145	Ba	100	D	91
PP4	6.1	1,265.0	5,463	5,340	123	Ba	100	D	91
PP4A	9.7	1,555.0	5,473	5,340	133	Ba	100	D	91
PP4B	9.1	1,676.0	5,482	5,340	142	Ba	100	D	91
PP5	57.6	3,306.0	5,575	5,360	215	Ba	100	D	91
PP6	22.0	2,228.0	5,525	5,330	195	Ba	100	D	91
PP7	152.8	4,976.0	5,645	5,350	295	Ba	100	D	91
PP8	34.5	2,455.0	5,605	5,360	245	Ba	100	D	91
PP9	9.8	1,679.0	5,515	5,370	145	Ba	100	D	91
PP10	56.0	3,422.0	5,620	5,360	260	Ba	100	D	91
PP11	12.3	1,819.0	5,512	5,380	132	Ba	100	D	91
PP12	10.9	1,535.0	5,495	5,330	165	Ba	100	D	91
PP13	201.4	7,082.0	5,655	5,340	315	Ba	100	D	91
PP14	332.8	9,091.0	5,645	5,378	267	Ba	100	D	91
PP15	76.4	3,923.0	5,542	5,410	132	Ba	100	D	91
PP16	678.2	14,649.0	5,655	5,432	223	Ba	100	D	91
PP17	NOT REQUIRED - REMOVED								
PP18	117.3	4,222.0	5,465	5,320	145	Reclaimed	100	n/a	76
PP19	83.4	2,679	5,415	5,350	65	Reclaimed	100	n/a	76
PP20	1,525.0	15,255	5,642	5,310	332	Reclaimed/Ba	31/69	n/a	86.4

1. Refer to Appendix 11-BB, "Chinde Arroyo Post-mine Hydrology" at Structure 23.

TABLE A (Cont'd)
WATERSHED DATA

Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	Soil Classification, Hydrologic Soil Group, and Curve Number (CN): Soil Type (1)	% of Area	Hydrologic Gp. (2)	CN (3)
PP21	79.1	3,700	5,460	5,390	70		100	D	85
PP22	122.4	3,700	5,460	5,400	60		100	D	88
PP23	396.9	8,200	5,530	5,355	175		100	D	87
PP24	16.7	1,000	5,410	5,340	70		100	D	82
PP25	83.0	2,760	5,430	5,340	90		100	D	82
PP26	13.9	1554	5,399	5,326	73	Reclaimed			79.7
PP27	71.9	2230	5,409	5,289	120	Reclaimed			79.9
PP28	55.6	3040	5,428	5,280	148	Reclaimed			79.9
PP29	457.0	8590	5,447	5,282	165	Reclaimed			79.9
PP30	6.9	845	5,440	5,290	150	Reclaimed			79.9
PP31	11.5	1010	5,455	5,300	155	Reclaimed			79.9

TABLE B

AREA II CHANNEL HYDRAULIC DIMENSIONS

Prediction Point	Q_{10} (cfs) * Q_{25}	Slope (%)	Bottom Width (ft)	Side Slope (Z:1)	Flow Depth (ft)	D_{50} (ft)	Riprap/ Gabion Thickness (ft)
PP0	32.5	7.6	6.0	3.0	0.44	0.75	1.2
PP1(1)	187.8	9.0	8.0	3.0	1.15	0.50	1.0
PP1A(1)	2,023.6	3.1	50.0	3.0	2.28	0.33	0.5
PP2	11.7	13.0	6.0	3.0	0.17	0.50	0.8
PP3	19.1	10.3	6.0	3.0	0.27	0.50	0.8
PP3A	9.8	9.4	6.0	3.0	0.17	0.50	0.8
PP3B	54.7	8.6	6.0	3.0	0.43	0.50	0.8
PP3C	17.6	13.5	6.0	3.0	0.23	0.75	1.2
PP4	8.3	15.5	6.0	3.0	0.12	0.50	0.8
PP4A	13.2	15.2	6.0	3.0	0.17	0.75	1.2
PP4B	12.4	15.7	6.0	3.0	0.16	0.50	0.8
PP5	48.8	17.4	12.0	3.0	0.30	0.75	1.2
PP6	29.9	16.6	12.0	3.0	0.20	0.75	1.2
PP7(1)	124.4	16.8	12.0	3.0	0.64	0.50	1.0
PP8	47.0	14.9	12.0	3.0	0.31	0.75	1.2
PP9	13.3	15.6	6.0	3.0	0.17	0.75	1.2
PP10	76.2	14.6	12.0	3.0	0.46	0.75	1.2
PP11	16.7	14.7	6.0	3.0	0.21	0.75	1.2
PP12	9.2	13.7	6.0	3.0	0.14	0.50	0.8
PP13(1)	134.2	13.6	10.0	3.0	0.77	0.50	1.0
PP14	173.8	4.4	14.0	3.0	1.10	0.75	1.2
PP15	57.4	4.0	12.0	3.0	0.53	0.50	0.8
PP16(1)	378.1	2.2	10.0	3.0	2.10	0.33	0.5
PP17	Not	required	- removed				
PP18	15.9	2.4	6.0	3.0	0.28	0.50	0.8
PP19	11.6	2.3	6.0	3.0	0.22	0.50	0.8
PP20(1)	679.8	1.9	12.0	3.0	2.99	0.33	0.5

(1) Gabion structure

TABLE C

AREA III AND AREA IV NORTH CHANNEL HYDRAULIC DIMENSIONS

Prediction Point	Q_{10} (cfs) * Q_{25}	Slope (%)	Bottom Width (ft)	Side Slope (Z:1)	Flow Depth (ft)	D_{50} (ft)	Riprap Thickness (ft)
PP21	18.01	13.5	12.0	3.0	0.15	0.50	0.8
PP22	36.07	10.9	12.0	3.0	0.28	0.50	0.8
PP23	64.57	7.0	12.0	3.0	0.53	0.50	0.8
PP24	5.1	5.5	3.0	3.0	0.25	0.50	0.8
PP25	17.1	5.9	6.0	3.0	0.29	0.50	0.8
PP26	3.95	11.6	6.0	3.0	0.09	0.50	0.8
PP27	20.02	6.6	6.0	3.0	0.32	0.50	0.8
PP28	12.10	6.9	6.0	3.0	0.22	0.50	0.8
PP29	58.01	8.4	12.0	3.0	0.46	0.50	0.8
PP30	4.23	24.0	9.0	3.0	0.04	0.50	0.8
PP31	7.05	17.8	9.0	3.0	0.08	0.50	0.8

TABLE D
AREA II RIPRAP COST ESTIMATE

Prediction Point	Riprap Channel Length (ft)	D_{50} (ft)	Riprap/Gabion Thickness (ft)	Channel Depth (ft)	Bottom Width (ft)	Side Slopes (Z:1)	Filter Fabric (SF)	Riprap/Gabion (CY)	Cost ($)
PP0	870	0.75	1.2	1.5	6.0	3.0	13,376	595	$ 42,745
PP1[(1)]	710	0.50	1.0	2.0	8.0	3.0	14,555	539	$ 66,770
PP1A[(1)]	1010	0.33	0.5	3.5	50.0	3.0	73,503	1,361	$ 175,209
PP2	680	0.50	0.8	1.5	6.0	3.0	10,455	310	$ 22,900
PP3	670	0.50	0.8	1.5	6.0	3.0	10,301	305	$ 22,564
PP3A	430	0.50	0.8	1.5	6.0	3.0	6,611	196	$ 14,481
PP3B	490	0.50	0.8	1.5	6.0	3.0	7,534	223	$ 16,502
PP3C	830	0.75	1.2	1.5	6.0	3.0	12,761	567	$ 40,779
PP4	650	0.50	0.8	1.5	6.0	3.0	9,994	296	$ 21,890
PP4A	670	0.75	1.2	1.5	6.0	3.0	10,301	458	$ 32,918
PP4B	800	0.50	0.8	1.5	6.0	3.0	12,300	364	$ 26,942
PP5	680	0.75	1.2	1.5	12.0	3.0	14,637	651	$ 46,773
PP6	670	0.75	1.2	1.5	12.0	3.0	14,422	641	$ 46,086
PP7[(1)]	740	0.50	1.0	2.0	12.0	3.0	18,204	674	$ 83,509
PP8	570	0.75	1.2	1.5	12.0	3.0	12,269	545	$ 39,207
PP9	600	0.75	1.2	1.5	6.0	3.0	9,225	410	$ 29,479
PP10	830	0.75	1.2	1.5	12.0	3.0	17,866	794	$ 57,091
PP11	660	0.75	1.2	1.5	6.0	3.0	10,148	451	$ 32,427
PP12	1080	0.50	0.8	1.5	6.0	3.0	16,605	492	$ 36,371
PP13[(1)]	1020	0.50	1.0	2.0	10.0	3.0	23,001	852	$ 105,515
PP14	850	0.75	1.2	2.0	14.0	3.0	22,653	1,007	$ 72,387
PP15	710	0.50	0.8	1.5	12.0	3.0	15,283	453	$ 33,475
PP16[(1)]	690	0.33	0.5	3.0	10.0	3.0	19,803	367	$ 47,204
PP17	NOT REQUIRED - REMOVED								
PP18	2530	0.50	0.8	1.5	6.0	3.0	38,899	1,153	$ 85,203
PP19	870	0.50	0.8	1.5	6.0	3.0	13,376	396	$ 29,299
PP20[(1)]	2110	0.33	0.5	4.0	12.0	3.0	77,859	1,442	$ 185,593
						Totals	**505,940**	**15,541**	**$ 1,413,318**

TABLE E

AREA III AND AREA IV NORTH RIPRAP COST ESTIMATE

Prediction Point	Riprap Channel Length (ft)	D50 (ft)	Riprap Thickness (ft)	Channel Depth (ft)	Bottom Width (ft)	Side Slopes (Z:1)	Filter Fabric (SF)	Riprap (CY)	Cost ($)
Area III									
PP 21	640	0.50	0.8	1.2	12.0	3.0	12,595	373	$ 27,588
PP 22	185	0.50	0.8	1.3	12.0	3.0	3,755	111	$ 8,224
PP 23	213	0.50	0.8	1.5	12.0	3.0	4,585	136	$ 10,042
PP 24	1269	0.50	0.8	1.3	3.0	3.0	14,048	416	$ 30,770
PP 25	373	0.50	0.8	1.3	6.0	3.0	5,276	156	$ 11,557
						Subtotals	**40,259**	**1,193**	**$ 88,181**
Area IV North									
PP26	410	0.50	0.8	1.1	6.0	3.0	5,295	157	$ 11,598
PP27	1397	0.50	0.8	1.3	6.0	3.0	19,761	585	$ 43,283
PP28	912	0.50	0.8	1.2	6.0	3.0	12,339	366	$ 27,028
PP29	1472	0.50	0.8	1.5	12.0	3.0	31,685	939	$ 69,401
PP30	329	0.50	0.8	1.0	9.0	3.0	5,058	150	$ 11,080
PP31	463	0.50	0.8	1.1	9.0	3.0	7,403	219	$ 16,216
						Subtotals	**81,542**	**2,416**	**$ 178,606**
						Totals	**121,800**	**3,609**	**$ 266,787**

Bond Scenario 9/2014

Prediction Point PP-0

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP0

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	23.900	23.900	32.53	1.16

Structure Detail:

Structure #1 (Riprap Channel)

PP0

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	32.53 cfs	
Depth:	0.44 ft	1.44 ft
Top Width:	8.67 ft	14.67 ft
Velocity*:		
X-Section Area:	3.26 sq ft	
Hydraulic Radius:	0.370 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	23.900	0.073	0.000	0.000	91.000	M	32.53	1.155
	Σ	**23.900**						**32.53**	**1.155**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	13.23	25.00	189.00	3.630	0.014
		8. Large gullies, diversions, and low flowing streams	8.66	163.00	1,883.00	8.820	0.059
#1	**1**	**Time of Concentration:**					**0.073**

Bond Scenario 9/2014

Prediction Point PP 1

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP1

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	370.900	370.900	187.76	14.31

Structure Detail:

Structure #1 (Riprap Channel)

PP1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	9.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	187.76 cfs	
Depth:	1.08 ft	2.08 ft
Top Width:	14.46 ft	20.46 ft
Velocity*:		
X-Section Area:	12.08 sq ft	
Hydraulic Radius:	0.816 ft	
Froude Number*:		
Manning's n*:		
Dmin:	6.00 in	
D50:	18.00 in	
Dmax:	22.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	370.900	0.554	0.000	0.000	91.000	M	187.76	14.305
	Σ	**370.900**						**187.76**	**14.305**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.19	25.00	404.00	2.480	0.045
		8. Large gullies, diversions, and low flowing streams	3.25	322.00	9,903.00	5.400	0.509
#1	**1**	**Time of Concentration:**					**0.554**

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1

Folder:
Date: 27/04/2009

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Gradient [%]	9.00	Froude number	2.69
Discharge [ft3/s]	188.00	Cross section [ft2]	13.13
Water level [ft]	1.15	Wetted perimeter [ft]	15.26
Average velocity [ft/s]	14.32	Hydraulic radius [ft]	0.86

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**V**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	6.33	9.87	1.00							
3.1	6.33			5.00	2.92	GabionMats 12"	N	5.01	6.53	Y
4	8.00	16.23	1.00							
4.1	8.00			5.00	2.92	GabionMats 12"	N	6.57	7.01	Y
5	6.33	9.87	1.00							
5.1	6.33			5.00	2.92	GabionMats 12"	N	5.01	6.53	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

1

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1

Folder:
Date: 27/04/2009

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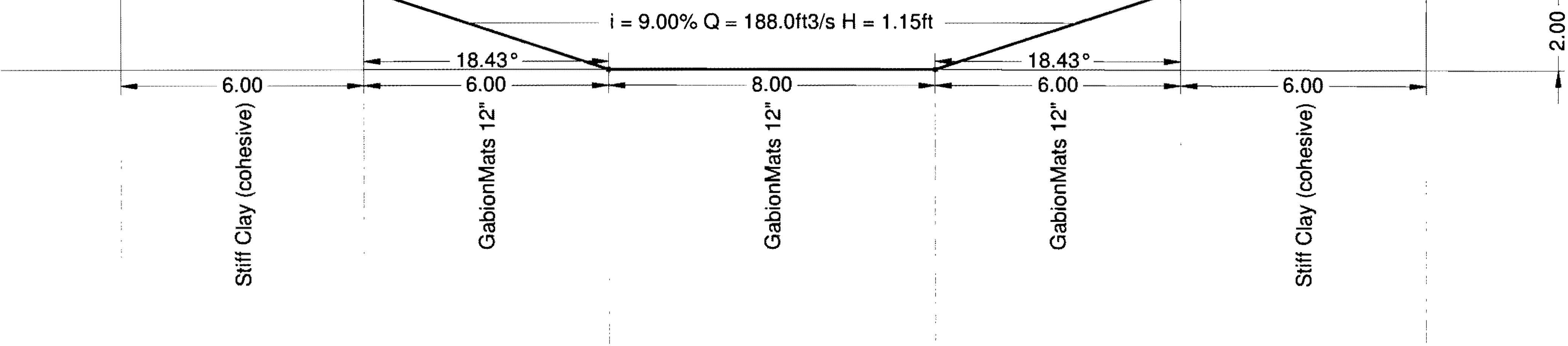
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
GabionMats 12"	0.0301	7.01	N	5.90	0.98	165.51		0.140

Macra1 2006
Maccaferri River Analysis
Bank Protections

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 1A (Chinde Arroyo)

The 100 yr - 6 hour peak flow from the Chinde Arroyo post-mine hydrology model at Structure 23 was used to design the drop structure at PP-1A. The summary report is attach, the full report is presented in Appendix 11-BB. The hydrology model and drainage subdivisions are presented on Exhibit 11-75.

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.040 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#42	1.386	0.156	
Null	#3	==>	#5	0.000	0.000	
Null	#4	==>	#5	0.000	0.000	
Null	#5	==>	#6	0.778	0.334	
Null	#6	==>	#40	1.118	0.289	
Null	#7	==>	#12	0.389	0.341	
Null	#8	==>	#12	0.213	0.373	
Null	#9	==>	#12	0.203	0.370	
Null	#10	==>	#12	0.122	0.381	
Null	#11	==>	#12	0.071	0.392	
Null	#12	==>	#25	0.584	0.301	
Null	#13	==>	#25	0.320	0.368	
Null	#14	==>	#38	0.749	0.206	
Null	#15	==>	#41	0.000	0.000	
Null	#16	==>	#38	0.043	0.404	
Null	#17	==>	#32	0.000	0.000	
Null	#18	==>	#41	0.076	0.313	
Null	#19	==>	#33	0.000	0.000	
Null	#21	==>	#25	0.188	0.334	
Null	#22	==>	#30	0.621	0.218	
Null	#23	==>	#24	0.494	0.312	Prediction Point PP-1A
Null	#24	==>	End	0.000	0.000	
Null	#25	==>	#27	0.354	0.297	
Null	#26	==>	#29	0.144	0.211	
Null	#27	==>	#28	0.450	0.301	
Null	#28	==>	#23	0.101	0.361	
Null	#29	==>	#40	0.653	0.305	
Null	#30	==>	#33	0.000	0.000	
Null	#31	==>	#32	0.274	0.297	
Null	#32	==>	#23	0.403	0.327	
Null	#33	==>	#18	0.349	0.315	
Null	#34	==>	#38	0.601	0.202	
Null	#35	==>	#23	0.080	0.367	
Null	#36	==>	#25	0.212	0.367	
Null	#37	==>	#4	1.717	0.316	
Null	#38	==>	#39	0.165	0.329	Doby Channel
Null	#39	==>	#15	0.342	0.321	Doby Permanent Imp.
Null	#40	==>	#41	0.000	0.000	
Null	#41	==>	#32	0.307	0.299	
Null	#42	==>	#3	1.479	0.221	
Null	#43	==>	#30	0.479	0.208	

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#35	105.000	105.000	103.52	4.87
#26	217.200	217.200	322.14	17.35
#29	90.200	307.400	393.26	24.64
#37	3,024.600	3,024.600	225.67	102.46
#4	2,965.700	5,990.300	835.44	216.48
#1	755.100	755.100	136.51	26.75
#42	2,360.600	3,115.700	254.61	115.55
#3	1,550.000	4,665.700	359.17	192.36
#5	0.000	10,656.000	1,069.56	408.84
#6	2,008.700	12,664.700	1,326.20	506.48
#40	155.400	13,127.500	1,307.65	535.49
#43	817.400	817.400	155.68	35.61
#22	163.500	163.500	204.78	12.51
#30	138.800	1,119.700	244.65	58.75
#19	452.600	452.600	252.70	27.27
#33	0.000	1,572.300	462.21	86.02
#18	119.500	1,691.800	461.62	89.38
#34	235.300	235.300	25.00	5.95
#16	1,570.700	1,570.700	154.14	42.08
#14	6,695.200	6,695.200	355.12	242.38
#38	0.000	8,501.199	441.11	290.42
#39	0.000	8,501.199	439.54	290.42
#15	600.300	9,101.499	463.56	307.30
#41	0.000	23,920.800	1,852.34	932.17
#31	120.200	120.200	64.98	3.40
#17	939.500	939.500	215.90	29.52
#32	168.000	25,148.500	1,882.88	969.82
#36	14.200	14.200	37.47	1.42
#21	90.300	90.300	152.24	7.20
#13	23.300	23.300	41.15	1.89
#11	154.900	154.900	260.18	12.34
#10	32.500	32.500	51.35	2.60
#9	15.000	15.000	39.58	1.50
#8	58.800	58.800	155.15	5.87
#7	204.800	204.800	267.23	15.75
#12	75.500	541.500	638.22	44.17
#25	359.300	1,028.600	791.36	77.46
#27	696.910	1,725.510	877.42	97.06
#28	534.300	2,259.810	884.92	112.11
#23	192.200	27,705.510	2,023.56	1,092.21
#24	548.700	28,254.210	1,999.13	1,124.80

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1A

Folder:
Date: 27/04/2009

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Gradient [%]	3.10	Froude number	1.93
Discharge [ft3/s]	2024.00	Cross section [ft2]	129.74
Water level [ft]	2.28	Wetted perimeter [ft]	64.44
Average velocity [ft/s]	15.60	Hydraulic radius [ft]	2.01

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	11.07	9.96	1.00							
3.1	11.07			5.00	1.31	Reno mattress 6"	N	3.43	4.36	Y
4	50.00	16.37	1.00							
4.1	50.00			5.00	1.31	Reno mattress 6"	N	4.50	4.68	Y
5	11.07	9.96	1.00							
5.1	11.07			5.00	1.31	Reno mattress 6"	N	3.43	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1A

Folder:
Date: 27/04/2009

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

2

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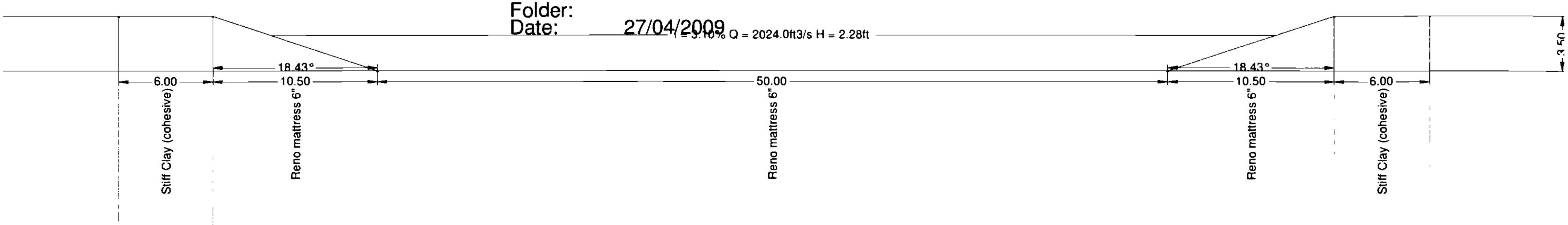
Title: A2 Bond Scenario 2014
Description: Prediction Point PP-1A

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 2

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP2

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.600	8.600	11.70	0.42

Structure Detail:

Structure #1 (Riprap Channel)

PP2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	13.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.70 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	7.03 ft	13.03 ft
Velocity*:		
X-Section Area:	1.12 sq ft	
Hydraulic Radius:	0.158 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	8.600	0.030	0.000	0.000	91.000	M	11.70	0.416
	Σ	**8.600**						**11.70**	**0.416**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	12.74	13.00	102.00	3.570	0.007
		8. Large gullies, diversions, and low flowing streams	12.33	111.00	900.00	10.530	0.023
#1	**1**	**Time of Concentration:**					**0.030**

Bond Scenario 9/2014

Prediction Point PP 3

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP3

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	14.000	14.000	19.05	0.68

Structure Detail:

Structure #1 (Riprap Channel)

PP3

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.3	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.05 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	7.64 ft	13.64 ft
Velocity*:		
X-Section Area:	1.86 sq ft	
Hydraulic Radius:	0.241 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	14.000	0.051	0.000	0.000	91.000	M	19.05	0.677
	Σ	**14.000**						**19.05**	**0.677**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.33	15.00	180.00	2.880	0.017
		8. Large gullies, diversions, and low flowing streams	9.12	102.00	1,119.00	9.050	0.034
#1	**1**	**Time of Concentration:**					**0.051**

Bond Scenario 9/2014

Prediction Point PP 3A

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP3A

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	7.200	7.200	9.80	0.35

Structure Detail:

Structure #1 (Riprap Channel)

PP3A

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.80 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	7.02 ft	13.02 ft
Velocity*:		
X-Section Area:	1.11 sq ft	
Hydraulic Radius:	0.157 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	7.200	0.037	0.000	0.000	91.000	M	9.80	0.348
	Σ	**7.200**						**9.80**	**0.348**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	12.30	15.00	122.00	3.500	0.009
		8. Large gullies, diversions, and low flowing streams	9.55	90.00	942.00	9.270	0.028
#1	**1**	**Time of Concentration:**					**0.037**

Bond Scenario 9/2014

Prediction Point PP 3B

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP3B

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	64.500	64.500	54.66	2.54

Structure Detail:

Structure #1 (Riprap Channel)

PP3B

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	8.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	54.66 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	14.61 ft	20.61 ft
Velocity*:		
X-Section Area:	5.78 sq ft	
Hydraulic Radius:	0.392 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	64.500	0.152	0.000	0.000	91.000	M	54.66	2.537
	Σ	**64.500**						**54.66**	**2.537**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.49	30.00	286.00	3.230	0.024
		8. Large gullies, diversions, and low flowing streams	5.53	180.00	3,256.00	7.050	0.128
#1	**1**	**Time of Concentration:**					**0.152**

Bond Scenario 9/2014

Prediction Point PP 3C

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP3C

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.900	12.900	17.56	0.62

Structure Detail:

Structure #1 (Riprap Channel)

PP3C

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	13.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.56 cfs	
Depth:	0.23 ft	1.23 ft
Top Width:	7.39 ft	13.39 ft
Velocity*:		
X-Section Area:	1.55 sq ft	
Hydraulic Radius:	0.208 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.900	0.042	0.000	0.000	91.000	M	17.56	0.623
	Σ	**12.900**						**17.56**	**0.623**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	12.22	27.00	221.00	3.490	0.017
		8. Large gullies, diversions, and low flowing streams	12.23	118.00	965.00	10.490	0.025
#1	**1**	**Time of Concentration:**					**0.042**

Bond Scenario 9/2014

Prediction Point PP 4

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.100	6.100	8.30	0.29

Structure Detail:

Structure #1 (Riprap Channel)

PP4

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.30 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	6.72 ft	12.72 ft
Velocity*:		
X-Section Area:	0.77 sq ft	
Hydraulic Radius:	0.114 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.100	0.049	0.000	0.000	91.000	M	8.30	0.295
	Σ	**6.100**						**8.30**	**0.295**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.33	16.00	192.00	2.880	0.018
		8. Large gullies, diversions, and low flowing streams	9.97	107.00	1,073.00	9.470	0.031
#1	**1**	**Time of Concentration:**					**0.049**

Bond Scenario 9/2014

Prediction Point PP 4A

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP4A

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.700	9.700	13.20	0.47

Structure Detail:

Structure #1 (Riprap Channel)

PP4A

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.20 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	7.05 ft	13.05 ft
Velocity*:		
X-Section Area:	1.14 sq ft	
Hydraulic Radius:	0.161 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.700	0.063	0.000	0.000	91.000	M	13.20	0.469
	Σ	**9.700**						**13.20**	**0.469**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.63	13.00	196.00	2.570	0.021
		8. Large gullies, diversions, and low flowing streams	8.83	120.00	1,359.00	8.910	0.042
#1	**1**	**Time of Concentration:**					**0.063**

Bond Scenario 9/2014

Prediction Point PP 4B

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP4B

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.100	9.100	12.38	0.44

Structure Detail:

Structure #1 (Riprap Channel)

PP4B

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.38 cfs	
Depth:	0.16 ft	1.16 ft
Top Width:	6.98 ft	12.98 ft
Velocity*:		
X-Section Area:	1.06 sq ft	
Hydraulic Radius:	0.151 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.100	0.080	0.000	0.000	91.000	M	12.38	0.440
	Σ	**9.100**						**12.38**	**0.440**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.17	12.00	288.00	2.040	0.039
		8. Large gullies, diversions, and low flowing streams	9.37	130.00	1,388.00	9.180	0.041
#1	**1**	**Time of Concentration:**					**0.080**

Bond Scenario 9/2014

Prediction Point PP 5

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP5

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	57.600	57.600	48.81	2.27

Structure Detail:

Structure #1 (Riprap Channel)

PP5

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	17.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	48.81 cfs	
Depth:	0.30 ft	1.30 ft
Top Width:	13.78 ft	19.78 ft
Velocity*:		
X-Section Area:	3.83 sq ft	
Hydraulic Radius:	0.276 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	57.600	0.138	0.000	0.000	91.000	M	48.81	2.266
	Σ	**57.600**						**48.81**	**2.266**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	14.95	45.00	301.00	3.860	0.021
		8. Large gullies, diversions, and low flowing streams	5.66	170.00	3,005.00	7.130	0.117
#1	**1**	**Time of Concentration:**					**0.138**

Bond Scenario 9/2014

Prediction Point PP 6

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP6

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	22.000	22.000	29.94	1.06

Structure Detail:

Structure #1 (Riprap Channel)

PP6

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	16.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	29.94 cfs	
Depth:	0.20 ft	1.20 ft
Top Width:	13.22 ft	19.22 ft
Velocity*:		
X-Section Area:	2.57 sq ft	
Hydraulic Radius:	0.193 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	22.000	0.088	0.000	0.000	91.000	M	29.94	1.063
	Σ	**22.000**						**29.94**	**1.063**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.48	35.00	334.00	3.230	0.028
		8. Large gullies, diversions, and low flowing streams	8.45	160.00	1,894.00	8.710	0.060
#1	**1**	**Time of Concentration:**					**0.088**

Bond Scenario 9/2014

Prediction Point PP 7

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP7

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	152.800	152.800	124.38	5.96

Structure Detail:

Structure #1 (Riprap Channel)

PP7

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	16.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	124.38 cfs	
Depth:	0.62 ft	1.62 ft
Top Width:	15.72 ft	21.72 ft
Velocity*:		
X-Section Area:	8.59 sq ft	
Hydraulic Radius:	0.539 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	152.800	0.187	0.000	0.000	91.000	M	124.38	5.965
	Σ	**152.800**						**124.38**	**5.965**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	20.33	25.00	123.00	4.500	0.007
		8. Large gullies, diversions, and low flowing streams	6.22	302.00	4,853.00	7.480	0.180
#1	**1**	**Time of Concentration:**					**0.187**

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-7

Folder:
Date: 27/04/2009

Notice
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Gradient [%]	16.80	Froude number	3.34
Discharge [ft3/s]	125.00	Cross section [ft2]	8.83
Water level [ft]	0.64	Wetted perimeter [ft]	16.02
Average velocity [ft/s]	14.15	Hydraulic radius [ft]	0.55

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**V**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	6.33	9.10	1.00							
3.1	6.33			5.00	3.98	GabionMats 12"	N	5.18	6.53	Y
4	12.00	14.95	1.00							
4.1	12.00			5.00	3.98	GabionMats 12"	N	6.79	7.01	Y
5	6.33	9.10	1.00							
5.1	6.33			5.00	3.98	GabionMats 12"	N	5.18	6.53	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-7

Folder:
Date: 27/04/2009

Notice
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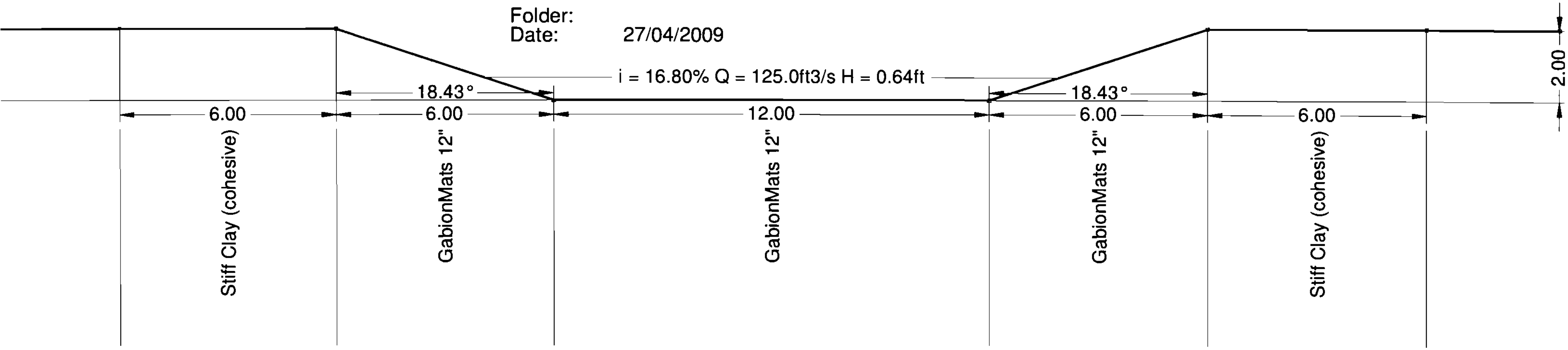
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
GabionMats 12"	0.0301	7.01	N	5.90	0.98	165.51		0.140

Macra1 2006
Maccaferri River Analysis
Bank Protections

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-7

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 8

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP8

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	34.500	34.500	46.95	1.67

Structure Detail:

Structure #1 (Riprap Channel)

PP8

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	14.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.95 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	13.87 ft	19.87 ft
Velocity*:		
X-Section Area:	4.04 sq ft	
Hydraulic Radius:	0.289 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	34.500	0.082	0.000	0.000	91.000	M	46.95	1.667
	Σ	**34.500**						**46.95**	**1.667**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	29.87	95.00	318.00	5.460	0.016
		8. Large gullies, diversions, and low flowing streams	8.79	188.00	2,138.00	8.890	0.066
#1	**1**	**Time of Concentration:**					**0.082**

Bond Scenario 9/2014

Prediction Point PP 9

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP9

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.800	9.800	13.34	0.47

Structure Detail:

Structure #1 (Riprap Channel)

PP9

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.34 cfs	
Depth:	0.17 ft	1.17 ft
Top Width:	7.04 ft	13.04 ft
Velocity*:		
X-Section Area:	1.13 sq ft	
Hydraulic Radius:	0.160 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	9.800	0.060	0.000	0.000	91.000	M	13.34	0.474
	Σ	**9.800**						**13.34**	**0.474**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	25.00	256.00	3.120	0.022
		8. Large gullies, diversions, and low flowing streams	11.67	166.00	1,423.00	10.240	0.038
#1	**1**	**Time of Concentration:**					**0.060**

Bond Scenario 9/2014

Prediction Point PP 10

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP10

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	56.000	56.000	76.21	2.71

Structure Detail:

Structure #1 (Riprap Channel)

PP10

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	14.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	76.21 cfs	
Depth:	0.46 ft	1.46 ft
Top Width:	14.78 ft	20.78 ft
Velocity*:		
X-Section Area:	6.20 sq ft	
Hydraulic Radius:	0.415 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	56.000	0.117	0.000	0.000	91.000	M	76.21	2.706
	Σ	**56.000**						**76.21**	**2.706**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	34.01	50.00	147.00	5.830	0.007
		8. Large gullies, diversions, and low flowing streams	7.51	246.00	3,275.00	8.220	0.110
#1	**1**	**Time of Concentration:**					**0.117**

Bond Scenario 9/2014

Prediction Point PP 11

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP11

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.300	12.300	16.74	0.59

Structure Detail:

Structure #1 (Riprap Channel)

PP11

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	14.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	16.74 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	7.29 ft	13.29 ft
Velocity*:		
X-Section Area:	1.43 sq ft	
Hydraulic Radius:	0.194 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.300	0.017	0.000	0.000	91.000	M	16.74	0.594
	Σ	**12.300**						**16.74**	**0.594**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	9. Small streams flowing bankfull	10.17	185.00	1,819.00	28.700	0.017
#1	**1**	**Time of Concentration:**					**0.017**

Bond Scenario 9/2014

Prediction Point PP 12

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP12

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	10.900	10.900	9.24	0.43

Structure Detail:

Structure #1 (Riprap Channel)

PP12

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	13.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.24 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	6.84 ft	12.84 ft
Velocity*:		
X-Section Area:	0.90 sq ft	
Hydraulic Radius:	0.131 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	10.900	0.129	0.000	0.000	91.000	M	9.24	0.429
	Σ	**10.900**						**9.24**	**0.429**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.88	167.00	1,535.00	3.290	0.129
#1	**1**	**Time of Concentration:**					**0.129**

Bond Scenario 9/2014

Prediction Point PP 13

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP13

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	201.400	201.400	134.20	7.80

Structure Detail:

Structure #1 (Riprap Channel)

PP13

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	13.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	134.20 cfs	
Depth:	0.78 ft	1.78 ft
Top Width:	14.70 ft	20.70 ft
Velocity*:		
X-Section Area:	9.67 sq ft	
Hydraulic Radius:	0.647 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	201.400	0.334	0.000	0.000	91.000	M	134.20	7.802
	Σ	**201.400**						**134.20**	**7.802**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.41	25.00	390.00	2.530	0.042
		8. Large gullies, diversions, and low flowing streams	4.50	301.00	6,692.00	6.360	0.292
#1	**1**	**Time of Concentration:**					**0.334**

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-13

Folder:
Date: 27/04/2009

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Gradient [%]	13.60	Froude number	3.10
Discharge [ft3/s]	134.20	Cross section [ft2]	9.47
Water level [ft]	0.77	Wetted perimeter [ft]	14.87
Average velocity [ft/s]	14.17	Hydraulic radius [ft]	0.64

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	6.33	9.30	1.00							
3.1	6.33			5.00	3.58	GabionMats 12"	N	5.08	6.53	Y
4	10.00	15.29	1.00							
4.1	10.00			5.00	3.58	GabionMats 12"	N	6.66	7.01	Y
5	6.33	9.30	1.00							
5.1	6.33			5.00	3.58	GabionMats 12"	N	5.08	6.53	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-13

Folder:
Date: 27/04/2009

Notice
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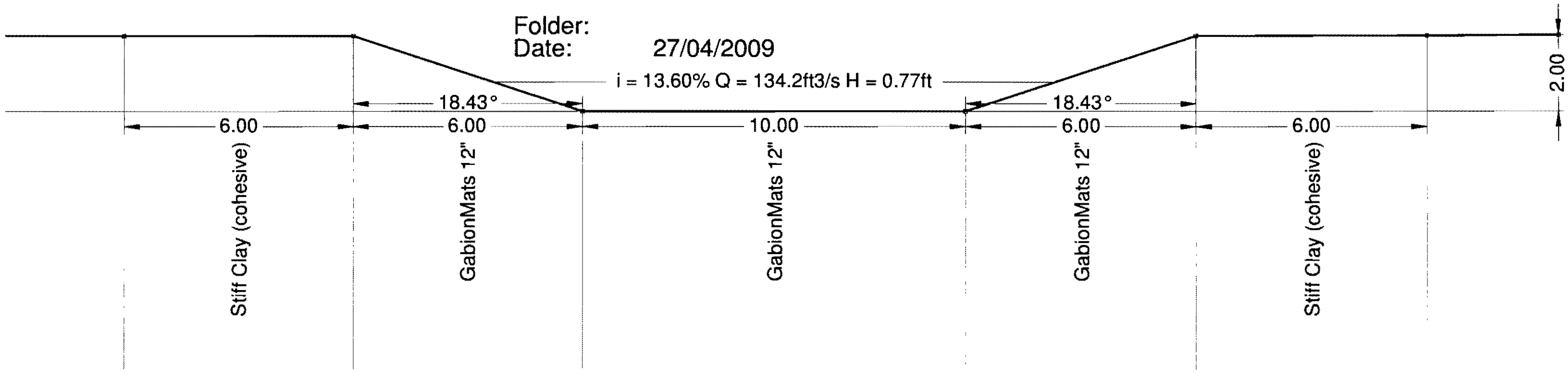
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
GabionMats 12"	0.0301	7.01	N	5.90	0.98	165.51		0.140

2

Macra1 2006
Maccaferri River Analysis
Bank Protections

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-13

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 14

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP14

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	332.800	332.800	173.82	12.85

Structure Detail:

Structure #1 (Riprap Channel)

PP14

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	3.0:1	3.0:1	4.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	173.82 cfs	
Depth:	1.10 ft	2.10 ft
Top Width:	20.59 ft	26.59 ft
Velocity*:		
X-Section Area:	18.99 sq ft	
Hydraulic Radius:	0.907 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	332.800	0.527	0.000	0.000	91.000	M	173.82	12.847
	Σ	**332.800**						**173.82**	**12.847**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.19	25.00	404.00	2.480	0.045
		8. Large gullies, diversions, and low flowing streams	2.79	242.00	8,687.00	5.000	0.482
#1	**1**	**Time of Concentration:**					**0.527**

Bond Scenario 9/2014

Prediction Point PP 15

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP15

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	76.400	76.400	57.43	2.97

Structure Detail:

Structure #1 (Riprap Channel)

PP15

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	4.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	57.43 cfs	
Depth:	0.53 ft	1.53 ft
Top Width:	15.16 ft	21.16 ft
Velocity*:		
X-Section Area:	7.15 sq ft	
Hydraulic Radius:	0.467 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	76.400	0.243	0.000	0.000	91.000	M	57.43	2.973
	Σ	**76.400**						**57.43**	**2.973**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.81	22.00	577.00	1.950	0.082
		8. Large gullies, diversions, and low flowing streams	3.71	124.00	3,346.00	5.770	0.161
#1	**1**	**Time of Concentration:**					**0.243**

Bond Scenario 9/2014

Prediction Point PP 16

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.040 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP16

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	678.200	678.200	378.08	53.92

Structure Detail:

Structure #1 (Riprap Channel)

PP16

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	2.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	378.08 cfs	
Depth:	1.59 ft	2.59 ft
Top Width:	19.56 ft	25.56 ft
Velocity*:		
X-Section Area:	23.54 sq ft	
Hydraulic Radius:	1.173 ft	
Froude Number*:		
Manning's n*:		
Dmin:	9.00 in	
D50:	27.00 in	
Dmax:	33.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	678.200	1.374	0.000	0.000	91.000	M	378.08	53.919
	Σ	**678.200**						**378.08**	**53.919**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.03	15.00	1,457.00	1.010	0.400
		8. Large gullies, diversions, and low flowing streams	1.58	208.00	13,192.00	3.760	0.974
#1	**1**	**Time of Concentration:**					**1.374**

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-16

Folder:
Date: 27/04/2009

Notice
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Gradient [%]	2.20	Froude number	1.59
Discharge [ft3/s]	378.10	Cross section [ft2]	34.17
Water level [ft]	2.10	Wetted perimeter [ft]	23.27
Average velocity [ft/s]	11.06	Hydraulic radius [ft]	1.47

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	9.49	7.93	1.00							
3.1	9.49			5.00	1.10	Reno mattress 6"	N	2.24	4.36	Y
4	10.00	13.04	1.00							
4.1	10.00			5.00	1.10	Reno mattress 6"	N	2.94	4.68	Y
5	9.49	7.93	1.00							
5.1	9.49			5.00	1.10	Reno mattress 6"	N	2.24	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

1

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-16

Folder:
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Notice
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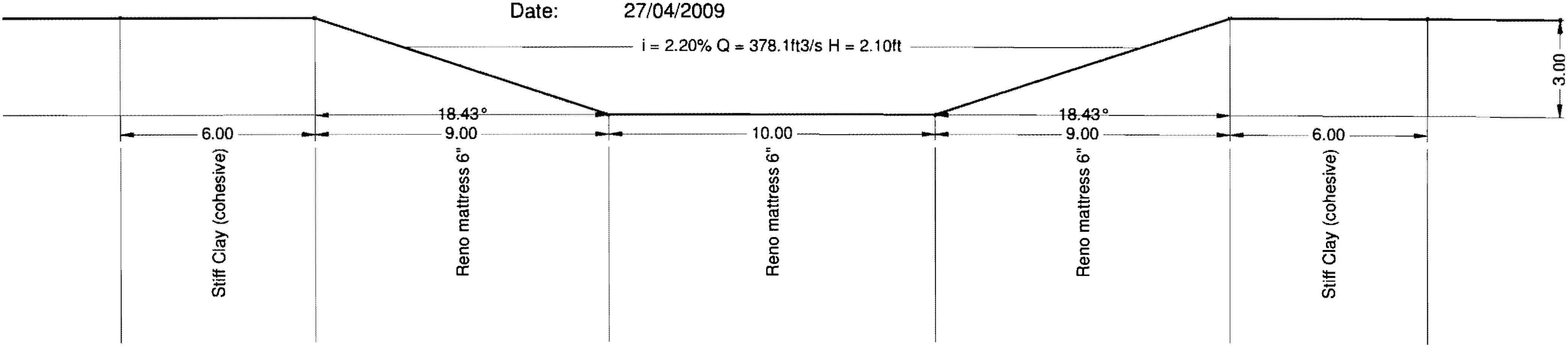
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006
Maccaferri River Analysis
Bank Protections

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-16

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 18

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.280 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP18

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	117.300	117.300	15.89	0.87

Structure Detail:

Structure #1 (Riprap Channel)

PP18

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	2.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.89 cfs	
Depth:	0.28 ft	1.28 ft
Top Width:	7.67 ft	13.67 ft
Velocity*:		
X-Section Area:	1.90 sq ft	
Hydraulic Radius:	0.245 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	117.300	0.248	0.000	0.000	76.000	M	15.89	0.868
	Σ	**117.300**						**15.89**	**0.868**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.41	45.00	535.00	2.900	0.051
		8. Large gullies, diversions, and low flowing streams	2.98	110.00	3,687.00	5.180	0.197
#1	**1**	**Time of Concentration:**					**0.248**

Bond Scenario 9/2014

Prediction Point PP 19

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP19

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	83.400	83.400	11.56	0.65

Structure Detail:

Structure #1 (Riprap Channel)

PP19

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	2.3	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.56 cfs	
Depth:	0.22 ft	1.22 ft
Top Width:	7.32 ft	13.32 ft
Velocity*:		
X-Section Area:	1.47 sq ft	
Hydraulic Radius:	0.199 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	83.400	0.265	0.000	0.000	76.000	M	11.56	0.650
	Σ	**83.400**						**11.56**	**0.650**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.69	25.00	930.00	1.630	0.158
		8. Large gullies, diversions, and low flowing streams	2.29	40.00	1,749.00	4.530	0.107
#1	**1**	**Time of Concentration:**					**0.265**

Bond Scenario 9/2014

Prediction Point PP 20

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.040 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP20

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1,525.000	1,525.000	801.06	91.30

Structure Detail:

Structure #1 (Riprap Channel)

PP20

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	1.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	801.06 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	1,525.000	1.002	0.000	0.000	86.400	M	801.06	91.297
	Σ	**1,525.000**						**801.06**	**91.297**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.30	22.00	415.00	2.300	0.050
		8. Large gullies, diversions, and low flowing streams	2.09	310.00	14,840.34	4.330	0.952
#1	**1**	**Time of Concentration:**					**1.002**

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-20

Folder:
Date: 27/04/2009

Notice
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Gradient [%]	1.90	Froude number	1.56
Discharge [ft3/s]	801.10	Cross section [ft2]	62.71
Water level [ft]	2.99	Wetted perimeter [ft]	30.92
Average velocity [ft/s]	12.77	Hydraulic radius [ft]	2.03

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**V**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
2	2.00	0.00	1.00							
2.1	2.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	12.65	9.33	1.00							
3.1	12.65			5.00	1.02	Reno mattress 6"	N	2.76	4.36	Y
4	12.00	15.35	1.00							
4.1	12.00			5.00	1.02	Reno mattress 6"	N	3.62	4.68	Y
5	12.65	9.33	1.00							
5.1	12.65			5.00	1.02	Reno mattress 6"	N	2.76	4.36	Y
6	2.00	0.00	1.00							
6.1	2.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-20

Folder:
Date: 27/04/2009

Notice
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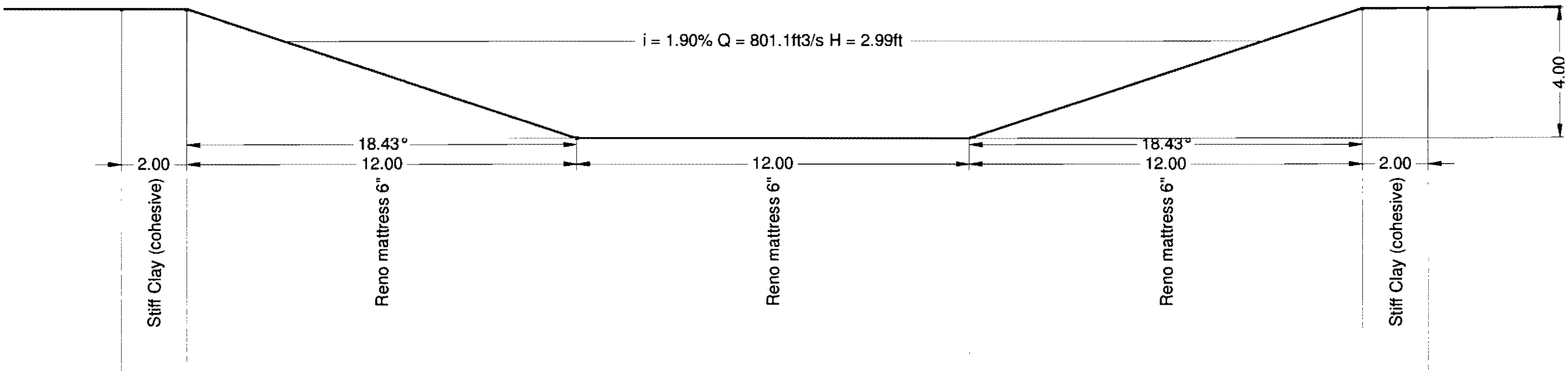
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

2

Macra1 2006
Maccaferri River Analysis
Bank Protections

Title: A2 Bond Scenario 2014
Description: Prediction Point PP-20

Folder:
Date: 27/04/2009



Bond Scenario 9/2014

Prediction Point PP 21

Area 3

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP21

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	79.100	79.100	18.01	2.18

Structure Detail:

Structure #1 (Riprap Channel)

PP21

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	13.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.15 ft	1.15 ft
Top Width:	12.89 ft	18.89 ft
Velocity*:		
X-Section Area:	1.84 sq ft	
Hydraulic Radius:	0.142	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	79.100	0.750	0.000	0.000	85.000	M	18.01	2.18
	S	**79.100**						**18.01**	**2.18**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.89	70.00	3,700.17	1.370	0.750
#1	**1**	**Time of Concentration:**					**0.750**

Bond Scenario 9/2009

Prediction Point PP 22

Area 3

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP22

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	122.400	122.400	36.07	4.50

Structure Detail:

Structure #1 (Riprap Channel)

PP22

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	10.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.28 ft	1.28 ft
Top Width:	13.69 ft	19.69 ft
Velocity*:		
X-Section Area:	3.62 sq ft	
Hydraulic Radius:	0.263	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	122.400	0.809	0.000	0.000	88.000	M	36.07	4.50
	S	**122.400**						**36.07**	**4.50**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.62	60.00	3,700.00	1.270	0.809
#1	**1**	**Time of Concentration:**					**0.809**

Bond Scenario 9 2014

Prediction Point PP 23

Area 3

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-23

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	396.900	396.900	64.57	13.28

Structure Detail:

Structure #1 (Riprap Channel)

PP-23

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	7.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.53 ft	1.53 ft
Top Width:	15.18 ft	21.18 ft
Velocity*:		
X-Section Area:	7.21 sq ft	
Hydraulic Radius:	0.470	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	396.900	1.560	0.000	0.000	87.000	M	64.57	13.28
	S	**396.900**						**64.57**	**13.28**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.13	175.00	8,200.00	1.460	1.560
#1	**1**	**Time of Concentration:**					**1.560**

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Prediction Point PP 24

Area 3

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP 24

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	16.700	16.700	5.10	0.34

Structure Detail:

Structure #1 (Riprap Channel)

PP 24

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
3.00	3.0:1	3.0:1	5.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.25 ft	1.25 ft
Top Width:	4.50 ft	10.50 ft
Velocity*:		
X-Section Area:	0.94 sq ft	
Hydraulic Radius:	0.205	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	16.700	0.277	0.000	0.000	82.000	M	5.10	0.34
	S	**16.700**						**5.10**	**0.34**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	10.00	1,000.00	1.000	0.277
#1	**1**	**Time of Concentration:**					**0.277**

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Prediction Point PP 25

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP 25

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	83.000	83.000	17.10	1.68

Structure Detail:

Structure #1 (Riprap Channel)

PP 25

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	5.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.29 ft	1.29 ft
Top Width:	7.72 ft	13.72 ft
Velocity*:		
X-Section Area:	1.96 sq ft	
Hydraulic Radius:	0.251	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	83.000	0.528	0.000	0.000	82.000	M	17.10	1.68
	S	**83.000**						**17.10**	**1.68**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.70	10.00	1,430.00	0.830	0.478
		8. Large gullies, diversions, and low flowing streams	6.01	80.00	1,330.00	7.350	0.050
#1	**1**	**Time of Concentration:**					**0.528**

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Prediction Point PP-26
Area-4 North

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-26

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	13.900	13.900	3.95	0.22

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-26

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	11.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.09 ft	1.09 ft
Top Width:	6.51 ft	12.51 ft
Velocity*:		
X-Section Area:	0.53 sq ft	
Hydraulic Radius:	0.082	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	13.900	0.181	0.000	0.000	79.700	M	3.95	0.22
	S	**13.900**						**3.95**	**0.22**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.31	8.00	609.00	1.140	0.148
		8. Large gullies, diversions, and low flowing streams	6.88	65.00	945.00	7.860	0.033
#1	**1**	**Time of Concentration:**					**0.181**

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Prediction Point PP-27

Area 4N

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-27

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	71.900	71.900	20.02	1.15

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-27

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	6.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.32 ft	1.32 ft
Top Width:	7.90 ft	13.90 ft
Velocity*:		
X-Section Area:	2.20 sq ft	
Hydraulic Radius:	0.275	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	71.900	0.200	0.000	0.000	79.900	M	20.02	1.15
	S	**71.900**						**20.02**	**1.15**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.13	30.00	960.00	1.760	0.151
		8. Large gullies, diversions, and low flowing streams	6.57	90.00	1,370.00	7.680	0.049
#1	**1**	**Time of Concentration:**					**0.200**

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Prediction Point PP-28

Area 4N

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-28

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	55.600	55.600	12.10	0.89

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-28

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	6.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.22 ft	1.22 ft
Top Width:	7.29 ft	13.29 ft
Velocity*:		
X-Section Area:	1.43 sq ft	
Hydraulic Radius:	0.194	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	55.600	0.321	0.000	0.000	79.900	M	12.10	0.89
	S	**55.600**						**12.10**	**0.89**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.57	18.00	1,150.00	1.250	0.255
		8. Large gullies, diversions, and low flowing streams	6.88	130.00	1,890.00	7.860	0.066
#1	**1**	**Time of Concentration:**					**0.321**

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Prediction Point PP-29

Area 4 North

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-29

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	457.000	457.000	58.01	7.30

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-29

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	8.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.46 ft	1.46 ft
Top Width:	14.76 ft	20.76 ft
Velocity*:		
X-Section Area:	6.15 sq ft	
Hydraulic Radius:	0.413	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	457.000	0.731	0.000	0.000	79.900	M	58.01	7.30
	S	**457.000**						**58.01**	**7.30**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.60	50.00	1,390.00	1.890	0.204
		8. Large gullies, diversions, and low flowing streams	1.60	115.00	7,200.00	3.790	0.527
#1	**1**	**Time of Concentration:**					**0.731**

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Prediction Point PP-30

Area 4 North

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-30

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.900	6.900	4.23	0.11

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-30

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	24.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.04 ft	1.04 ft
Top Width:	9.22 ft	15.22 ft
Velocity*:		
X-Section Area:	0.33 sq ft	
Hydraulic Radius:	0.036	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.900	0.027	0.000	0.000	79.900	M	4.23	0.11
	S	**6.900**						**4.23**	**0.11**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.00	10.00	125.00	2.820	0.012
		8. Large gullies, diversions, and low flowing streams	19.44	140.00	720.00	13.220	0.015
#1	**1**	**Time of Concentration:**					**0.027**

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Prediction Point PP-31

Area 4 North

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Prediction Point PP-31

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	11.500	11.500	7.05	0.18

Structure Detail:

Structure #1 (Riprap Channel)

Prediction Point PP-31

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	17.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.08 ft	1.08 ft
Top Width:	9.49 ft	15.49 ft
Velocity*:		
X-Section Area:	0.76 sq ft	
Hydraulic Radius:	0.080	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	11.500	0.046	0.000	0.000	79.900	M	7.05	0.18
	S	**11.500**						**7.05**	**0.18**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	11.25	45.00	400.00	3.350	0.033
		8. Large gullies, diversions, and low flowing streams	18.03	110.00	610.00	12.730	0.013
#1	**1**	**Time of Concentration:**					**0.046**

LEGEND

PP-24	PREDICTION POINT
	WATERSHED BOUNDARY
	RIPRAP STRUCTURE

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	L. RAYMOND	Y. BENALLY	L. RAYMOND
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	LR/ RCVV	Y. BENALLY	RCVV
E	3-06-07	PJF	Updated for Mine Plan changes, and submitted to OSM for Review.	SS	MC	KB
D	11-10-06	PJF	Updated for Mine Plan changes, and submitted to OSM for Review.	BH	KJ	LR
C	8-11-06	PJF	Updated for Mine Plan changes, Modified Drop Structures P1, P2, P3, P4, Added P3A and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes, Modified Drop Structures P1, P2, P3 and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated Exhibit and submitted to OSM for Review.	DJR	MC	LR
				APPROVALS		

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowlege.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

Appendix Exhibit 12C-1

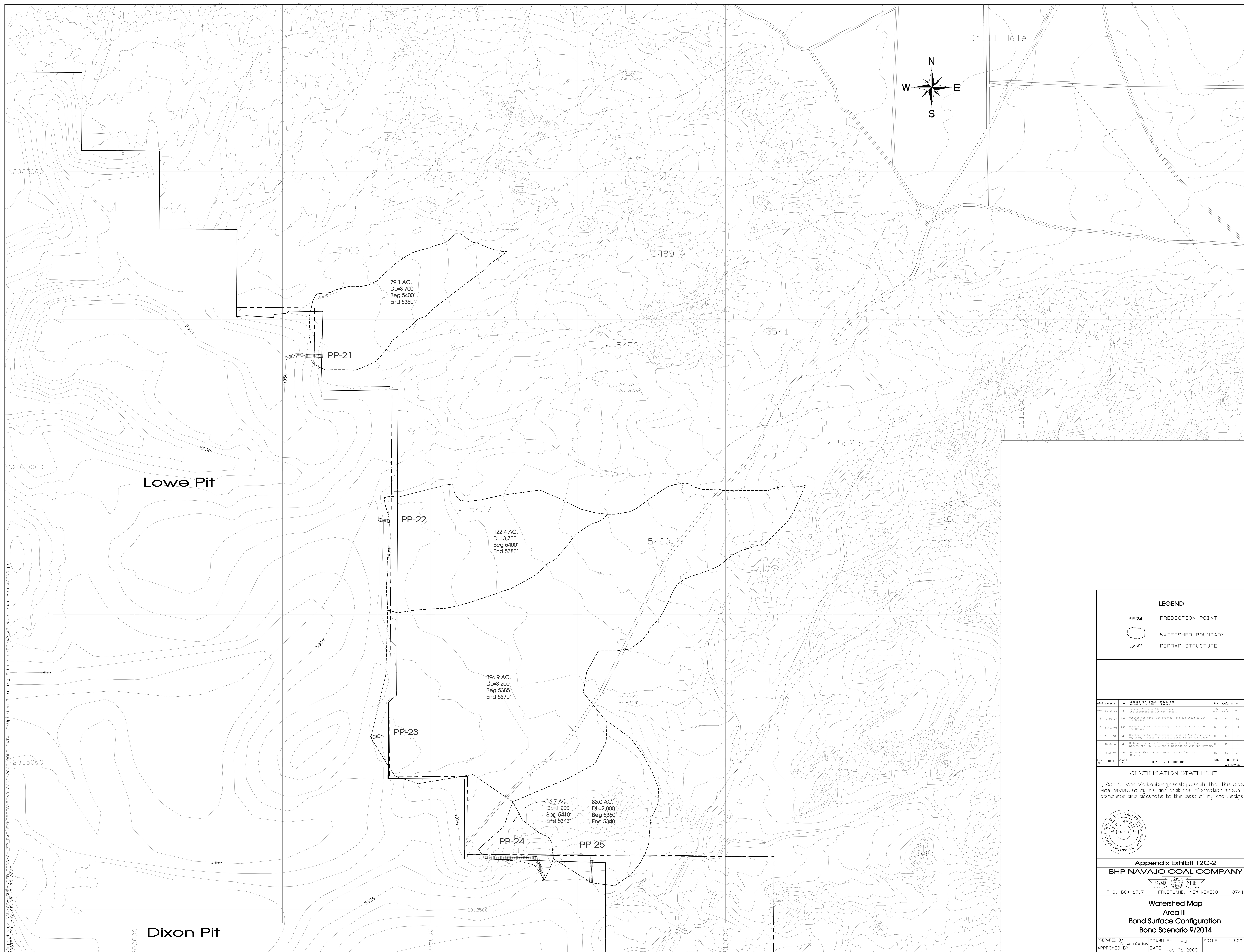
BHP NAVAJO COAL COMPANY

NAVAJO MINE SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

Watershed Map
Area II
Bond Surface Configuration
Bond Scenario 9/2014

PREPARED BY L. Raymond	DRAWN BY PJF	SCALE 1"=500'
APPROVED BY	DATE May 01, 2009	



LEGEND

PP-24	PREDICTION POINT
	WATERSHED BOUNDARY
	RIPRAP STRUCTURE

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.Q.	P.E.
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	RCV	Y. BENALLY	RCV
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	LR/ RCVV	Y. BENALLY	RCVV
E	3-06-07	PJF	Updated for Mine Plan changes, and submitted to OSM for Review.	SS	MC	KB
D	11-10-06	PJF	Updated for Mine Plan changes, and submitted to OSM for Review.	BH	KJ	LR
C	8-11-06	PJF	Updated for Mine Plan changes, Modified Drop Structures P1, P2, P3, P4, Added P3A and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes, Modified Drop Structures P1, P2, P3 and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated Exhibit and submitted to OSM for Review.	DJR	MC	LR
				APPROVALS		

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg,hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG NEW MEXICO 9263 LICENSED PROFESSIONAL ENGINEER

Appendix Exhibit 12C-2

BHP NAVAJO COAL COMPANY

NAVAJO MINE SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

Watershed Map
Area III
Bond Surface Configuration
Bond Scenario 9/2014

PREPARED BY Ron Van Valkenburg	DRAWN BY PJF	SCALE 1"=500'
APPROVED BY	DATE May 01, 2009	

APPENDIX 12-D

BOND CALCULATION WORKSHEETS FOR AREA 4 NORTH

WORST CASE BOND SCENARIO 2009

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT
BOND AMOUNT CALCULATION

APPENDIX 12 - D
AREA 4 NORTH BOND WORKSHEETS

Table of Contents

Item	Title

WORKSHEETS

Project	**Navajo Mine**
Date	**November 2004**

WORKSHEET NO. 1

DESCRIPTION OF WORST CASE BONDING RECLAMATION SCENARIO FOR AREA 4 NORTH

Determination of Maximum Reclamation Requirements

The point at which reclamation liabilities will be greatest occurs during the first two years of the five-year term ending in 2009 (see Worksheet 1, APPENDIX 12-B). Throughout the five-year term, strip progression results in an increase in disturbed land, increased pit backfill volumes due to ramp extensions and increased pit depths and slight increases in pit lengths. During the first two years however, the open (final) pit volumes of South and North Barber are unreclaimed. As Hosteen pit and its associated prestrip advance, the final pit in South Barber receives prestrip material as backfill, as does North Barber later in the permit term. By 2009 South Barber is essentially complete and North Barber is the primary prestrip and CCB dump area. This in conjunction with the closure of Pinto Pit and the relative static size of the open pit volumes in Area III leads us to the conclusion that the maximum volumetric reclamation requirement occurs earlier in the term than would be the norm. Areas 2 and 3 will be the primary areas to be reclaimed with small areas in Areas 1 and 4North.

The Yazzie, Hosteen, North Barber, South Barber, Lowe, Dixon and Area 4North pits will all require reclaiming at the end of 2009. Dozers will be utilized to push the maximum amount of material into the pits. Any material the dozers cannot move in a cost effective manner will be moved by scrapers or trucks and dozers. Any areas that do not pass the spoil sampling tests will be mitigated by one of the approved methods in the permit prior to topsoil placement. For the purpose of this reclamation bond calculation, 2% of the regraded area in the permanent program category will require spoil mitigation. After all spoil is regraded, final pits will be shaped to the their final contours, and mitigation material will be placed where required; topsoil will be placed, revegetation will occur with a 20% failure rate and the mine facilities will be removed. Facilities areas will be mitigated as required and topsoiled. At this time, the mine will be ready to begin phased bond release with the ultimate goal of total bond release. It will be necessary to move and place approximately 154,000,000 cubic yards of material during the reclamation effort. The majority (approximately 144,000,000 cubic yards) will be moved and placed during the primary grading effort. Therefore, the major effort for this reclamation bond calculation is focused on primary grading.

Area IV North operator wage rates were taken from worksheets and tables located in Appendix 12-B.

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 2
STRUCTURE DEMOLITION AND DISPOSAL COST SUMMARY

Structure	l (ft)	w (ft)	h (ft)	Construction	Building Volume (cu ft)	Building UnitCost ($/cu ft)	Building Ref ID	Building Cost	Floors, Surfaces & Walls Area (sq ft)	Floors, Surfaces & Walls UnitCost ($/sq ft)	Floors, Surfaces & Walls Ref ID	Floors, Surfaces & Walls Cost	Footings Length (lin ft)	Footings UnitCost ($/lin ft)	Footings Ref ID	Footings Cost
Area IVN																
Culvert: Concrete Box Top and Bottom (16 total	200	8		10" Concrete Walls					25,600	11.06	23b	$283,175				
Culvert: Concrete Box Walls (16 total)	200	8		8" Concrete Walls					25,600	9.47	23	$242,514				
Bridge Piers (15 total)	14	2	2	Concrete									210	$16	17	$3,359
Bridge Footings (3 total)	16	4	4	Concrete									48	$93	19b*	$4,467
Bridge Guardrails (2 total)	320	3	1	Steel	51,840	$0.21	31	$10,693								
Deck Sections (4-double sections)	80	8.5		Steel	193,120	$0.21	31	$39,836								
Abutement Walls (4)	436	5-12		Concrete/MSE					3,756	8.28	21	$31,107				
Concrete Apron	90	75		Concrete					6,750	13.25	23d	$89,445				
Wall around concrete apron (9 ft height)	180	9		Concrete					1,620	11.06	23b	$17,920				
Wall around concrete apron (3 ft height)	150	3		Concrete					450	11.06	23b	$4,978				
69 kV Power Line (3 miles)													3	$5,982	25	$17,946
Area IVN Total								**$50,529**				**$669,140**				**$25,773**
TOTAL								**$50,529**				**$669,140**				**$25,773**
TOTAL A4N DEMOLITION COST																**$745,442**

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 3
MATERIAL HANDLING SUMMARY SHEET

Description	Quantity	Swell Factor	Adjusted Quantity	Push/Haul Distance (ft)	Push/Haul Grade (%)	Equipment
Area 4						
Dril & Blast	0 BCY					DMM2
Grading - Dozer	3,411,640 LCY			296	-14.90%	D11R
Grading - Scrapers	0 LCY					631G
Grading - Trucks	2,575,677 LCY			4,478	-3.49%	992G/777D
Topsoil - Scrapers	4,368 BCY	1.142	4,988 LCY	400	0.00%	631G
Topsoil - Trucks	252,419 BCY	1.142	288,263 LCY	8,514	0.61%	992G/777D
Mitigation - Scrapers	0 BCY	1.142	0 LCY			631G
Mitigation - Trucks	38,713 BCY	1.142	44,210 LCY	14,078	-0.50%	992G/777D
Revegetation	335 ac.					
Backfilling Ponds	119,251 BCY	1.142	136,185 LCY	168	0.00%	D11R
Grade Road	21,184 BCY	1.142	24,192 LCY	55	0.00%	D11R
Road Ripping	13.1 ac.					16G
Concrete & Asphalt Disp.	2,013 BCY	1.142	2,299 LCY	3,704	-8.50%	992G/777D

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 5H
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling Ponds

Characterization of Dozer Used (type, size, etc.) (3)

Caterpillar D11R, Universal Blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0% grade on average
168 ft. weighted average push distance
Loose clay and sand = 2700 lb/yd3

Productivity Calculations (3) :

Operating Adjustment = Factor	0.90 x	1.00 x	0.83 x	1.00 x	0.85 x		
	operator factor	material factor	work hour factor	grade factor	weight correction factor		
	0.90 x	1.00 x	1.10			=	0.63
	visibility	elevation	production method/blade factor				

Net Hourly Production =	1,850 LCY/hr x	0.63	=	1,163 LCY/hr
	normal hourly production	operating adjustment factor		

Hours Required (2)	136,185 LCY	/	1,163 LCY/hr =	117 hrs
	volume to be moved (1)		net hourly production	

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 5H
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Backfilling Ponds

Characterization of Dozer Used (type, size, etc.) (3)

Caterpillar D11R, Universal Blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0% grade on average
168 ft. weighted average push distance
Loose clay and sand = 2700 lb/yd3

Productivity Calculations (3) :

Operating Adjustment = Factor	0.90 x	1.00 x	0.83 x	1.00 x	0.85 x		
	operator factor	material factor	work hour factor	grade factor	weight correction factor		
	0.90 x	1.00 x	1.10		=	0.63	
	visibility	elevation	production method/blade factor				
Net Hourly Production =	1,850 LCY/hr x	0.63		=	1,163 LCY/hr		
	normal hourly production	operating adjustment factor					
Hours Required (2)	136,185 LCY /	1,163 LCY/hr =	117 hrs				
	volume to be moved (1)	net hourly production					

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 5I
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:

Dozing road

Characterization of Dozer Used (type, size, etc.) (3)

Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)

0% grade on average
55 ft typical dozer push distance
Loose clay and sand = 2700 lb/yd3

Productivity Calculations (3) :

Operating Adjustment Factor =	0.90 x	1.00 x	0.83 x	1.00 x	0.85 x	
	operator factor	material factor	work hour factor	grade factor	weight correction factor	
	0.90 x	1.00 x	1.10	=	0.63	
	visibility	elevation	production method/blade factor			

Net Hourly Production =	4,200 LCY/hr	0.63	=	2,640 LCY/hr
	normal hourly production	operating adjustment factor		

Hours Requi	24,192 LCY /	2,640 LCY/h =	9 hrs
	volume to be moved (1)	net hourly production	

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 5J
PRODUCTIVITY AND HOURS REQUIRED FOR DOZER USE

Earthmoving Activity:
Area IVN Regrade

Characterization of Dozer Used (type, size, etc.) (3)
Caterpillar D11R, Universal blade

Description of Dozer Use (origin, destination, grade, haul distance, material, etc.)
-15% grade on average
296 ft weighted average dozer push distance

Productivity Calculations (3) :

Operating Adjustment Factor =	0.90 x	1.00 x	0.83 x	1.16 x		0.85 x
	operator factor	material factor	work hour factor	grade factor		weight correction factor
	0.90 x	1.00 x	1.10		=	0.73
	visibility	elevation	production method/blade factor			

Net Hourly Productio	1,100 LCY/h x	0.73		=	802 LCY/hr
	normal hourly production	operating adjustment factor			
Hours Re	3,411,640 LCY /	802 LCY/hr =	4253 hrs		
	volume to be moved (1)	net hourly production			

Data Sources:
1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 8M
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 4N Regrade

Characterization of Loader Used (type, size, etc.) 3

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
Bucket Fill Factor =
Rated Bucket Capacity = 15 LCY

Productivity Calculation (3) :

cycle time = ____ (haul time (loaded)) + ____ (return time (empty)) + 0.65 (basic cycle time) = 0.65 min

Net Bucket Capacity = 15 LCY (heaped bucket capacity) x 1.05 (bucket fill factor) = 15.8 LCY

Net Hourly Production = 15.8 LCY (net bucket capacity) / 0.65 min (cycle time) x 50 min / hr (work hour factor) = 1212 LCY/ hr

Hours Required (2) = 2,575,677 LCY / (volume to be moved (1)) 1212 yd3 / hr (net hourly production) = 2,126 hrs

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 8N
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:

Area 4N Topsoil

Characterization of Loader Used (type, size, etc.) 3

Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)

Load Caterpillar 777D Trucks
Bucket Fill Factor = 105%
Rated Bucket Capacity = 15 LCY

Productivity Calculation (3) :

cycle time = ______ + ______ + 0.65 = 0.65 min

haul time (loaded) + return time (empty) + basic cycle time

Net Bucket Capacity = 15 LCY x 1.05 = 15.8 LCY

heaped bucket capacity x bucket fill factor

Net Hourly Production = 15.8 LCY / 0.65 min x 50 min / hr = 1215 LCY/ hr

net bucket capacity / cycle time x work hour factor

Hours Required (2) = 288,263 LCY / 1215 LCY/ hr = 237 hrs

volume to be moved (1) / net hourly production

Data Sources:

1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 8O
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:
Area 4N Mitigation

Characterization of Loader Used (type, size, etc.) 3
Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)
Load Caterpillar 777D Trucks
Bucket Fill Factor = 105%
Rated Bucket Capacity = 15 LCY

Productivity Calculation (3) :

cycle time =	___	+	___	+	0.65	=	0.65	min
	haul time (loaded)		return time (empty)		basic cycle time			

Net Bucket Capacity =	15 LCY	x	1.05	=	15.8	LCY
	heaped bucket capacity		bucket fill factor			

Net Hourly Production =	15.8 LCY	/	0.65	min	x	50 min / hr	=	1212 LCY/ hr
	net bucket capacity		cycle time			work hour factor		

Hours Required (2) =	44,210 LCY	/	1212 LCY/ hr	=	36	hrs
	volume to be moved (1)		net hourly production			

Data Sources:
1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

WORKSHEET NO. 8P
PRODUCTIVITY AND HOURS REQUIRED FOR LOADER USE

Earthmoving Activity:
Area 4N Concrete Disposal

Characterization of Loader Used (type, size, etc.) 3
Caterpillar 992G with 15 CYD Bucket

Description of Loader Use (origin, destination, grade,haul distance, etc.)
Load Caterpillar 777D Trucks
Bucket Fill Factor = 105%
Rated Bucket Capacity = 15 LCY

Productivity Calculation (3) :

cycle time =	______ haul time (loaded)	+	______ return time (empty)	+	0.65 basic cycle time	=	0.65	min		
Net Bucket Capacity =	15 LCY heaped bucket capacity	x	0.6 bucket fill factor	=	9.0	LCY				
Net Hourly Production =	9.0 LCY net bucket capacity			/	0.65 cycle time	min	x	50 min / hr work hour factor	=	692 LCY/ hr
Hours Required (2)	2,299 LCY volume to be moved (1)	/	692 LCY/ hr net hourly production	=	3	hrs				

Data Sources:
1) Volume to be moved from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 9M
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Regrade

Characterization of Truck Used (type, size, etc.) (3)

Caterpillar 777D
Struck Capacity = 54.6 yd3   Heaped Capacity = 79.1 yd3
Adjusted Capacity = Average of Struck and Heaped = 66.9 yd3

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

4,478 ft. average haul distance
-3% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation (3) :

Loader Passes per Truck	=	66.9 LCY (truck capacity)	/	13.2 LCY (loader bucket net capacity)		=	5 passes (round down)	
Net Truck Capacity	=	13.2 LCY (loader bucket net capacity)	x	5 (no. passes)		=	66 LCY (net truck capacity)	
Loading Time per Truck	=	0.65 min (loader cycle time)	x	5 (no. passes)		=	3.3 min (total loading time)	
Truck Cycle Time	=	1.4 (haul time)	+	1.3 (return time)	+ 3.3 (total loading time)	+ 1.0 (dump and manuever time)	=	7.0 min
Number of Trucks Required	=	7.0 min (truck cycle time)	/	3.3 (truck loading time)	= 2 trucks			
Production Rate	=	66.0 LCY (net truck capacity)	/	7.0 (cycle time)	min	=	9.5 LCY/min	
Hourly Production	=	9.5 LCY/min (production rate)	x	50 (work hour factor)	min / hr		=	475 LCY/hr
Hours Required (2)	=	2,575,677 LCY (volume to be moved (1))	/	475 (hourly production)	LCY/hr	=	5425 hrs	

Data Sources:

1) *Volume to be moved from Worksheet 3*
2) *Hours required go to Worksheet 13*
3) *Caterpillar Performance Handbook, Edition 32*

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 9N
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Topsoiling

Characterization of Truck Used (type, size, etc.) (3)

Caterpillar 777D
Struck Capacity = 54.6 yd3 Heaped Capacity = 79.1 yd3
Adjusted Capacity = Average of Struck and Heaped = 66.9 yd3

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

8,514 ft. average haul distance
1% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation (3) :

Loader Passes per Truck	=	66.9 LCY truck capacity	/	15.8 LCY loader bucket net capacity			=	4 passes (round down)
Net Truck Capacity	=	15.8 LCY loader bucket net capacity	x	4 no. passes			=	63.2 LCY net truck capacity
Loading Time per Truck	=	0.65 min loader cycle time	x	4 no. passes			=	2.6 min total loading time
Truck Cycle Time	=	5.0 haul time	+	3.1 + return time	2.6 + total loading time	1.0 dump and manuever time	=	11.7 min
Number of Trucks Required	=	11.7 min truck cycle time	/	2.6 truck loading time	= 5 trucks			
Production Rate	=	63.2 LCY net truck capacity	/	11.7 min cycle time			=	5.4 LCY/min
Hourly Production	=	5.4 LCY/min production rate	x	50 min / hr work hour factor			=	270 LCY/hr
Hours Required (2)	=	288,263 LCY volume to be moved (1)	/	270 LCY/hr hourly production			=	1067 hrs

Data Sources:

1) *Volume to be moved from Worksheet 3*
2) *Hours required go to Worksheet 13*
3) *Caterpillar Performance Handbook, Edition 32*

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 9O
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Mitigation @ 2%

Characterization of Truck Used (type, size, etc.) (3)

Caterpillar 777D
Struck Capacity = 54.6 yd3 Heaped Capacity = 79.1 yd3
Adjusted Capacity = Average of Struck and Heaped = 66.9 yd3

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

14,078 ft. average haul distance
0% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation (3) :

Loader Passes per Truck =	66.9 LCY (truck capacity)	/	15.8 LCY (loader bucket net capacity)		=	4 passes (round down)
Net Truck Capacity =	15.8 LCY (loader bucket net capacity)	x	4 (no. passes)		=	63.2 LCY (net truck capacity)
Loading Time per Truck =	0.65 min (loader cycle time)	x	4 (no. passes)		=	2.6 min (total loading time)
Truck Cycle Time =	6.0 (haul time)		4.4 + (return time)	2.6 + (total loading time)	1.0 (dump and manuever time)	= 14.0 min
Number of Trucks Required =	14.0 min (truck cycle time)	/	2.6 (truck loading time)	= 5 trucks		
Production Rate =	63.2 LCY (net truck capacity)	/	14.0 min (cycle time)		=	4.5 LCY/min
Hourly Production =	4.5 LCY/min (production rate)	x	50 min / hr (work hour factor)		=	226 LCY/hr
Hours Required (2) =	44,210 LCY (volume to be moved (1))	/	226 LCY/hr (hourly production)		=	196 hrs

Data Sources:

1) *Volume to be moved from Worksheet 3*
2) *Hours required go to Worksheet 13*
3) *Caterpillar Performance Handbook, Edition 32*

WORKSHEET NO. 9P
PRODUCTIVITY AND HOURS REQUIRED FOR TRUCK USE

Earthmoving Activity:

Area 4N Concrete Disposal in Area 4N Pit

Characterization of Truck Used (type, size, etc.) (3)

Caterpillar 777D
Struck Capacity = 54.6 yd3 Heaped Capacity = 79.1 yd3
Adjusted Capacity = Average of Struck and Heaped = 66.9 yd3

Description of Truck Use (origin, destination, grade,haul distance, truck capacity, etc.):

3,704 ft. average haul distance
-9% Grade (Loaded)
3% Rolling Resisance

Productivity Calculation (3) :

Loader Passes per Truck	66.9 LCY truck capacity	/	15.8 LCY loader bucket net capacity			=	4 passes (round down)		
Net Truck Capacity	= 9 LCY loader bucket net capacity	x	7 no. passes			=	63 LCY net truck capacity		
Loading Time per Truck	0.65 min loader cycle time	x	4 no. passes			=	2.6 min total loading time		
Truck Cycle Ti	3.0 haul time		1.5 + return time		2.6 + total loading time		1.0 dump and manuever time	=	8.1 min
Number of Trucks Requir	8.1 min truck cycle time	/	2.6 truck loading time	=	3 trucks				
Production Rate	63.0 LCY net truck capacity	/	8.1 cycle time	min		=	7.8 LCY/min		
Hourly Production	7.8 LCY/min production rate	x	50 work hour factor	min / hr				=	389 LCY/hr
Hours Required (2)	2,299 LCY volume to be moved (1)	/	389 hourly production	LCY/hr		=	6	hrs	

Data Sources:

1) *Volume to be moved from Worksheet 3*
2) *Hours required go to Worksheet 13*
3) *Caterpillar Performance Handbook, Edition 32*

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 11I
PRODUCTIVITY FOR SCRAPER USE

Earthmoving Activity:

Area 4N Topsoiling

Characterization of Scraper Used (type, size, etc.) (3)

Caterpillar 631E with D10N push dozer
Struck Capacity = 21 yd3 Heaped Capacity = 31 yd3
Adjusted Capacity = Average of Struck and Heaped = 26.0 CCY

Description of Scraper Route (% grade,haul distance, etc.):

400 ft. average haul distance
0% Grade (Loaded)
3% Rolling Resisance

Cycle Time (3) =	0.5 min	+	0.4 min	+	0.7 min	+	0.4 min	=	2.0 min
	load time		loaded trip time		maneuver and spread time		return trip time		
Net Hourly Production =	26.0 yd3	x	60.0 min	/	2 min	x	0.83	=	647 LCY/hr
	adjusted capacity		hour		cycle time		efficiency factor		net hourly production
Hours Required (2) =	4,988 LCY	/	647 LCY / hr	=	8 hrs				
	volume to be handled (1)		net hourly production						

Data Sources:

1) Volume to be handled from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 12C
PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE -- GRADING

Earthmoving Activity:
Ripping road grades

Characterization of Grader Used (type, size capacity, etc.) (3)
Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):
Ripper width = 9.75'

Productivity Calculations:

Scarification:

Hourly (3)
Production = 1.25 mi / hr (work speed) x 9.75 ft (scarifier width) x 5,280 ft / mi x 1 ac / 43,560 ft2 /ac x 0.83 (work hour factor) = 1.23 ac / hr

Hours
Required (2) = 13 ac (1) / 1.23 ac / hr = 11 hrs

Data Sources
1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 12D
PRODUCTIVITY AND HOURS FOR MOTOR GRADER USE -- GRADING

Earthmoving Activity:

Finish Grading Areas to be Topsoiled

Characterization of Grader Used (type, size capacity, etc.) (3)

Caterpillar 16H

Description of Grader Route (push distance,% blade effective length, operating speed, etc.):

Effective Blad length = 13.9'
Width of Overlap = 2'

Productivity Calculations:

Contour Grading:

Hourly 3
Productivity = 3.4 mi / hr (speed) x 10 ft. (eff. blade width) x 5,280 ft. / mi x 1 ac / 43,560 ft2 /ac x

50 min / hr (work hour factor) x 0.90 (availability 4) = 185 ac / hr

Scarification:

Hourly (3)
Production = 1.5 mi / hr (work speed) x 11.9 ft (effective width) x 5,280 ft / mi x 1 ac / 43,560 ft2 /ac x

0.83 (work hour factor) = 1.80 ac / hr

Hours
Required (2) = 335 ac (1) / 1.80 ac / hr = 186 hrs

Data Sources

1) Acres from Worksheet 3
2) Hours required go to Worksheet 13
3) Caterpillar Performance Handbook, Edition 32

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 13G
SUMMARY CALCULATION OF EARTHMOVING COSTS - DOZERS

Project	Equip Type (1)	Ratio	Equipment Unit Costs ($/HR) (2)		Labor Costs ($/HR) (3)		Total Hours Required (4)		Total Cost ($)
Backfilling Ponds	D11R Dozer	100%	$ 236.70	+	$ 23.72	X	117	=	$30,497
Road Fills	D11R Dozer	100%	$ 236.70	+	$ 23.72	X	9	=	$2,386
Area 4 Regrade	D11R Dozer	100%	$ 236.70	+	$ 23.72	X	4,253	=	$1,107,684
							TOTAL COST	=	$1,140,568

Equipment and Accesory Identification

1) Caterpillar D11R with Universal Blade

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition. (see Table 12-B-23)
3) Labor Cost based on 2003 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 5

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 13H
SUMMARY CALCULATION OF EARTHMOVING COSTS - LOADERS

Activity	Equip Type (1)	Ratio	Equipment Unit Costs ($/HR) (2)	Labor Costs ($/HR) (3)	Total Hours Required (4)	Total Cost ($)
Area 4N Regrade						
	992G Loader	100%	$ 196.83 +	$ 23.72 X	2,126 =	$468,890
	16H Grader	50%	$ 69.40 +	$ 23.72 X	1,063 =	$98,988
	D9R Dozer	100%	$ 114.78 +	$ 23.72 X	2,126 =	$294,453
	Water Truck	50%	$ 108.83 +	$ 19.60 X	1,063 =	$136,514
Area 4N Topsoil						
	992G Loader	100%	$ 196.83 +	$ 23.72 X	237 =	$52,311
	16H Grader	50%	$ 69.40 +	$ 23.72 X	119 =	$11,043
	D9R Dozer	100%	$ 114.78 +	$ 23.72 X	237 =	$32,850
	Water Truck	50%	$ 108.83 +	$ 19.60 X	119 =	$15,230
Area 4N Mitigation						
	992G Loader	100%	$ 196.83 +	$ 23.72 X	36 =	$8,048
	16H Grader	50%	$ 69.40 +	$ 23.72 X	18 =	$1,699
	D9R Dozer	100%	$ 114.78 +	$ 23.72 X	36 =	$5,054
	Water Truck	50%	$ 108.83 +	$ 19.60 X	18 =	$2,343
Area 4N Concrete Disposal						
	992G Loader	100%	$ 196.83 +	$ 23.72 X	3 =	$732
	16H Grader	50%	$ 69.40 +	$ 23.72 X	2 =	$155
	D9R Dozer	100%	$ 114.78 +	$ 23.72 X	3 =	$460
	Water Truck	50%	$ 108.83 +	$ 19.60 X	2 =	$213
					TOTAL COST =	$1,128,985

Equipment and Accesory Identification

1) Caterpillar 992G Loader with standard 15 cubic yard bucket
Caterpillar 16H Grader, standard blade, road maintenance time = 1/2 loader time
Caterpillar D9R Dozer with Semi-Universal Blade time = loader time
10,000 gal. Water truck, road maintenance time = 1/2 loader time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition. (see Table 12-B-23)
3) Labor Cost based on 2003 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 8 and Note 1 above

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 13I
SUMMARY CALCULATION OF EARTHMOVING COSTS - TRUCKS

Activity	Equip Type (1)	Ratio	Equipment Unit Costs ($/HR) (2)		Labor Costs ($/HR) (3)		Total Hours Required (4)	Total Cost ($)
Concrete Disposal	777D Truck	100%	$ 149.50	+	$ 23.72	X	6	$1,024
Area 4N Regrade	777D Truck	100%	$ 149.50	+	$ 23.72	X	5,425	$939,661
Area 4N Topsoil	777D Truck	100%	$ 149.50	+	$ 23.72	X	1,067	$184,883
Area 4N Mitigation	777D Truck	100%	$ 149.50	+	$ 23.72	X	196	$33,929
							TOTAL COST =	$1,159,497

Equipment and Accesory Identification

1) Caterpillar 777D Dump Truck, mechanical drive, standard bed

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition. (see Table 12-B-23)
3) Labor Cost based on 2003 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 9

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 13J
SUMMARY CALCULATION OF EARTHMOVING COSTS - SCRAPERS

Activity	Equip Type (1)	Ratio	Equipment Unit Costs ($/HR) (2)		Labor Costs ($/HR) (3)		Total Hours Required (4)		Total Cost ($)
Area 4N Regrade									
	631G Scraper	100%	$ 133.10	+	$ 23.72	X	8	=	$1,208
	D10R Dozer	25%	$ 155.22	+	$ 23.72	X	2	=	$345
	16H Grader	13%	$ 69.40	+	$ 23.72	X	1	=	$90
	Water Truck	13%	$ 108.83	+	$ 19.60	X	1	=	$124
	631G Scraper	100%	$ 133.10	+	$ 23.72	X	0	=	$0
	D10R Dozer	25%	$ 155.22	+	$ 23.72	X	0	=	$0
	16H Grader	13%	$ 69.40	+	$ 23.72	X	0	=	$0
	Water Truck	13%	$ 108.83	+	$ 19.60	X	0	=	$0
	631G Scraper	100%	$ 133.10	+	$ 23.72	X	0	=	$0
	D10R Dozer	25%	$ 155.22	+	$ 23.72	X	0	=	$0
	16H Grader	13%	$ 69.40	+	$ 23.72	X	0	=	$0
	Water Truck	13%	$ 108.83	+	$ 19.60	X	0	=	$0
	631G Scraper	100%	$ 133.10	+	$ 23.72	X	0	=	$0
	D10R Dozer	25%	$ 155.22	+	$ 23.72	X	0	=	$0
	16H Grader	13%	$ 69.40	+	$ 23.72	X	0	=	$0
	Water Truck	13%	$ 108.83	+	$ 19.60	X	0	=	$0
									-
							TOTAL COST	=	$1,766

Equipment and Accesory Identification

1) Caterpillar 631G Scraper
Caterpillar D10R with Semi-Universal Blade, time = 1/4 scraper time
Caterpillar 16H Grader, standard blade, road maintenance time = 1/8 scraper time
10,000 Water truck, road maintenance time = 1/8 scraper time

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition. (see Table 12-B-23)
3) Labor Cost based on 2003 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 11 and Note 1 above

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 13K
SUMMARY CALCULATION OF EARTHMOVING COSTS - MOTOR GRADERS

Activity	Equip Type (1)	Ratio	Equipment Unit Costs ($/HR) (2)		Labor Costs ($/HR) (3)		Total Hours Required (4)		Total Cost ($)
Ripping Roads	16H Grader, ripping	100%	$ 71.11	+	$ 23.72	X	11	=	1,016
Finish Grade Areas	16H Grader	100%	$ 69.40	+	$ 23.72	X	186	=	17,364
to be Topsoiled									
							TOTAL COST	=	$18,380

Equipment and Accesory Identification

1) Caterpillar 16H Motor Grader with Ripper Blade

Data Sources:

2) PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition. (see Table 12-B-23)
3) Labor Cost based on 2003 contract with ACME Inc. (see Table 12-B-24)
4) Total Hours Required from Worksheet 12

Project	Navajo Mine
Date	November 2004

WORKSHEET NO. 14D
REVEGETATION COSTS

Name and Description of Areas to be Revegetated:
Area 4N

Description of Revegetation Activities

Reseeding plus 20% contingency for vegetation failure:

335 acres	x	($320.21	per acre	+	$1,318.29)	per acre	=	$658,389
(# of acres to be reseeded)		($/acre for seedbed preparation)			($/acre for seeding fertilizing, mulching, and irrigation)			costs for seeding

Reseeding 20% of permenent program lands that were revegged during or before 1999:

0 acres	x	($320.21	per acre	+	$1,318.29)	per acre	$0
(20% of PP reveg acres to be reseeded)		($/acre for seedbed preparation)			($/acre for seeding fertilizing, mulching, and irrigation)		costs for seeding

Other Revegetation Activity for this Area (e.g. Soil Sampling):

(Describe and provide cost estimate with documentation; use additional sheets if necessary).

TOTAL REVEGETATION COST FOR THIS A = $658,389

Data Sources:

Navajo Mine records for contractor planting costs
Seedbed Preparation includes discing and ripping, drill seeding, topsoil and spoil sampling
Irrigation costs are included with seeding, fertilizing and mulching costs

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 15D
OTHER RECLAMATION ACTIVITY COSTS
RIP RAP CHANNELS

Earthmoving Activity:

Rip-Rap for Channels and Drop Structures

Characterization of Drill Used:

Assumptions

See detailed calculations in Appendix 12-C

Calculation:

Area IVN: 79,295

ANFO @ 0.9 powder factor	=	0 bcy to be blasted	x	0.9 pounds per bcy	=	0 pounds ANFO
miscellaneous powder supplies @ 5%	=	0	x	5.0% factor	=	0 pounds ANFO

Data Sources: quotes received from ____________________

Project: Navajo Mine
Date: November 2004

WORKSHEET NO. 16
RECLAMATION BOND SUMMARY SHEET

			2004 Estimate
1	Total Facility and Structure Removal Costs	$745,442	
2	Total Earthmoving Costs	$3,449,196	
3	Total Revegetation Costs	$658,389	
4	Total Other Reclamation Activities Costs	$79,295	
5	Subtotal: Total Direct Costs		$4,932,322
6	Mobilization and Demobilization (at 1.0% of Item 5)	1.0%	$49,323
7	Contingencies (at 2.0% of Item 5)	2.0%	$98,646
8	Engineering Redesign Fee (at 1.8% of Item 5)	1.8%	$88,782
9	Contractor Profit and Overhead* (at 10.0% of Item 5)	15.0%	$739,848
10	Reclamation Management Fee (at 1.7% of Item 5)	3.9%	$192,361
	GRAND TOTAL BOND AMOUNT *(Sum of Items 5 through 10)*		**$6,101,283**

Project: Navajo Mine
Date: November 2004

TABLE 12-B-7
AREA IV NORTH BOND REGRADE EARTHMOVING
DOZERS

Cut Block	Total Volume cu. yds.	Permanent Program %	Permanent Volume cu. yds.	Fill Block	Centroid Distance ft.	Planned Adj. Distance ft.	Cut Elev. ft	Fill Elev. ft	Grade %	Comments
P1	1,742	100	1,742	P1	100	100	5440	5430	-10.00%	Centroid to Centroid
P1	184,036	100	184,036	P2	300	300	5440	5410	-10.00%	Centroid to Centroid
P2	1,197	100	1,197	P2	100	100	5435	5420	-15.00%	Centroid to Centroid
P3	1,327	100	1,327	P3	300	300	5370	5340	-10.00%	Centroid to Centroid
P3	262,230	100	262,230	P2	300	300	5450	5400	-16.67%	Centroid to Centroid
P3	212,000	100	212,000	P4	300	300	5450	5400	-16.67%	Centroid to Centroid
P4	234	100	234	P4	150	150	5430	5410	-13.33%	Centroid to Centroid
P5	2,804	100	2,804	P5	300	300	5420	5370	-16.67%	Centroid to Centroid
P5	721,074	100	721,074	P6	300	300	5430	5380	-16.67%	Centroid to Centroid
P6	710	100	710	P6	150	150	5350	5350	0.00%	Centroid to Centroid
P7	3,823	100	3,823	P7	100	100	5352	5350	-2.00%	Centroid to Centroid
P7	789,596	100	789,596	P8	300	300	5400	5350	-16.67%	Centroid to Centroid
P8	3,224	100	3,224	P8	150	150	5380	5370	-6.67%	Centroid to Centroid
P9	1,975	100	1,975	P9	150	150	5340	5335	-3.33%	Centroid to Centroid
P9	82,378	100	82,378	P10	300	300	5350	5320	-10.00%	Centroid to Centroid
P10	682	100	682	P10	300	300	5300	5280	-6.67%	Centroid to Centroid
P11	5,413	100	5,413	P11	300	300	5340	5290	-16.67%	Centroid to Centroid
P12	394	100	394	P12	300	300	5310	5270	-13.33%	Centroid to Centroid
P13	14,706	100	14,706	P13	300	300	5298	5310	4.00%	Centroid to Centroid
P13	15,662	100	15,662	P10	300	300	5290	5280	-3.33%	Centroid to Centroid
P14	2	100	2	P14	100	100	5300	5295	-5.00%	Centroid to Centroid
P15	20,477	100	20,477	P15	300	300	5360	5310	-16.67%	Centroid to Centroid
P15	358,935	100	358,935	P16	300	300	5340	5290	-16.67%	Centroid to Centroid
P16	242	100	242	P16	300	300	5310	5300	-3.33%	Centroid to Centroid
P17	8,565	100	8,565	P17	200	200	5320	5310	-5.00%	Centroid to Centroid
P17	2,885	100	2,885	P14	300	300	5320	5310	-3.33%	Centroid to Centroid
P18	638	100	638	P18	100	100	5295	5290	-5.00%	Centroid to Centroid
P19	3,732	100	3,732	P19	200	200	5310	5280	-15.00%	Centroid to Centroid
P19	400,000	100	400,000	P20	300	300	5330	5280	-16.67%	Centroid to Centroid
P20	2,817	100	2,817	P20	200	200	5320	5310	-5.00%	Centroid to Centroid
P21	4,553	100	4,553	P21	150	150	5350	5330	-13.33%	Centroid to Centroid
P22	1,137	100	1,137	P22	200	200	5300	5290	-5.00%	Centroid to Centroid
P22	199,744	100	199,744	P20	250	250	5300	5300	0.00%	Centroid to Centroid
P23	634	100	634	P23	150	150	5280	5290	6.67%	Centroid to Centroid
P24	1,974	100	1,974	P24	200	200	5310	5290	-10.00%	Centroid to Centroid
P24	98,807	100	98,807	P20	300	300	5310	5260	-16.67%	Centroid to Centroid
P25	1,291	100	1,291	P25	200	200	5320	5300	-10.00%	Centroid to Centroid
Total	3,411,640		3,411,640	Weighted Average		296			-14.90%	

Total yards go to Worksheet 3

(11/04; 7/05)

Project: Navajo Mine
Date: November 2004

TABLE 12-B-10
AREA IV NORTH BOND REGRADE EARTHMOVING
TRUCKS AND LOADER

Cut Block	Total Volume cu. yds.	Permanent Program %	Permanent Volume cu. yds.	Fill Block	Centroid Distance ft.	Planned Adj. Distance ft.	Cut Elev. ft	Fill Elev. ft	Grade %	Comments
P3	186556	100	186556	P4	544	3500	5506	5352	-4.40%	Adj. Dist. reflects haul route
P5	187,526	100	187,526	P4	1322	2322	5458	5352	-4.57%	Adj. Dist. reflects haul route
P5	200,000	100	200,000	P6	630	2630	5458	5352	-4.03%	Adj. Dist. reflects haul route
P5	119,324	100	119324	P8	2123	4077	5458	5290	-4.12%	Adj. Dist. reflects haul route
P7	100,000	100	100000	P8	3443	3443	5432	5290	-4.12%	Adj. Dist. reflects haul route
P9	258,684	100	258684	P8	1502	2502	5410	5290	-4.80%	Adj. Dist. reflects haul route
P11	494,435	100	494,435	P10	5814	5814	5374	5283	-1.57%	Adj. Dist. reflects haul route
P15	162,925	100	162,925	P10	6794	6794	5420	5283	-2.02%	Adj. Dist. reflects haul route
P15	231,725	100	231,725	P12	7437	7437	5420	5250	-2.29%	Adj. Dist. reflects haul route
P15	30,576	100	30,576	P14	7839	7839	5420	5290	-1.66%	Adj. Dist. reflects haul route
P19	118,258	100	118,258	P16	2506	3700	5462	5296	-4.49%	Adj. Dist. reflects haul route
P19	428,626	100	428,626	P20	2338	4500	5462	5260	-4.49%	Adj. Dist. reflects haul route
P25	57,042	100	57,042	P20	806	2300	5350	5260	-3.91%	Adj. Dist. reflects haul route
Total	2,575,677		2,575,677	Weighted Average		4,478			-3.5%	Adj. Dist. reflects haul route

Total yards go to Worksheet 3

Project: Navajo Mine
Date: November 2004

TABLE 12-B-13
AREA IV NORTH BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT
TRUCKS AND LOADER

Cut Block	Total Volume cu. yds.	Area acres	Perm. Topsoil Volume cu. yds.	Root Zone Volume cu. yds.	Fill Block	Centroid Distance ft.	Planned Adj. Distance ft.	Cut Elev. ft	Fill Elev. ft	Grade %	Comments
	2,848	3.7	2,848		P1	21802	21802	5,256	5,425	0.78%	Centroid to Centroid
	5,833	7.6	5,833		P2	21388	21388	5,256	5,429	0.81%	Centroid to Centroid
	7,833	10.2	7,833		P3	6888	6888	5,256	5,408	2.21%	Centroid to Centroid
	5,026	6.6	5,026		P4	7045	7045	5,256	5,420	2.33%	Centroid to Centroid
	13,441	17.5	13,441		P5	5790	5790	5,256	5,407	2.61%	Centroid to Centroid
	10,666	13.9	10,666		P6	5793	5793	5,256	5,397	2.43%	Centroid to Centroid
	12,931	16.9	12,931		P7	4093	4093	5,256	5,343	2.13%	Centroid to Centroid
	18,881	24.6	18,881		P8	3941	3941	5,256	5,364	2.74%	Centroid to Centroid
	5,936	7.7	5,936		P9	7467	7467	5,256	5,351	1.27%	Centroid to Centroid
	10,092	13.2	10,092		P10	2429	2429	5,256	5,344	3.62%	Centroid to Centroid
	8,784	11.5	8,784		P11	1269	1269	5,256	5,323	5.28%	Centroid to Centroid
	4,020	5.2	4,020		P12	6349	8879	5,400	5,330	-0.79%	Adjusted for Haul Route
	4,845	6.3	4,845		P13	6831	9211	5,400	5,320	-0.87%	Adjusted for Haul Route
	2,266	3.0	2,266		P14	6744	9211	5,400	5,290	-1.19%	Adjusted for Haul Route
	9,203	12.0	9,203		P15	6568	7956	5,400	5,302	-1.23%	Adjusted for Haul Route
	13,718	17.9	13,718		P16	6084	8090	5,400	5,300	-1.24%	Adjusted for Haul Route
	1,619	2.1	1,619		P17	6651	8669	5,400	5,339	-0.70%	Adjusted for Haul Route
	932	1.2	932		P18	6860	8297	5,400	5,290	-1.33%	Adjusted for Haul Route
	11,888	15.5	11,888		P19	6728	7960	5,400	5,315	-1.07%	Adjusted for Haul Route
	8,876	11.6	8,876		P20	7468	8693	5,400	5,360	-0.46%	Adjusted for Haul Route
	1,867	2.4	1,867		P21	7531	8739	5,400	5,320	-0.92%	Adjusted for Haul Route
	3,285	4.3	3,285		P22	7264	8671	5,400	5,293	-1.23%	Adjusted for Haul Route
	833	1.1	833		P23	7542	8959	5,400	5,285	-1.28%	Adjusted for Haul Route
	2,284	3.0	2,284		P24	7726	9079	5,400	5,293	-1.18%	Adjusted for Haul Route
	2,415	3.2	2,415		P25	8111	9413	5,400	5,300	-1.06%	Adjusted for Haul Route
	40,101	52.3	40,101		Additional Strip	7473	8884	5,400	5,330	-0.79%	Adjusted for Haul Route
	5,507	7.2	5,507		Haul Road (East)	7542	9141	5,400	5,279	-1.32%	Adjusted for Haul Route
	3,860	5.0	3,860		Haul Road (West)	9221	16142	5,400	5,440	0.25%	Adjusted for Haul Route
	2,622	3.4	2,622		Ancillary Road	8827	12572	5,400	5,390	-0.08%	Adjusted for Haul Route
	20,401	26.6	20,401		Coal Stockpile	11,117	17098	5,400	5,442	0.25%	Adjusted for Haul Route
	200	0.3	200		Powerlines	11,117	17098	5,400	5,390	-0.06%	Adjusted for Haul Route
	1,467	1.9	1,467		Pond 1	11,881	17679	5,400	5,376	-0.14%	Adjusted for Haul Route
	853	1.1	853		Pond 2	8,230	13994	5,400	5,320	-0.57%	Adjusted for Haul Route
	99	0.1	99		Pond 3	7,832	14078	5,400	5,330	-0.50%	Adjusted for Haul Route
	268	0.3	268		Pond 4	6,907	11009	5,400	5,267	-1.21%	Adjusted for Haul Route
	3,183	4.2	3,183		Pond 5	5,597	8148	5,400	5,266	-1.64%	Adjusted for Haul Route
	1,020	1.3	1,020		Pond 6*	7,519	10885	5,400	5,395	-0.05%	Adjusted for Haul Route
	2,516	3.3	2,516		Pond 7	6379	7099	5,400	5,264	-1.92%	Adjusted for Haul Route
TOTAL	252,419	329	252,419		Weighted Average:		8,514			0.61%	

Total yards and acres go to Worksheet 3

Assumption: 5.7 inches topsoil replacement depth Area IVN
Centroid distance is measured from the topsoil stockpile centroid to the polygon centroid
* Part of Pond 6 lies in the already accounted for disturbed pit area.

Project: Navajo Mine
Date: November 2004

TABLE 12-B-16
AREA IV NORTH BOND RECLAMATION MITIGATION MATERIAL MOVEMENT
TRUCKS AND LOADER

Cut Block	Total Volume cu. yds.	Area acres	Topsoil Volume cu. yds.	Perm. Root Zone Volume cu. yds.	Fill Block	Centroid Distance ft.	Planned Adj. Distance ft.	Cut Elev. ft	Fill Elev. ft	Grade %	Comments
	423	0.07	2,848	423	P1	9146	15501	5,400	5,429	0.19%	Adj. Dist. reflects haul route
	866	0.15	5,633	866	P2	9262	15414	5,400	5,426	0.17%	Adj. Dist. reflects haul route
	1,168	0.21	7,833	1,168	P3	8586	14801	5,400	5,386	-0.09%	Adj. Dist. reflects haul route
	746	0.13	5,026	746	P4	9019	14822	5,400	5,418	0.12%	Adj. Dist. reflects haul route
	1,995	0.35	13,441	1,995	P5	7814	13686	5,400	5,410	0.07%	Adj. Dist. reflects haul route
	1,583	0.28	10,666	1,583	P6	8189	13653	5,400	5,399	-0.01%	Adj. Dist. reflects haul route
	1,919	0.34	12,931	1,919	P7	8889	11995	5,400	5,324	-0.63%	Adj. Dist. reflects haul route
	2,803	0.49	18,881	2,803	P8	7136	11773	5,400	5,370	-0.25%	Adj. Dist. reflects haul route
	881	0.15	5,936	881	P9	6233	10359	5,400	5,350	-0.48%	Adj. Dist. reflects haul route
	1,498	0.26	10,092	1,498	P10	6564	10174	5,400	5,285	-1.13%	Adj. Dist. reflects haul route
	1,304	0.23	8,784	1,304	P11	5914	8982	5,400	5,323	-0.86%	Adj. Dist. reflects haul route
	597	0.10	4,020	597	P12	6349	8879	5,400	5,330	-0.79%	Adj. Dist. reflects haul route
	719	0.13	4,845	719	P13	6831	9211	5,400	5,320	-0.87%	Adj. Dist. reflects haul route
	336	0.06	2,266	336	P14	6744	9211	5,400	5,290	-1.19%	Adj. Dist. reflects haul route
	1,367	0.24	9,203	1,367	P15	6568	7956	5,400	5,302	-1.23%	Adj. Dist. reflects haul route
	2,036	0.36	13,718	2,036	P16	6084	8090	5,400	5,300	-1.24%	Adj. Dist. reflects haul route
	240	0.04	1,619	240	P17	6651	8669	5,400	5,339	-0.70%	Adj. Dist. reflects haul route
	138	0.02	932	138	P18	6860	8297	5,400	5,290	-1.33%	Adj. Dist. reflects haul route
	1,764	0.31	11,866	1,764	P19	6728	7960	5,400	5,315	-1.07%	Adj. Dist. reflects haul route
	1,317	0.23	8,876	1,317	P20	7468	8693	5,400	5,360	-0.46%	Adj. Dist. reflects haul route
	277	0.05	1,867	277	P21	7531	8739	5,400	5,320	-0.92%	Adj. Dist. reflects haul route
	488	0.09	3,285	488	P22	7264	8671	5,400	5,293	-1.23%	Adj. Dist. reflects haul route
	124	0.02	833	124	P23	7542	8959	5,400	5,285	-1.28%	Adj. Dist. reflects haul route
	339	0.06	2,284	339	P24	7726	9079	5,400	5,293	-1.18%	Adj. Dist. reflects haul route
	358	0.06	2,415	358	P25	8111	9413	5,400	5,300	-1.06%	Adj. Dist. reflects haul route
	5,952	1.05	40,101	5,952	Additional Strip	7473	8884	5,400	5,330	-0.79%	Adj. Dist. reflects haul route
	817	0.14	5,507	817	Haul Road (East)	7542	9141	5,400	5,279	-1.32%	Adj. Dist. reflects haul route
	573	0.10	3,860	573	Haul Road (West)	9221	16142	5,400	5,440	0.25%	Adj. Dist. reflects haul route
	389	0.07	2,622	389	Ancillary Road	8827	12572	5,400	5,390	-0.08%	Adj. Dist. reflects haul route
	3,623	0.64	20,401	3,623	Coal Stockpile	11,117	17098	5,400	5,442	0.25%	Adj. Dist. reflects haul route
	30	0.01	200	30	Powerlines	11,117	17098	5,400	5,390	-0.06%	Adj. Dist. reflects haul route
	218	0.04	1,467	218	Pond 1	11,881	17879	5,400	5,376	-0.14%	Adj. Dist. reflects haul route
	127	0.02	853	127	Pond 2	8,230	13994	5,400	5,320	-0.57%	Adj. Dist. reflects haul route
	15	0.00	99	15	Pond 3	7,832	14078	5,400	5,330	-0.50%	Adj. Dist. reflects haul route
	40	0.01	268	40	Pond 4	6,907	11009	5,400	5,267	-1.21%	Adj. Dist. reflects haul route
	472	0.08	3,183	472	Pond 5	5,597	6148	5,400	5,266	-1.64%	Adj. Dist. reflects haul route
	151	0.03	1,020	151	Pond 6*	7,519	10,885	5,400	5,395	-0.05%	Adj. Dist. reflects haul route
	373	0.07	2,516	373	Pond 7	6379	7099	5,400	5,264	-1.92%	Adj. Dist. reflects haul route
	648	0.11	252,419	648	Topdressing Stockpile	5312	6354	5,400	5,256	-1.72%	Adj. Dist. reflects haul route
TOTAL	38,713	7		38,713	Weighted Average		11,141			-0.59%	

Total yards go to Worksheet 3

Assumptions:

2% of all reclaim acres require mitigation
4 feet total of mitigation and topsoil
5.7 Inches of topsoil to be replaced in Area IVN
* Part of Pond 6 lies in the already accounted for disturbed pit area.

Project: Navajo Mine
Date: November 2004

TABLE 12-B-21
AREA IV NORTH BOND RECLAMATION TOPSOIL MATERIAL MOVEMENT
SCRAPERS

Cut Block	Total Topsoil Volume cu. yds.	Area acres	Perm. Topsoil Volume cu. yds.	Root Zone Volume cu. yds.	Fill Block	Centroid Distance ft.	Planned Adj. Distance ft.	Cut Elev. ft	Fill Elev. ft	Grade %	Comments
	4,368	5.5	4,368		Topdressing Stockpile	0	400	5,256	5,256	0%	
TOTAL	4,368	5	4,368		Weighted Average:		400			0.00%	

Total yards and acres go to Worksheet 3

Assumption: 5.7 inches topsoil replacement depth Area IVN
Centroid distance is measured from the topsoil stockpile centroid to the polygon centroid

Project : Navajo Mine
Date: November 2004

TABLE 12-B-23
EQUIPMENT OWNERSHIP AND OPERATING COSTS

Equipment Model		Ownership Costs ($/hr)		Overhaul Costs ($/hr)			Field Repair and Fuel Costs ($/hr)									2004 Total ($/hr)
		Depr.	Adj Depr	Labor	Adj. Labor	O/H Parts	Labor	Adj. Labor	Parts	Fuel	Fuel Multiplier	Adj. Fuel	Lube	Tires	GEC (2)	
D9R Dozer	Semi-U Blade	$ 24.39	$ 20.33	$ 6.88	$ 5.40	$ 18.38	$ 8.08	$ 6.33	$ 17.90	$ 21.67	1.700	$ 36.84	$ 6.63	$ -	$ 2.98	$ 114.78
D10R Dozer	Semi-U Blade	$ 34.24	$ 28.53	$ 6.88	$ 5.40	$ 25.53	$ 8.06	$ 6.33	$ 24.87	$ 30.12	1.700	$ 51.20	$ 9.21	$ -	$ 4.14	$ 155.22
D11R Dozer	U Blade	$ 55.27	$ 46.06	$ 6.88	$ 5.40	$ 41.22	$ 8.06	$ 6.33	$ 40.15	$ 44.92	1.700	$ 76.36	$ 14.49	$ -	$ 6.69	$ 236.70
631G Scraper		$ 25.01	$ 20.84	$ 6.72	$ 5.28	$ 18.33	$ 10.07	$ 7.91	$ 18.19	$ 28.12	1.700	$ 47.80	$ 8.77	$ 5.21	$ 0.77	$ 133.10
992G Loader		$ 67.59	$ 58.33	$ 4.20	$ 3.30	$ 14.26	$ 5.12	$ 4.02	$ 15.73	$ 38.66	1.700	$ 65.72	$ 12.77	$ 22.57	$ 2.14	$ 196.83
777D Truck		$ 42.09	$ 35.08	$ 16.06	$ 12.61	$ 14.58	$ 9.86	$ 7.74	$ 9.00	$ 27.20	1.700	$ 46.24	$ 10.54	$ 13.72	$ -	$ 149.50
16H Grader		$ 18.42	$ 15.35	$ 3.02	$ 2.37	$ 8.57	$ 2.52	$ 1.98	$ 8.31	$ 13.29	1.700	$ 22.59	$ 4.25	$ 5.29	$ 0.69	$ 69.40
Water Truck	10,000 gal	$ 28.40	$ 23.67	$ 5.76	$ 4.52	$ 5.71	$ 13.97	$ 10.97	$ 11.01	$ 22.25	1.700	$ 37.83	$ 5.81	$ 9.32	$ -	$ 108.83
Small Backhoe	Cat 446B	$ 6.11	$ 5.09	$ 2.10	$ 1.65	$ 2.25	$ 2.77	$ 2.17	$ 1.99	$ 5.99	1.700	$ 10.18	$ 1.52	$ 1.62	$ 0.28	$ 26.76
16H Grader, ripping		$ 19.21	$ 16.01	$ 3.05	$ 2.39	$ 8.78	$ 2.72	$ 2.14	$ 8.67	$ 13.29	1.700	$ 22.59	$ 4.32	$ 5.29	$ 0.92	$ 71.11
Pickup Truck		$ 2.40	$ 2.00	$ 0.47	$ 0.37	$ 0.48	$ 0.59	$ 0.46	$ 0.47	$ 3.88	1.700	$ 6.60	$ 0.52	$ 0.36	$ -	$ 11.26
Mechanic truck		$ 3.19	$ 2.66	$ 0.47	$ 0.37	$ 0.64	$ 0.59	$ 0.46	$ 0.62	$ 2.26	1.700	$ 3.84	$ 0.41	$ 0.48	$ -	$ 9.48

The Total $/hr are used in Worksheet 13

1) CRG - PRIMEDIA Equipmentwatch, "Cost Reference Guide for Construction Equipment," 2004 edition.
2) GEC - Ground Engaging Components
Multipliers are calculated as follows:

Depreciation:	Assume two shifts per day		
	Assume 90% availability on all equipment		0.83
Labor - Heavy Equipment Mechanic: Field Repair and Fuel Costs			
((0.08)(CRG Wages) + Local Wages) / CRG Wages			
	CFG Wages	$35.46 /hr	
	Local Wages	$25.00 /hr	
			0.79
Parts:	No adjustment		1.00
Fuel (Diesel):	CFG Cost	$1.51 /gal	
	Navajo Fuel Tax	$0.19 /gal	
			1.70
Lube:	No adjustment		1.00
Tires:	No adjustment		1.00
GEC:	No adjustment		1.00

APPENDIX 12-E

Permanent Impoundments

APPENDIX 12-E

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TOPIC	PAGE NO.

Permanent Impoundments:

LOWE PERMANENT IMPOUNDMENT #1

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INTRODUCTION

Lowe Permanent Impoundment 1 is proposed as a 9.67 acre-foot permanent impoundment replacing the temporary impoundment Lowe Hole 3 Pond 1, see Exhibit 11-13D (Area II Impoundment and Pond Locations/Watershed Areas) and Exhibit 11-13E (Area III Impoundment and Pond Locations/Watershed Areas). Lowe Hole 3 Pond 1 was established in 1997 within the BHP Navajo Coal Company (BNCC) permanent program reclamation lands. BNCC intends to utilize Lowe Permanent Impoundment 1 as one of the eight (8), NM-0003E permanent impoundments to facilitate the post-mining livestock and wildlife resources. Please refer to Section 12.3.4, Reclamation of Surface Water Controls for impoundment location and watershed information and Exhibit 12-43, for design specific construction details.

This information is specific to Lowe Permanent Impoundment 1. Slope stability, hydrology methodology, and analytical data are found on the following pages. Typical design, construction and reclamation information is available in the Reclamation Surface Stabilization Handbook for Navajo Coal Company.

SITE DESCRIPTION

LAND USE

Lowe Permanent Impoundment 1 has an 825.6-acre drainage area and is located in a tributary to the Lowe Arroyo. The watershed is classified as 99.3 % undisturbed lands and 0.7 % permanent program reclaimed land. Lowe Permanent Impoundment 1 will benefit the permitted post-mining land use of livestock grazing by providing a year-round water source.

DESIGN ANALYSIS

GENERAL

Lowe Permanent Impoundment 1 was designed under the supervision of a Registered Professional Engineer from Navajo Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and includes a review of available project files. The most current information contained in the Navajo Coal

Company files includes topographic maps developed from aerial photography flown in 2000 for Navajo Coal Company and used in analysis of the structure.

STABILITY

Lowe Permanent Impoundment 1 is completely incised and does not incorporate an embankment. All regraded (incised) side slopes are designed to a general 5:1 (horizontal to vertical) slope when possible (approximately 50%) and are no greater than a 3.5:1 slope. Given the side slopes are flatter than the recommended final reclamation slopes, the slopes will be stable.

WATER PERSISTENCE

The watershed draining into Lowe Permanent Impoundment 1 consists of undisturbed (820.2 acres) and reclaimed lands (5.4 acres). A total of 825.6 acres drains into this impoundment, this has resulted in standing water occurring in the pond all year. Lowe Permanent Impoundment 1 will be incised into spoil material with 5.03×10^{-7} cm/sec. permeability rates (Appendix 11-K) allowing negligible loss due to infiltration. Predictive water depths range from approximately 6 to 8 feet, with respective volumes of 6.45 to 9.67 acre-feet.

The temporary impoundment has retained water since being established in 1997, demonstrating that the impoundment will provide a persistent water source.

WATER QUALITY

Water contained in Lowe Permanent Impoundment 1 will originate from the surface water runoff of undisturbed and reclaimed lands. Given that the top four feet of all reclaimed lands (either a combination of spoil and topsoil or all topsoil) does not contain material that could adversely affect the quality of the surface runoff, BNCC does not anticipate water quality issues in Lowe Permanent Impoundment 1. Testing to-date indicates that none of the livestock standards for potentially toxic constituents has been exceeded. The only standard exceeded during testing was the pH level, and this was only periodically. To substantiate this, four full suite water quality analyses have been performed on water samples collected from Lowe Permanent Impoundment 1 and presented in Table 1. In addition, a comparison of chemical constituents with respect to federal livestock drinking water standards is included in Table 1. Based on the above-referenced chemical analysis, the water in Lowe Permanent Impoundment 1 is well suited for its intended use as a livestock and wildlife impoundment.

TABLE 1
Navajo Coal Company
Lowe Hole 3 Pond - Water Quality Statistics

		Quality Data for Reservoir Station				Livestock Standard CL609[a]
Sample Date		4/5/2000	6/15/2000	8/22/2000	12/4/2000	
pH (Lab)	(S.U.)	8.29	8.79	8.54	8.05	6.0-8.0
TDS (180 deg C)	(mg/l)	1150	1360	1620	1490	2000-4000
Boron	(mg/l)	0.1	0.2	0.2	0.2	NA
Fluoride	(mg/l)	1.2	1.3	1.6	1.2	2
Major Ions						
Bicarbonate as HCO3	(mg/l)	150	119	138	188	NA
Carbonate as CO3	(mg/l)	-10	14	14	-10	NA
Hydroxide as OH	(mg/l)	-10	-10	-10	-10	NA
Chloride	(mg/l)	40	52	66	56	NA
Sulfate	(mg/l)	620	820	1000	860	1000
Calcium	(mg/l)	61	54	50	60	NA
Magnesium	(mg/l)	10	13	15	13	NA
Potassium	(mg/l)	6.8	11	8.2	6.6	NA
Sodium	(mg/l)	260	380	450	400	4,999
Major Cations	(meq/l)	15.35	20.57	23.51	21.63	NA
Major Anions	(meq/l)	16.5	20.96	25.41	22.57	NA
Charge Balance	(percent)	3.6	0.92	3.88	2.12	NA
Lab Determined Ion Balance	(percent)	4.55	0.8	3.92	2.56	NA
Trace Metals (Dissolved)						
Aluminum	(mg/l)	N	N	N	-0.083	5
Arsenic	(mg/l)	N	-0.005	N	N	0.2
Cadmium	(mg/l)	N	-0.005	N	N	0.05
Chromium	(mg/l)	N	-0.01	N	N	1
Cobalt	(mg/l)	N	N	N	N	1
Copper	(mg/l)	N	-0.01	N	N	0.5
Iron	(mg/l)	-0.05	-0.05	-0.05	-0.05	no limit
Lead	(mg/l)	N	-0.002	N	N	0.1
Manganese	(mg/l)	-0.01	-0.01	0.09	0.06	no limit
Mercury	(mg/l)	N	-0.0002	N	N	0.001
Selenium	(mg/l)	-0.025	-0.005	0.006	-0.005	0.05
Zinc	(mg/l)	N	-0.05	N	N	0.01
Trace Metals (Total)						
Total Iron	(mg/l)	0.26	0.57	0.25	0.83	NA
Total Manganese	(mg/l)	0.01	0.01	0.17	0.1	NA

Note: N = No Trace

a. CL609 Cooperative Extension System, 1995. Analysis of Water Quality for Livestock. Cattle Producers Library

DIMINUTION OF ADJACENT WATER QUANTITY AND QUALITY

No pre-existing ponds or wells have been documented adjacent or immediately downstream of Lowe Permanent Impoundment 1. Additionally, the 825.6 acres draining into the impoundment comprise of only 11.7% of the total Lowe Arroyo watershed system. Furthermore, Lowe Permanent Impoundment 1 is a pass-through structure retaining less than 10 acre-feet of capacity. Diminution of adjacent water quantity and quality is negligible.

HYDROLOGY / HYDRAULICS

Hydrologic analysis was completed using SEDCAD 4 software (see attached report). Lowe Permanent Impoundment 1 is classified as a Class A, low hazard structure. Inlet and outlet structures were designed to remain stable during a 25 year-6 hour precipitation event at peak discharge. Riprap material is placed at the pond inlets as protective lining to minimize erosion. Inlet and outlet structures were designed to safely contain a 100 year-6 hour storm event at peak discharge.

The following hydrology parameters were used in the hydrologic analysis:

Storm Type	NRCS Type II-60
Design Storm / Rainfall Depth	25 year – 6 hour / 1.60 inches
Design Storm / Rainfall Depth	100 year – 6 hour / 2.00 inches
Watershed Area	825.6 acres

The following impoundment parameters were used as in the hydrologic analysis in the 25 year-6 hour storm event:

Peak Flow	320.72 cubic feet per second
Peak Volume	46.13 acre-feet
Initial Elevation	5342.00 feet
Peak Elevation	5344.54 feet
Free Board	2.54 feet
Dewater time	0.62 days

IMPOUNDMENT SUITABILITY

Lowe Permanent Impoundment 1 was designed for future use as a livestock and wildlife resource. Design considerations of this impoundment include an adequate watershed insuring water persistence and quality with no diminution of adjacent or downstream land users. Additionally, the impoundments 9.67 acre-feet of capacity, shallow design and irregular outline provide livestock and wildlife suitability.

Lowe Permanent Impoundment #1

The Lowe Arroyo post-mine hydrology model was used to determine the peak flows. Refer to Exhibit 11-77 for the Sedcad hydrology model. Structure 14 represents the impoundment.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

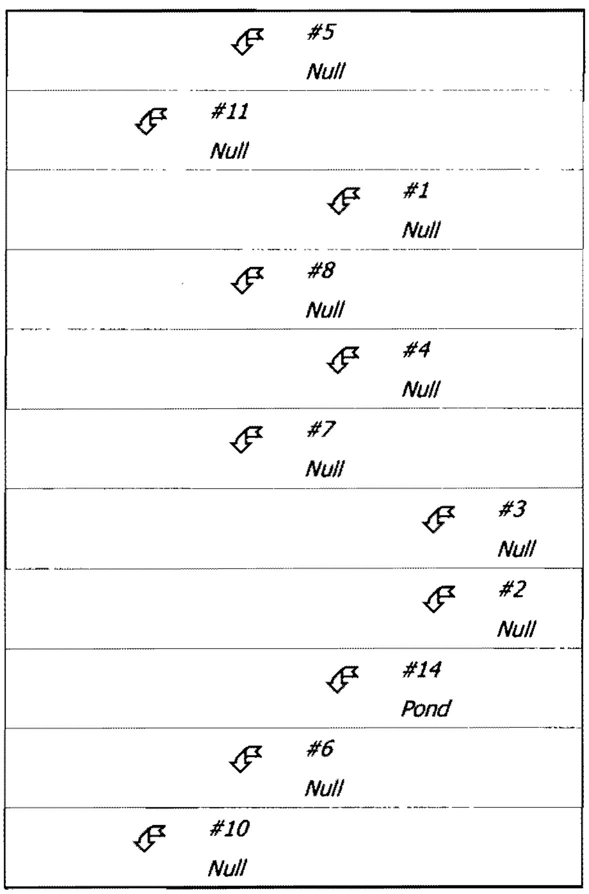
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#8	0.419	0.337	
Null	#2	==>	#14	0.052	0.343	North Inlet
Null	#3	==>	#14	0.000	0.453	East Inlet
Null	#4	==>	#7	0.517	0.328	
Null	#5	==>	#11	5.868	0.239	
Null	#6	==>	#10	0.469	0.325	
Null	#7	==>	#10	0.469	0.325	
Null	#8	==>	#10	0.274	0.337	
Null	#9	==>	#12	0.000	0.000	
Null	#10	==>	#12	0.000	0.000	
Null	#11	==>	#12	0.000	0.000	
Null	#12	==>	#13	1.302	0.306	
Null	#13	==>	End	0.000	0.000	
Pond	#14	==>	#6	0.365	0.327	Lowe Permanent Impoundment #1



#9 Null
#12 Null
#13 Null

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.38	73.00	5,307.00	3.51	0.419
#1	**Muskingum K:**					**0.419**
#2	8. Large gullies, diversions, and low flowing streams	1.55	11.00	710.00	3.73	0.052
#2	**Muskingum K:**					**0.052**
#3	8. Large gullies, diversions, and low flowing streams	30.00	3.00	10.00	16.43	0.000
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	1.16	70.00	6,012.00	3.23	0.517
#4	**Muskingum K:**					**0.517**
#5	5. Nearly bare and untilled, and alluvial valley fans	0.33	38.00	11,449.23	0.57	5.579
	8. Large gullies, diversions, and low flowing streams	1.92	83.00	4,330.00	4.15	0.289
#5	**Muskingum K:**					**5.868**
#6	8. Large gullies, diversions, and low flowing streams	1.12	60.00	5,360.01	3.17	0.469
#6	**Muskingum K:**					**0.469**
#7	8. Large gullies, diversions, and low flowing streams	1.12	60.00	5,360.00	3.17	0.469
#7	**Muskingum K:**					**0.469**
#8	8. Large gullies, diversions, and low flowing streams	1.38	48.00	3,479.00	3.52	0.274
#8	**Muskingum K:**					**0.274**
#12	8. Large gullies, diversions, and low flowing streams	0.81	102.00	12,617.00	2.69	1.302
#12	**Muskingum K:**					**1.302**
#14	8. Large gullies, diversions, and low flowing streams	1.14	48.00	4,214.00	3.20	0.365
#14	**Muskingum K:**					**0.365**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#5		386.400	386.400	83.16	17.31
#11		1,459.300	1,845.700	199.75	84.72
#1		384.000	384.000	82.66	14.90
#8		224.900	608.900	150.02	24.61
#4		1,417.400	1,417.400	420.23	76.93
#7		669.200	2,086.600	564.56	109.89
#3		825.600	825.600	320.72	46.13
#2		798.200	798.200	147.88	30.91
#14	In	0.000	1,623.800	438.72	77.04
	Out			408.35	77.04
#6		131.700	1,755.500	414.50	81.60
#10		208.400	4,659.400	1,068.16	230.83
#9		541.300	541.300	340.11	39.46
#12		0.000	7,046.400	1,347.54	355.02
#13		808.700	7,855.101	1,334.40	405.34

Structure Detail:

Structure #5 (Null)

Structure #11 (Null)

Structure #1 (Null)

Structure #8 (Null)

Structure #4 (Null)

Structure #7 (Null)

Structure #3 (Null)

East Inlet

Structure #2 (Null)

North Inlet

Structure #14 (Pond)

Lowe Permanent Impoundment #1

Pond Inputs:

Initial Pool Elev:	5,342.50
Initial Pool:	7.08 ac-ft

Pond Results:

Peak Elevation:	5,344.95
Dewater Time:	0.64 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
5,334.20	0.000	0.000	0.000	
5,334.21	0.001	0.000	0.000	
5,335.00	0.070	0.020	0.000	
5,335.20	0.094	0.037	0.000	
5,336.00	0.210	0.155	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,336.20	0.252	0.202	0.000		
5,337.00	0.440	0.475	0.000		
5,337.20	0.496	0.568	0.000		
5,338.00	0.740	1.059	0.000		
5,338.20	0.788	1.212	0.000		
5,339.00	0.990	1.922	0.000		
5,339.20	1.041	2.125	0.000		
5,340.00	1.250	3.040	0.000		
5,340.20	1.303	3.295	0.000		
5,341.00	1.520	4.423	0.000		
5,341.20	1.583	4.734	0.000		
5,342.00	1.840	6.101	0.000		
5,342.20	1.931	6.478	0.000		
5,342.50	2.070	7.078	0.000		
5,343.00	2.210	8.148	23.100	11.00	
5,343.20	2.294	8.599	50.667	0.95	
5,344.00	2.640	10.570	160.800	2.45	
5,344.20	2.749	11.110	212.851	0.30	
5,344.95	3.173	13.344	408.347	0.60	Peak Stage
5,345.00	3.200	13.487	420.800		
5,345.20	3.312	14.138	500.438		
5,346.00	3.770	16.968	818.600		

Detailed Discharge Table

Elevation	User-input discharge (cfs)	Combined Total Discharge (cfs)
5,334.20	0.000	0.000
5,334.21	0.000	0.000
5,335.00	0.000	0.000
5,335.20	0.000	0.000
5,336.00	0.000	0.000
5,336.20	0.000	0.000
5,337.00	0.000	0.000
5,337.20	0.000	0.000
5,338.00	0.000	0.000
5,338.20	0.000	0.000
5,339.00	0.000	0.000

Elevation	User-input discharge (cfs)	Combined Total Discharge (cfs)
5,339.20	0.000	0.000
5,340.00	0.000	0.000
5,340.20	0.000	0.000
5,341.00	0.000	0.000
5,341.20	0.000	0.000
5,342.00	0.000	0.000
5,342.20	0.000	0.000
5,342.50	0.000	0.000
5,343.00	23.100	23.100
5,343.20	50.667	50.667
5,344.00	160.800	160.800
5,344.20	212.851	212.851
5,345.00	420.800	420.800
5,345.20	500.438	500.438
5,346.00	818.600	818.600

Structure #6 (Null)

Structure #10 (Null)

Structure #9 (Null)

Structure #12 (Null)

Structure #13 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	87.500	0.590	1.287	0.200	91.500	M	56.22	6.224
	2	298.900	1.434	0.000	0.000	83.200	M	51.84	11.084
	Σ	**386.400**						**83.16**	**17.307**
#11	1	412.100	2.888	0.734	0.325	84.300	M	46.24	16.747
	2	221.700	1.474	0.639	0.330	88.400	M	59.55	12.474
	3	446.000	1.668	0.377	0.347	84.900	M	80.77	19.036
	4	379.500	1.000	0.000	0.000	87.000	M	119.66	19.153
	Σ	**1,845.700**						**199.75**	**84.717**
#1	1	293.800	1.413	0.000	0.000	81.200	M	42.47	9.168
	2	90.200	0.263	0.000	0.000	90.000	M	74.49	5.733
	Σ	**384.000**						**82.66**	**14.900**
#8	1	87.100	0.557	0.211	0.323	83.200	M	28.46	3.230
	2	137.800	0.553	0.000	0.000	86.100	M	58.80	6.477
	Σ	**608.900**						**150.02**	**24.608**
#4	1	470.600	1.256	0.387	0.350	87.000	M	126.21	23.751
	2	166.700	1.396	0.534	0.354	81.100	M	24.07	5.156
	3	66.500	0.818	0.534	0.354	82.600	M	16.05	2.344
	4	96.300	0.766	0.389	0.341	90.200	M	47.35	6.214
	5	54.100	0.199	0.389	0.341	93.000	M	59.34	4.301
	6	112.200	0.398	0.332	0.342	92.700	M	96.70	8.725
	7	56.900	0.238	0.183	0.333	93.000	M	59.95	4.524
	8	89.500	0.413	0.183	0.333	91.900	M	71.59	6.558
	9	226.200	0.610	0.000	0.000	87.500	M	102.54	11.871
	10	78.400	0.397	0.000	0.000	85.400	M	37.84	3.484
	Σ	**1,417.400**						**420.23**	**76.927**
#7	1	388.800	1.318	0.089	0.330	86.100	M	93.13	18.276
	2	207.300	1.094	0.089	0.330	86.900	M	60.86	10.381
	3	73.100	0.360	0.000	0.000	89.000	M	49.72	4.306
	Σ	**2,086.600**						**564.56**	**109.890**
#3	1	256.900	2.055	0.510	0.336	83.500	M	34.98	9.769
	2	138.800	0.315	0.510	0.336	89.900	M	106.86	8.755
	3	54.800	0.221	0.510	0.336	93.000	M	58.85	4.357
	4	98.200	0.277	0.176	0.362	89.900	M	79.20	6.194
	5	111.900	0.466	0.176	0.362	92.700	M	89.73	8.701

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	6	37.900	0.159	0.418	0.309	93.000	M	43.46	3.013
	7	127.100	0.386	0.000	0.000	84.700	M	58.62	5.337
	Σ	**825.600**						**320.72**	**46.128**
#2	1	549.100	2.696	0.436	0.369	80.300	M	44.78	15.806
	2	191.400	0.472	0.000	0.000	88.300	M	107.38	10.686
	3	57.700	0.205	0.000	0.000	92.500	M	60.83	4.421
	Σ	**798.200**						**147.88**	**30.913**
#14	Σ	**1,623.800**						**438.72**	**77.041**
#6	1	131.700	0.434	0.000	0.000	82.400	M	46.30	4.562
	Σ	**1,755.500**						**414.50**	**81.603**
#10	1	179.300	0.676	0.000	0.000	91.200	M	103.47	12.471
	2	29.100	0.311	0.000	0.000	92.700	M	27.57	2.263
	Σ	**4,659.400**						**1,068.16**	**230.835**
#9	1	274.600	0.559	0.179	0.345	90.600	M	169.32	18.260
	2	266.700	0.484	0.000	0.000	93.000	M	214.67	21.204
	Σ	**541.300**						**340.11**	**39.463**
#12	Σ	**7,046.400**						**1,347.54**	**355.016**
#13	1	130.600	0.245	1.141	0.305	91.800	M	125.71	9.499
	2	101.000	0.160	1.048	0.302	92.300	M	111.02	7.624
	3	133.900	0.165	0.948	0.300	90.500	M	131.32	8.837
	4	443.200	1.345	0.000	0.000	88.100	M	124.25	24.367
	Σ	**7,855.101**						**1,334.40**	**405.343**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.14	50.00	4,385.00	1.060	1.149
		8. Large gullies, diversions, and low flowing streams	3.18	162.00	5,088.00	5.350	0.264
#1	**1**	**Time of Concentration:**					**1.413**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.30	10.00	434.00	1.510	0.079
		8. Large gullies, diversions, and low flowing streams	3.70	142.00	3,834.00	5.770	0.184
#1	**2**	**Time of Concentration:**					**0.263**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.00	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.00	3.300	0.193
#2	**1**	**Time of Concentration:**					**2.696**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.97	23.00	580.00	1.990	0.080
		8. Large gullies, diversions, and low flowing streams	2.60	178.00	6,838.00	4.840	0.392
#2	**2**	**Time of Concentration:**					**0.472**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	13.68	45.00	329.00	3.690	0.024
		8. Large gullies, diversions, and low flowing streams	3.12	108.00	3,466.00	5.290	0.181
#2	**3**	**Time of Concentration:**					**0.205**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.00	0.890	1.809
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.00	5.450	0.246
#3	**1**	**Time of Concentration:**					**2.055**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.00	2.220	0.190
		8. Large gullies, diversions, and low flowing streams	2.98	70.00	2,345.00	5.180	0.125
#3	**2**	**Time of Concentration:**					**0.315**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	6.42	83.00	1,293.00	2.530	0.141
		8. Large gullies, diversions, and low flowing streams	3.21	50.00	1,559.00	5.370	0.080
#3	**3**	**Time of Concentration:**					**0.221**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	8.98	60.00	668.00	2.990	0.062
		8. Large gullies, diversions, and low flowing streams	2.82	110.00	3,900.00	5.030	0.215
#3	**4**	**Time of Concentration:**					**0.277**
#3	5	5. Nearly bare and untilled, and alluvial valley fans	4.11	50.00	1,216.00	2.020	0.167
		8. Large gullies, diversions, and low flowing streams	1.86	82.00	4,404.00	4.090	0.299
#3	**5**	**Time of Concentration:**					**0.466**
#3	6	5. Nearly bare and untilled, and alluvial valley fans	9.01	53.00	588.00	3.000	0.054
		8. Large gullies, diversions, and low flowing streams	1.64	24.00	1,463.00	3.840	0.105
#3	**6**	**Time of Concentration:**					**0.159**
#3	7	5. Nearly bare and untilled, and alluvial valley fans	3.83	50.00	1,304.00	1.950	0.185

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.42	37.00	2,598.00	3.580	0.201
#3	**7**	**Time of Concentration:**					**0.386**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.256**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.00	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.00	6.070	0.102
#4	**2**	**Time of Concentration:**					**1.396**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.00	0.960	0.717
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.00	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.818**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.00	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.00	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.766**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.00	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.199**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.398**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.00	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.238**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	3.98	30.00	754.00	1.990	0.105
		8. Large gullies, diversions, and low flowing streams	1.87	85.00	4,548.00	4.100	0.308
#4	**8**	**Time of Concentration:**					**0.413**
#4	9	5. Nearly bare and untilled, and alluvial valley fans	2.53	40.00	1,584.00	1.580	0.278
		8. Large gullies, diversions, and low flowing streams	1.61	73.00	4,546.00	3.800	0.332
#4	**9**	**Time of Concentration:**					**0.610**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	10	5. Nearly bare and untilled, and alluvial valley fans	3.26	50.00	1,536.00	1.800	0.237
		8. Large gullies, diversions, and low flowing streams	1.21	23.00	1,901.00	3.290	0.160
#4	**10**	**Time of Concentration:**					**0.397**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	2.32	75.00	3,231.00	1.520	0.590
#5	**1**	**Time of Concentration:**					**0.590**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	1.37	83.00	6,044.00	1.170	1.434
#5	**2**	**Time of Concentration:**					**1.434**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	2.93	22.00	752.00	1.710	0.122
		8. Large gullies, diversions, and low flowing streams	1.52	63.00	4,146.00	3.690	0.312
#6	**1**	**Time of Concentration:**					**0.434**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.93	102.00	5,288.00	1.380	1.064
		8. Large gullies, diversions, and low flowing streams	1.09	31.00	2,857.00	3.120	0.254
#7	**1**	**Time of Concentration:**					**1.318**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	1.54	55.00	3,561.00	1.240	0.797
		8. Large gullies, diversions, and low flowing streams	1.40	53.00	3,788.00	3.540	0.297
#7	**2**	**Time of Concentration:**					**1.094**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	3.26	60.00	1,842.00	1.800	0.284
		8. Large gullies, diversions, and low flowing streams	0.98	8.00	817.00	2.960	0.076
#7	**3**	**Time of Concentration:**					**0.360**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	3.08	75.00	2,436.00	1.750	0.386
		8. Large gullies, diversions, and low flowing streams	1.53	35.00	2,291.00	3.700	0.171
#8	**1**	**Time of Concentration:**					**0.557**
#8	2	5. Nearly bare and untilled, and alluvial valley fans	5.25	60.00	1,142.00	2.290	0.138
		8. Large gullies, diversions, and low flowing streams	1.88	115.00	6,130.00	4.100	0.415
#8	**2**	**Time of Concentration:**					**0.553**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	130.00	2,477.00	2.290	0.300
		8. Large gullies, diversions, and low flowing streams	2.40	104.00	4,333.00	4.640	0.259
#9	**1**	**Time of Concentration:**					**0.559**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.24	80.00	1,105.00	2.690	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.34	143.00	6,113.00	4.580	0.370
#9	**2**	**Time of Concentration:**					**0.484**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	3.67	68.00	1,855.00	1.910	0.269
		8. Large gullies, diversions, and low flowing streams	1.16	55.00	4,740.00	3.230	0.407
#10	**1**	**Time of Concentration:**					**0.676**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	4.40	103.00	2,342.00	2.090	0.311
#10	**2**	**Time of Concentration:**					**0.311**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	0.70	60.00	8,630.00	0.830	2.888
#11	**1**	**Time of Concentration:**					**2.888**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	1.08	59.00	5,468.00	1.030	1.474
#11	**2**	**Time of Concentration:**					**1.474**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	0.89	50.00	5,647.00	0.940	1.668
#11	**3**	**Time of Concentration:**					**1.668**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	1.48	47.00	3,181.00	1.210	0.730
		8. Large gullies, diversions, and low flowing streams	1.98	81.00	4,100.00	4.210	0.270
#11	**4**	**Time of Concentration:**					**1.000**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	778.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	3.74	98.00	2,620.00	5.800	0.125
#13	**1**	**Time of Concentration:**					**0.245**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	9.77	50.00	512.00	3.120	0.045
		8. Large gullies, diversions, and low flowing streams	3.65	87.00	2,386.00	5.720	0.115
#13	**2**	**Time of Concentration:**					**0.160**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	19.02	85.00	447.00	4.360	0.028
		8. Large gullies, diversions, and low flowing streams	3.12	82.00	2,627.00	5.300	0.137
#13	**3**	**Time of Concentration:**					**0.165**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.51	105.00	2,995.00	1.870	0.444
		8. Large gullies, diversions, and low flowing streams	0.72	60.00	8,278.00	2.550	0.901
#13	**4**	**Time of Concentration:**					**1.345**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#3	**1**	**Muskingum K:**					**0.510**
#3	2	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#3	**2**	**Muskingum K:**					**0.510**
#3	3	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.03	3.490	0.510
#3	**3**	**Muskingum K:**					**0.510**
#3	4	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.00	4.440	0.176
#3	**4**	**Muskingum K:**					**0.176**
#3	5	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.00	4.440	0.176
#3	**5**	**Muskingum K:**					**0.176**
#3	6	8. Large gullies, diversions, and low flowing streams	0.84	35.00	4,143.48	2.750	0.418
#3	**6**	**Muskingum K:**					**0.418**
#4	1	8. Large gullies, diversions, and low flowing streams	1.76	98.00	5,553.00	3.980	0.387
#4	**1**	**Muskingum K:**					**0.387**
#4	2	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**2**	**Muskingum K:**					**0.534**
#4	3	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**3**	**Muskingum K:**					**0.534**
#4	4	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**4**	**Muskingum K:**					**0.389**
#4	5	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**5**	**Muskingum K:**					**0.389**
#4	6	8. Large gullies, diversions, and low flowing streams	1.50	66.00	4,388.00	3.670	0.332
#4	**6**	**Muskingum K:**					**0.332**
#4	7	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**7**	**Muskingum K:**					**0.183**
#4	8	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**8**	**Muskingum K:**					**0.183**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.30	68.00	5,236.00	1.130	1.287
#5	**1**	**Muskingum K:**					**1.287**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	1	8. Large gullies, diversions, and low flowing streams	1.22	13.00	1,067.00	3.310	0.089
#7	**1**	**Muskingum K:**					**0.089**
#7	2	8. Large gullies, diversions, and low flowing streams	1.22	13.00	1,067.00	3.310	0.089
#7	**2**	**Muskingum K:**					**0.089**
#8	1	8. Large gullies, diversions, and low flowing streams	1.06	25.00	2,356.04	3.090	0.211
#8	**1**	**Muskingum K:**					**0.211**
#9	1	8. Large gullies, diversions, and low flowing streams	1.59	39.00	2,446.00	3.780	0.179
#9	**1**	**Muskingum K:**					**0.179**
#11	1	8. Large gullies, diversions, and low flowing streams	1.11	93.00	8,350.00	3.160	0.734
#11	**1**	**Muskingum K:**					**0.734**
#11	2	8. Large gullies, diversions, and low flowing streams	1.22	93.00	7,626.00	3.310	0.639
#11	**2**	**Muskingum K:**					**0.639**
#11	3	8. Large gullies, diversions, and low flowing streams	1.67	88.00	5,265.04	3.870	0.377
#11	**3**	**Muskingum K:**					**0.377**
#13	1	8. Large gullies, diversions, and low flowing streams	0.79	87.00	10,974.00	2.670	1.141
#13	**1**	**Muskingum K:**					**1.141**
#13	2	8. Large gullies, diversions, and low flowing streams	0.75	73.00	9,772.00	2.590	1.048
#13	**2**	**Muskingum K:**					**1.048**
#13	3	8. Large gullies, diversions, and low flowing streams	0.72	63.00	8,709.00	2.550	0.948
#13	**3**	**Muskingum K:**					**0.948**

Outflow Channel - Stability Design for 25 yr - 6 hr Storm Event

Material: Spoils - shale w/sandstone cobbles

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
20.00	5.0:1	11.0:1	0.5	0.0300	1.00			5.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	408.00 cfs	
Depth:	2.27 ft	3.27 ft
Top Width:	56.32 ft	72.32 ft
Velocity:	4.71 fps	
X-Section Area:	86.62 sq ft	
Hydraulic Radius:	1.530	
Froude Number:	0.67	

APPENDIX 12-F

LOWE CORNER 3 EAST AND NORTH DROP STRUCTURES

Lowe Corner 3 East and North Drop Structure

The D50 riprap size required for the east drop structure is approximately 2.5 feet; the availability of this size material is very limited in the local area. Gabion mats will be utilized in lieu of a normal riprap lining. Computer software developed by Maccaferri Incorporated was used to design the gabions. The design flows were taken from Appendix 11-X "Lowe Arroyo Post-mining Hydrology & Sedimentology"; 25 year-6 hour storm event for stability design and 100 year-6 hour event storm for capacity design. The printouts for the design are attached. The plan, typical section, and profile are shown on Exhibit 12-33.

The north drop structure also requires large size riprap. The riprap placed in this structure was grouted with concrete to produce a more rigid structure that would withstand the high flow velocity. This structure will remain as is and monitored for stability in the future.

MACRA1 2002

Program released to:	Leonard Raymond	**Tel:**	505-590-3268
Company:	BHP Navajo Coal Company	**EMail:**	leonard.r.raymond@bhpbilliton.com
Title:	Lowe Reclamation		
Description:	Drop structure east of Lowe Premanent Imp. 25 yr-6 hr Storm		
Folder:	Lowe Corner 3 east DS 25yr6hr		
Date:	12/16/03		

Notice

Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	0.50	Froude number	0.59
Discharge [ft3/s]	334.00	Cross section [ft2]	64.99
Water level [ft]	3.07	Wetted perimeter [ft]	28.75
Average velocity [ft/s]	5.14	Hydraulic radius [ft]	2.26

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**Veg**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
3.0	10.06	3.42	1.00							
3.1	10.06			5.00	0.90	GabionMats 12"	N	0.73	8.95	Y
4.0	15.00	5.84	1.00							
4.1	15.00			5.00	0.90	GabionMats 12"	N	0.98	10.45	Y
5.0	10.06	3.42	1.00							
5.1	10.06			5.00	0.90	GabionMats 12"	N	0.73	8.95	Y

Run n.2

Gradient [%]	5.60	Froude number	1.77
Discharge [ft3/s]	334.00	Cross section [ft2]	28.68
Water level [ft]	1.58	Wetted perimeter [ft]	22.07
Average velocity [ft/s]	11.64	Hydraulic radius [ft]	1.30

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**Veg**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
3.0	10.06	7.34	1.00							
3.1	10.06			5.00	3.01	GabionMats 12"	N	4.22	8.95	Y
4.0	15.00	12.55	1.00							
4.1	15.00			5.00	3.01	GabionMats 12"	N	5.63	10.45	Y
5.0	10.06	7.34	1.00							
5.1	10.06			5.00	3.01	GabionMats 12"	N	4.22	8.95	Y

Run n.3

Gradient [%]	10.50	Froude number	2.35
Discharge [ft3/s]	334.00	Cross section [ft2]	23.33
Water level [ft]	1.32	Wetted perimeter [ft]	20.91
Average velocity [ft/s]	14.32	Hydraulic radius [ft]	1.12

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**Veg**	**tau max [lb/ft2]**	**tau adm [lb/ft2]**	**GeoFil**
3.0	10.06	8.93	1.00							
3.1	10.06			5.00	4.13	GabionMats 12"	N	6.63	8.95	Y
4.0	15.00	15.27	1.00							
4.1	15.00			5.00	4.13	GabionMats 12"	N	8.84	10.45	Y
5.0	10.06	8.93	1.00							
5.1	10.06			5.00	4.13	GabionMats 12"	N	6.63	8.95	Y

Materials used Description	**Roughness**	**Allow. shear stress [lb/ft2]**	**Veg**	**Rock d50 [inch]**	**Thickness [ft]**	**Rockfill unit weight [lb/ft3]**	**Time [h]**	**C Shields**
GabionMats 12"	0.0380	10.45	N	8.85	0.98	165.51		0.14

Where,

V= Maximum flow velocity
K= Correction factor for curvature
Vadm= Maximum allowable interface velocity beween the gabion structure and soil (erosive velocity of the soil)
Vb= Calculated interface velocity
Veg= Is vegetation established through the gabions (Y=yes or N=no)
tau max= Calculated maximum shear stress
tau adm= Maximum allowable shear stress
GeoFil= Is filter fabric used beneath the gabion (Y=yes or N=no)
C= Shields Coefficient

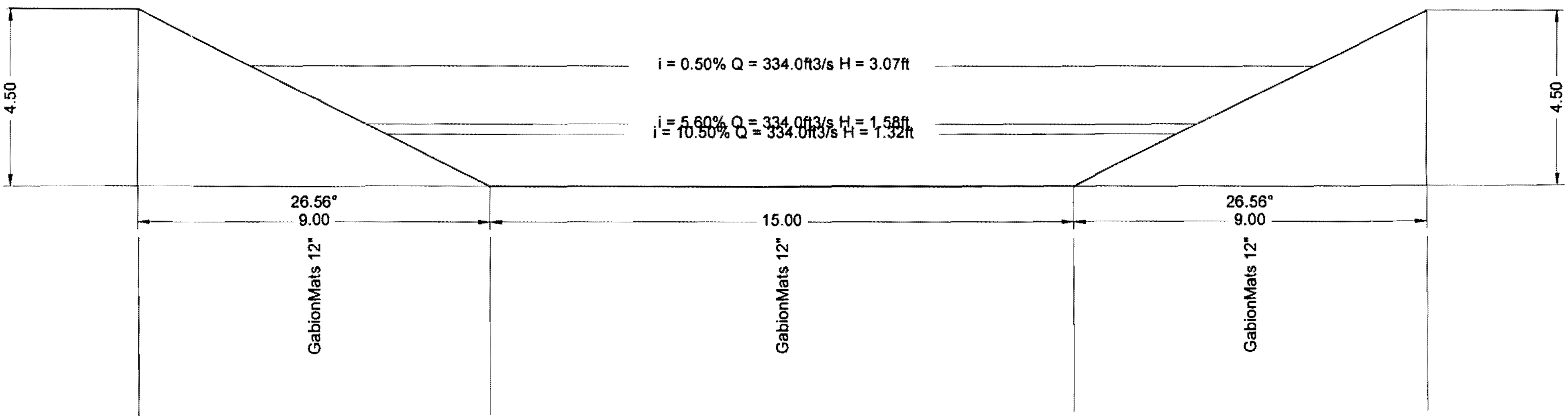
Macra1 2002

Maccaferri River Analysis
Bank Protections

Title: Lowe Reclamation
Description: Drop structure east of Lowe Premanent Imp.
25 yr-6 hr Storm

Folder: Lowe Corner 3 east DS 25yr6hr
Date: 12/16/2003

Program released to:Leonard Raymond
BHP Navajo Coal Company
505-590-3268
leonard.r.raymond@bhpbilliton.com



MACRA1 2002

Program released to: Leonard Raymond
Company: BHP Navajo Coal Company
Title: Lowe Reclamation
Description: Drop structure east of Lowe Premanent Imp.
100 yr-6 hr Storm

Folder: Lowe Corner 3 east DS 100yr6hr
Date: 12/16/03

Tel: 505-590-3268
EMail: leonard.r.raymond@bhpbilliton.com

Notice

Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	0.50	Froude number	0.60
Discharge [ft3/s]	482.00	Cross section [ft2]	83.98
Water level [ft]	3.74	Wetted perimeter [ft]	31.71
Average velocity [ft/s]	5.74	Hydraulic radius [ft]	2.65

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**Veg**	**tau max [lb/ft2]**	**tau adm** [lb/ft2]	**GeoFil**
3.0	10.06	3.89	1.00							
3.1	10.06			5.00	0.90	GabionMats 12"	N	0.89	8.94514	Y
4.0	15.00	6.66	1.00							
4.1	15.00			5.00	0.90	GabionMats 12"	N	1.19	10.445	Y
5.0	10.06	3.89	1.00							
5.1	10.06			5.00	0.90	GabionMats 12"	N	0.89	8.94514	Y

Run n.2

Gradient [%]	5.60	Froude number	1.83
Discharge [ft3/s]	482.00	Cross section [ft2]	36.62
Water level [ft]	1.94	Wetted perimeter [ft]	23.67
Average velocity [ft/s]	13.16	Hydraulic radius [ft]	1.55

Stretch	**Length [ft]**	**V [ft/s]**	**K**	**Vadm [ft/s]**	**Vb [ft/s]**	**Material**	**Veg**	**tau max [lb/ft2]**	**tau adm** [lb/ft2]	**GeoFil**
3.0	10.06	8.42	1.00							
3.1	10.06			5.00	3.01	GabionMats 12"	N	5.19	8.94514	Y
4.0	15.00	14.39	1.00							
4.1	15.00			5.00	3.01	GabionMats 12"	N	6.91	10.445	Y
5.0	10.06	8.42	1.00							
5.1	10.06			5.00	3.01	GabionMats 12"	N	5.19	8.94514	Y

Run n.3

Gradient [%]	10.50	Froude number	2.43
Discharge [ft3/s]	482.00	Cross section [ft2]	29.70
Water level [ft]	1.63	Wetted perimeter [ft]	22.28
Average velocity [ft/s]	16.23	Hydraulic radius [ft]	1.33

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	Veg	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
3.0	10.06	10.25	1.00							
3.1	10.06			5.00	4.13	GabionMats 12"	N	8.16	8.94514	Y
4.0	15.00	17.53	1.00							
4.1	15.00			5.00	4.13	GabionMats 12"	N	10.87	10.445	Y
5.0	10.06	10.25	1.00							
5.1	10.06			5.00	4.13	GabionMats 12"	N	8.16	8.94514	Y

Materials used Description	Roughness	Allow. shear stress [lb/ft2]	Veg	Rock d50 [inch]	Thickness [ft]	Rockfill unit weight [lb/ft3]	Time [h]	C Shields
GabionMats 12"	0.0380	10.45	N	8.85	0.98	165.51		0.14

Where,

V= Maximum flow velocity
K= Correction factor for curvature
Vadm= Maximum allowable interface velocity beween the gabion structure and soil (erosive velocity of the soil)
Vb= Calculated interface velocity
Veg= Is vegetation established through the gabions (Y=yes or N=no)
tau max= Calculated maximum shear stress
tau adm= Maximum allowable shear stress
GeoFil= Is filter fabric used beneath the gabion (Y=yes or N=no)
C= Shields Coefficient

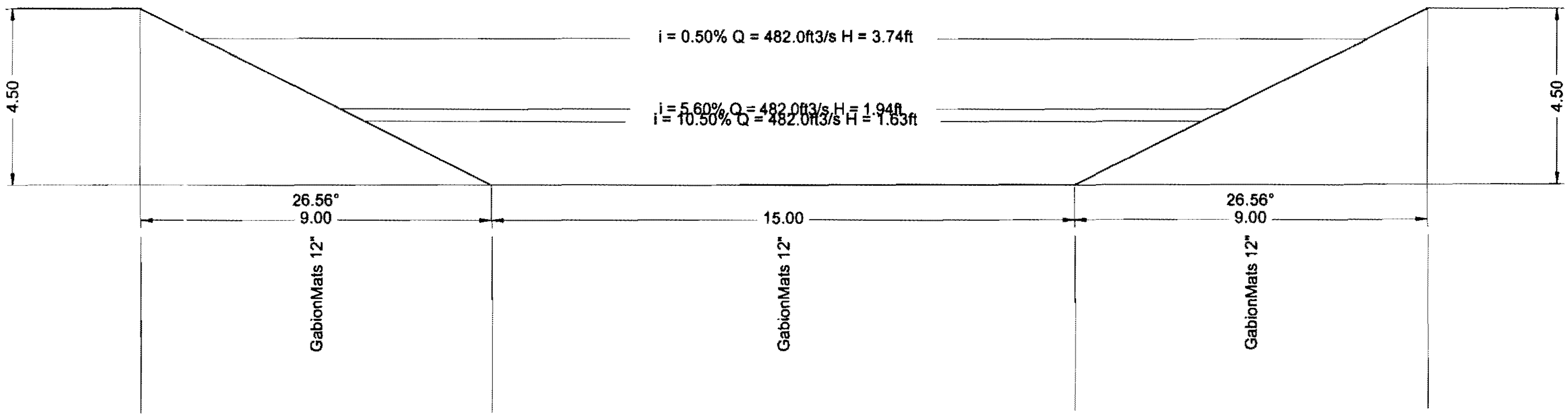
Macra1 2002

Maccaferri River Analysis
Bank Protections

Title: Lowe Reclamation
Description: Drop structure east of Lowe Premanent Imp.
100 yr-6 hr Storm

Folder: Lowe Corner 3 east DS 100yr6hr
Date: 12/16/2003

Program released to:Leonard Raymond
BHP Navajo Coal Company
505-590-3268
leonard.r.raymond@bhpbilliton.com



Lowe Corner 3 North Downdrain Sta 0+26 to 3+85, Stability Design, 25yr-6hr Storm Event (As-built)

Material: Grouted Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	12.1	0.0250	1.00			15.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	146.00 cfs	
Depth:	0.70 ft	1.70 ft
Top Width:	16.20 ft	22.20 ft
Velocity:	14.77 fps	
X-Section Area:	9.88 sq ft	
Hydraulic Radius:	0.601	
Froude Number:	3.33	

Lowe Corner 3 North Downdrain Sta 0+26 to 3+85, Capacity Design, 100yr-6hr Storm Event (As-built)

Material: Grouted Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
12.00	3.0:1	3.0:1	2.3	0.0250	1.00			15.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	212.10 cfs	
Depth:	1.38 ft	2.38 ft
Top Width:	20.28 ft	26.28 ft
Velocity:	9.52 fps	
X-Section Area:	22.27 sq ft	
Hydraulic Radius:	1.074	
Froude Number:	1.60	

Lowe Corner 3 North Downdrain Sta 3+85 to 5+16, Stability Design, 25yr-6hr Storm Event (Asbuilt)

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	5.0:1	5.0:1	2.4	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	146.00 cfs	
Depth:	0.97 ft	1.97 ft
Top Width:	19.72 ft	29.72 ft
Velocity*:		
X-Section Area:	14.44 sq ft	
Hydraulic Radius:	0.725	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Lowe Corner 3 North Downdrain Sta 3+85 to 5+16, Capacity Design, 100yr-6hr Storm Event (Asbuilt)

Material: Ripap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
10.00	3.0:1	3.0:1	2.4	0.0400	1.00			10.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	212.10 cfs	
Depth:	1.91 ft	2.91 ft
Top Width:	21.44 ft	27.44 ft
Velocity:	7.08 fps	
X-Section Area:	29.96 sq ft	
Hydraulic Radius:	1.359	
Froude Number:	1.06	

West Lowe Drainage Control Structure

West Lowe Drainage Control Structures

The West Lowe drainage control structures were constructed in 1990. These structures consist of a Gabion drop structure, a rip-rapped channel and rip-rapped check dams. Refer to Exhibit 12-47 for as-built plan, profile and section details.

With a watershed of 49 Acres, this channel is an Ephemeral drainage channel and the minimum design storm frequency is 10 year-6 hour (Table A, Reclamation Surface Stabilization handbook). Computer software developed by Maccaferri Incorporated was used to check the typical configuration and safety factor of the as-built gabion structure. Refer to Appendix 12-F for the Sedcad and Maccaferri results.

Existing West Lowe Gabion Structure, location NW of Lowe Coal Stockpile.

Inflow information upstream of West Lowe Gabion Structure.

RYazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	Type II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	West Lowe Gabion

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	45.100	45.100	23.34	1.37

Structure Detail:

Structure #1 (Null)

West Lowe Gabion

Subwatershed Hydrology Detail:

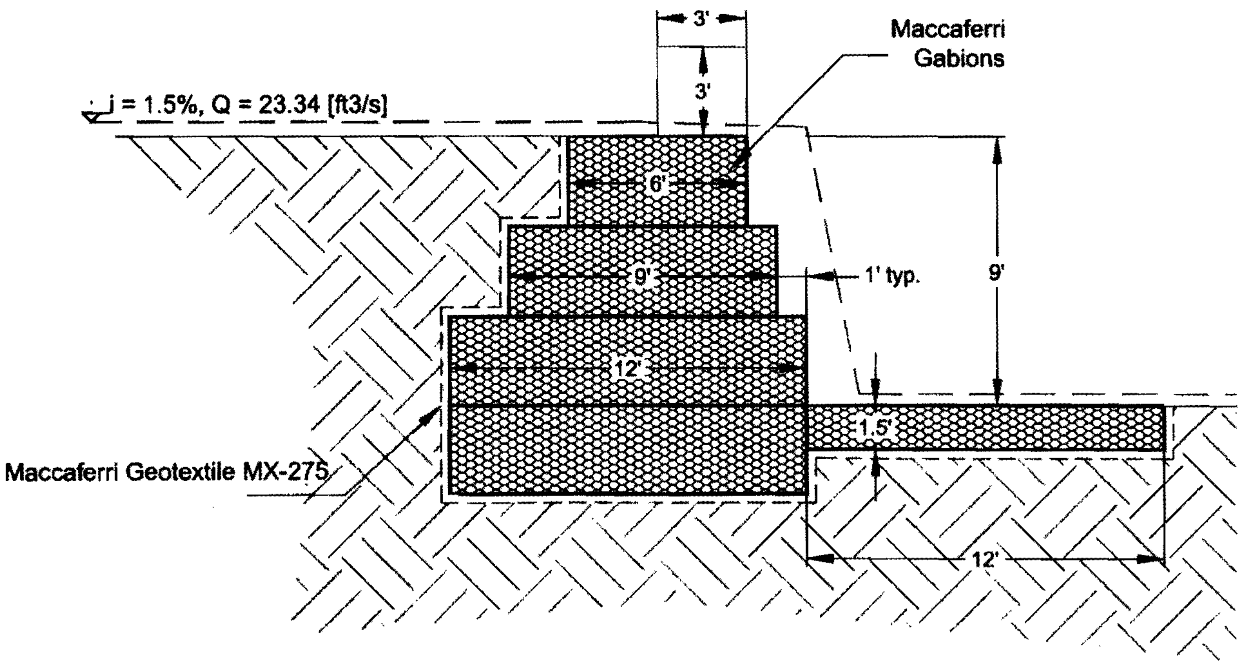
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	45.100	0.207	0.000	0.000	86.000	M	23.34	1.37
	S	**45.100**						**23.34**	**1.37**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.69	5.70	212.00	1.630	0.036
		8. Large gullies, diversions, and low flowing streams	2.14	58.00	2,711.08	4.380	0.171
#1	**1**	**Time of Concentration:**					**0.207**

SECTION VIEW

NOTES:
1. Gabion Mesh to ASTM A975.
2. Gabion Fill to ASTM D6711:
   - 2.1. Rock Size 4" to 8", D50 = 6"
   - 2.1. Rock Unit Weight 157 pcf min.
   - 2.2. Voids 30% max.
3. Maccaferri is not responsible for the Bearing Capacity of the Soil.



1 9' TYPICAL CROSS SECTION
Maccaferri Gabion Weir

20

Maccaferri Inc. assumes no responsibility for the drawings and calculations it provides, as they must be intended as a general indication to suggest the proper use of its products.				
Rev:	Issue / Revision:	Drawn:	App:	Date:

MACCAFERRI

Maccaferri, Inc.
10303 Governor Lane Blvd.
Williamsport, MD 21795-3116 USA
Ph. (301) 223-6910 Fax (301) 223-6134

Designed: EG	Date: 02/28/08
Drawn: EG	Date: 02/28/08
Checked: LV	Date: 02/28/08

Project Title: BHP NAVAJO

Client: Contractor Limited

NOT FOR CONSTRUCTION

Title: Typical Cross Section Maccaferri Gabion Weir

Scale: NTS	Project No: —	
Rev: 0	Units: Feet	Drawing No: 1 / 1

Macra

Program released to:	Tel:
Company:	EMail:
Title: BHP Navajo	
Description:	
Folder:	
Date: 2/29/2008	

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Design discharge	Q [ft3/s]	23.34
River bed gradient	i [%]	1.50
Roughness coefficient	n	0.033
Soil Granulometry in the pool	dt [inch]	10.00
Channel Width	L3 [ft]	12.00
Bank top elevation	fp [ft]	15.00
Slope of left bank	Pl [deg]	33.00
Slope of right bank	Pr [deg]	23.00

Soil unit weight	[lb/ft3]	113.97
Soil friction angle	[deg]	32.50
Soil type		Fine Sand
Gabion porosity	n	0.30
Soil-weir friction angle	[deg]	10.00
Soil-foundation friction coefficient	f	0.70
Underpressure influence	Sot (%)	50.00
Bligh coefficient	Cb	4.00

Weir Data - Weir with Vertical Drop

Crest elevation	fg [ft]	9.00
Crest width	Lg [ft]	12.00
Slope of crest wings	Pg [deg]	33.00
Total weir height	H [ft]	12.00

21 **Summary of Hydraulic Results**

Water elevation on crest	zg [ft]	9.48
Water elevation downstream	z3 [ft]	0.53
Backwater elevation	z0 [ft]	9.71
Scour depth downstream	fb [ft]	-4.65
Scour location	X [ft]	3.02
Water elevation under nappe flow	zv [ft]	-3.13
Water elevation at the nappe toe	z1 [ft]	-4.54

Summary of Static Results

Normal force on foundation	N [klb]	16771.63
Shear force on foundation	T [klb]	6391.22
Restoring moment	Ms [klb*ft]	139769.91
Overturning moment	Mo [klb*ft]	50103.12
FS against sliding	**FSsl**	1.84
FS against overtuning	**FSov**	2.79
FS against seepage	**FSseep**	1.06
Normal stress on downstream edge	Sigma1 [klb/ft2]	2081.32
Normal stress on upstream edge	Sigma2 [klb/ft2]	154.90

Static Results Details

Active thrust coefficient	Ka	0.30
Active thrust of upstream backfill soil	Pam [klb]	1489.00
Horizontal component	Pamh [klb]	1466.40
Lever arm of horizontal component	bPamh [ft]	4.00
Moment of horizontal component	MPamh [klb*ft]	5865.61
Vertical component	Pamv [klb]	258.43
Lever arm of vertical component	bPamv [ft]	15.00
Moment of vertical component	MPamv [klb*ft]	3876.49
downstream soil active thrust	Pav [klb]	93.06
Upstream hydrostatic pressure	Pwm [klb]	5018.39
Lever arm of upstream hydrostatic pressure	bPwm [ft]	4.21
Moment of upstream hydrostatic pressure	MPwm [klb*ft]	21130.80
Downstream hydrostatic pressure	Pwv [klb]	0.52

Lever arm of downstream hydrostatic pressure	bPwv [ft]	-0.04
Moment of downstream hydrostatic pressure	MPwv [klb*ft]	-0.02
Lever arm of Weir unit weight	bP [ft]	5.92
Moment of Weir unit weight	MP [klb*ft]	89795.04
Soil unit weight	Pt [klb]	3707.82
Lever arm of Soil unit weight	bPt [ft]	11.50
Moment of Soil unit weight	MPt [klb*ft]	42639.97
Water unit weight	Pw [klb]	448.72
Lever arm of Water unit weight	bPw [ft]	7.50
Moment of Water unit weight	MPw [klb*ft]	3365.37
Uplift pressure	Vw [klb]	2805.73
Lever arm of Uplift pressure	bVw [ft]	8.24
Moment of Uplift pressure	MVw [klb*ft]	23106.70

West Lowe existing Rip-rapped Structure

Location NW of Lowe Coal Stockpile and downstream of existing Gabion Structure.

RYazzie

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	

#1
Channel

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	49.000	49.000	24.95	1.49

Structure Detail:

Structure #1 (Riprap Channel)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
13.00	2.0:1	2.0:1	9.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.20 ft	1.20 ft
Top Width:	13.79 ft	17.79 ft
Velocity*:		
X-Section Area:	2.63 sq ft	
Hydraulic Radius:	0.189	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	49.000	0.217	0.000	0.000	86.000	M	24.95	1.49
	S	**49.000**						**24.95**	**1.49**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.69	5.70	212.00	1.630	0.036
		8. Large gullies, diversions, and low flowing streams	2.41	73.55	3,047.00	4.660	0.181
#1	**1**	**Time of Concentration:**					**0.217**

Lowe Reclamation
Lowe Boxcut Channel

Lowe Boxcut Channel Southwest of Explosive yard. Design is for a 10yr-6hr storm event.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

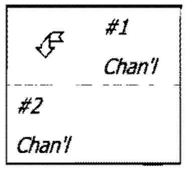
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#2	0.000	0.000	
Channel	#2	==>	End	0.000	0.000	Riprap Section



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	55.000	55.000	16.89	0.89
#2	0.000	55.000	16.89	0.89

Structure Detail:

Structure #1 (Erodible Channel)

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
9.00	5.0:1	4.0:1	5.0	0.0250				6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	16.89 cfs	
Depth:	0.30 ft	
Top Width:	11.69 ft	
Velocity:	5.47 fps	
X-Section Area:	3.09 sq ft	
Hydraulic Radius:	0.263 ft	
Froude Number:	1.87	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	55.000	0.274	0.000	0.000	82.000	M	16.89	0.890
	Σ	**55.000**						**16.89**	**0.890**
#2	Σ	**55.000**						**16.89**	**0.890**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	7.73	14.00	181.00	8.340	0.006
		8. Large gullies, diversions, and low flowing streams	2.37	5.00	211.00	4.610	0.012
		8. Large gullies, diversions, and low flowing streams	12.50	5.00	40.00	10.600	0.001
		8. Large gullies, diversions, and low flowing streams	1.42	16.00	1,130.02	3.560	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	5.00	300.01	3.870	0.021
		8. Large gullies, diversions, and low flowing streams	1.56	25.00	1,600.00	3.750	0.118
		5. Nearly bare and untilled, and alluvial valley fans	6.00	15.00	250.00	2.440	0.028
#1	**1**	**Time of Concentration:**					**0.274**

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	55.000	55.000	44.79	2.38
#2	0.000	55.000	44.79	2.38

Structure Detail:

Structure #2 (Riprap Channel)

Riprap Section

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	7.0:1	9.5			

Riprap Channel Results:

PADER Method - Steep Slope Design

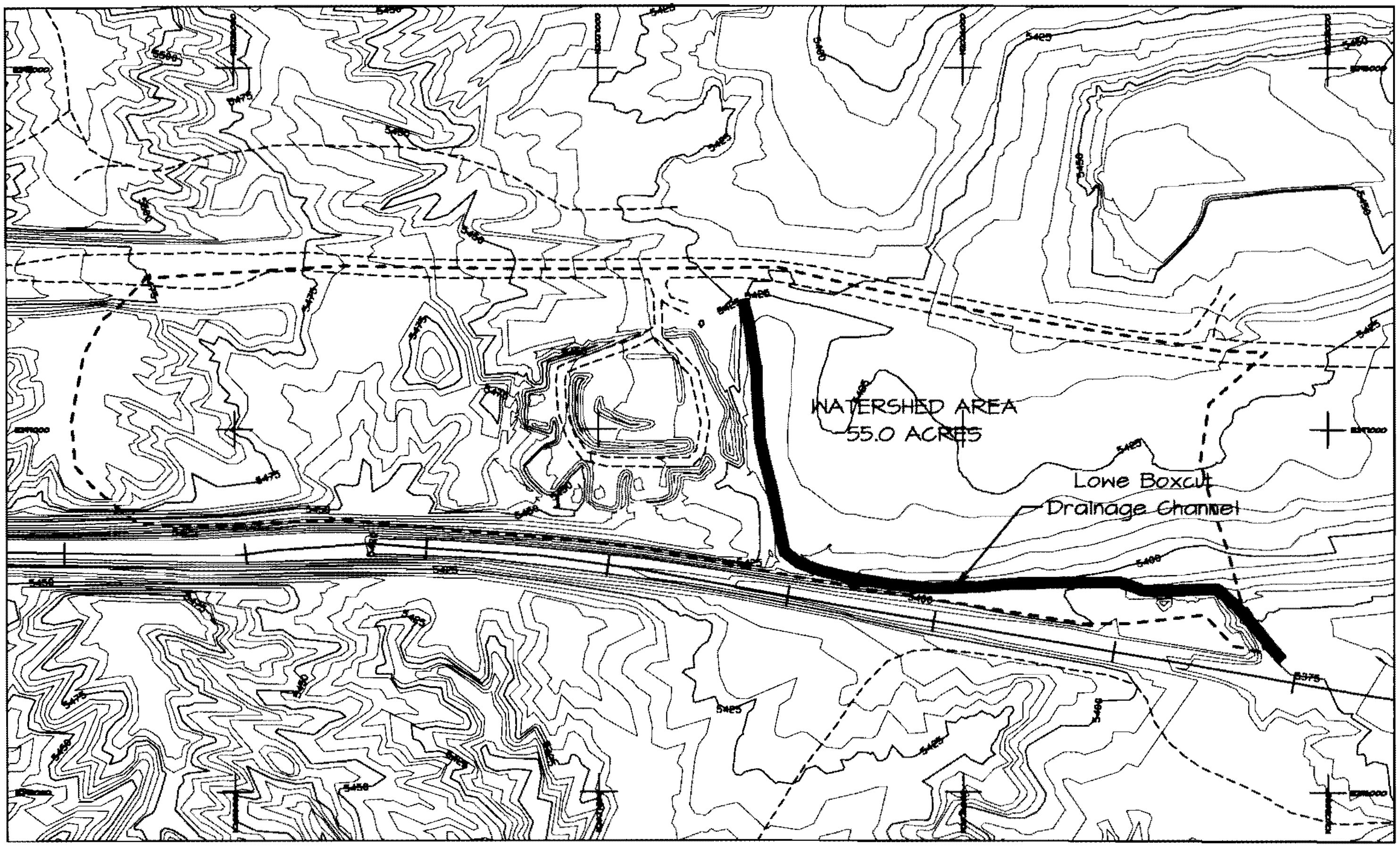
	w/o Freeboard	w/ Freeboard
Design Discharge:	44.79 cfs	
Depth:	0.84 ft	
Top Width:	12.37 ft	
Velocity:	6.53 fps	
X-Section Area:	6.85 sq ft	
Hydraulic Radius:	0.547 ft	
Froude Number:	1.55	
Manning's n:	0.0470	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	55.000	0.274	0.000	0.000	82.000	M	44.79	2.381
	Σ	**55.000**						**44.79**	**2.381**
#2	**Σ**	**55.000**						**44.79**	**2.381**

Subwatershed Time of Concentration Details:

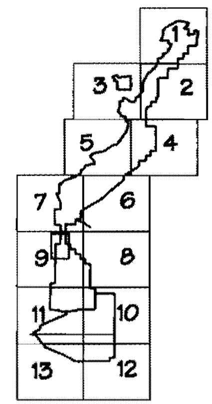
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	7.73	14.00	181.00	8.340	0.006
		8. Large gullies, diversions, and low flowing streams	2.37	5.00	211.00	4.610	0.012
		8. Large gullies, diversions, and low flowing streams	12.50	5.00	40.00	10.600	0.001
		8. Large gullies, diversions, and low flowing streams	1.42	16.00	1,130.02	3.560	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	5.00	300.01	3.870	0.021
		8. Large gullies, diversions, and low flowing streams	1.56	25.00	1,600.00	3.750	0.118
		5. Nearly bare and untilled, and alluvial valley fans	6.00	15.00	250.00	2.440	0.028
#1	**1**	**Time of Concentration:**					**0.274**



PLAN 1"=500'

LEGEND

- PAVED ROAD
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- WATERSHED



CERTIFICATION STATEMENT

I, Ron C. VAN VALKENBURG, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Ron C. VAN VALKENBURG
NEW MEXICO
9263
LICENSED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION					
A	1-16-09	RY	SUBMITTEDTO OSM FOR APPROVAL	SS	SS	FB	RCV	BH

NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

LOWE RECLAMATION
LOWE BOXCUT CHANNEL
LOCATION AND WATERSHED AREAS

PREPARED BY RY	DRAWN BY RY	SCALE 1"=500'
APPROVED BY RCV	DATE JAN. 16, 2009	

DWG LOC C:\Rays\Terramodel\Lowe\Lowe_bxcut_drain_ditch.pro

BHP Navajo Coal Company Noxious Weed Management Plan

I. INTRODUCTION

Invasive weeds pose a serious threat to many native plants in New Mexico. They specialize in colonizing highly disturbed ground. They are able to establish quickly and grow faster on disturbed areas than other plants.

As a surface coal mining operation, BHP Navajo Coal Company (BNCC) has numerous acres of disturbed land. Land disturbances associated with mining provide a habitat conducive to invasion and spread of noxious weeds. A weed management plan is needed to assist with BNCC's revegetation plan to establish diverse, stable and self-sustaining vegetation that will satisfy the following criteria:

1. Adequate cover capable of stabilizing the soil surface from erosion,
2. Adequate forage to sustain the post-mining land uses (i.e. livestock grazing and wildlife habitat), and
3. Suitable species composition for enhancement of wildlife forage and cover.

The Navajo Nation is in the process of developing a Noxious Weed Management Plan. Their plan will supersede this plan when it is completed and accepted.

II. INVENTORY OF NOXIOUS WEED SPECIES

The main areas of concern for noxious weeds at Navajo Mine are on the older reclaimed plots and along waterways. The new reclaimed plots undergoing irrigation will be watched for noxious weeds but will not be addressed unless the weeds consistently persist after irrigation has ceased. These irrigated plots commonly have a high initial density of noxious weeds (which are in the form of annuals). However, the amount is often reduced when the area is no longer irrigated.

There are 5 weed species that are known to be present on the mine site (Table 1). Only 3 of the weeds listed are considered Noxious Weeds.

Table 1. Weed species found at Navajo Mine.

Scientific Name	Common Name	New Mexico Class	Comments
Cenchus longispinus	Sandbur	Not designated	Not noxious
Elaeagnus angustifolia	Russion Olive	C	Noxious
Halogeton glomeratus	Halogeton	B	Noxious
Salsola iberica	Russian Thistle	Not designated	Not noxious
Tamarix ramosissima	Saltcedar	C	Noxious
Kochia scoparia	Kochia	Not designated	Not noxious

III. OBJECTIVES

One of the reclamation objectives stated in the permit is to "Establish on all affected areas a diverse, effective, and long-lasting vegetative cover of the same seasonal variety as the native vegetation" (Chapter 12.1). In addition, BNCC's Health, Safety, Environmental, and Community (HSEC) policy strives for zero harm and long-lasting benefits to the local environment from mining operations. Noxious weeds must be addressed to adhere to this policy.

The objectives of BNCC's weed management plan are prevention, early detection and control of noxious weeds to assist in achieving successful reclamation.

1. Prevention

The best weed management action is to prevent noxious weeds from becoming established in the first place. Preventing weeds from invading a site is the most effective and least costly method for controlling weeds.

Reclamation activities provide a venue for the introduction of noxious weeds. The introduction of noxious weeds can be reduced by purchasing seeds and mulch from licensed and reputable dealers. Routine inspections and familiarization with these dealers will be conducted to ensure no new weed seeds or vegetative parts enter the site through a contaminated seed source in seed mix, straw, and mulch.

Areas will be seeded using native species or carefully chosen non-invasive introduced species as soon as possible after mining has ceased. Quickly establishing a good stand of desirable vegetation will minimize the timeframe for noxious weed establishment by increasing the competition.

2. Early Detection

Early detection of new noxious weeds on the mine site is paramount for controlling noxious weeds. Isolated infestations are high in priority to monitor and control if needed. The BNCC environmental department will remain up to date on the noxious weeds present on the mine site and those that have the potential to invade the mine site from surrounding areas.

3. Control

Control of noxious weeds at BNCC primarily consists of informally monitoring the disturbed/reclaimed areas. These areas are informally inventoried throughout the year via regulatory inspections, irrigation pipeline checks, and general field inspections by BNCC environmental specialists. Infestations of noxious weeds will be addressed according to suitable control measures for each individual species.

3.A. <u>Russian Olive</u>

Russian Olive was introduced from Europe. It is usually found on wet, saline affected sites as well as riparian corridors. They have deep taporoots and a well developed lateral root system. Their fruits are eaten by birds that disseminate it to other areas. At 3 years of age, the trees begin to flower and fruit. Yellow flowers appear in June and July and are later replaced by clusters of fruits. The seeds remain viable for up to 3 years. Control is most effective when the tree is young.

Russian Olive is typically found around ponds and riparian. Russian Olive is well established around Morgan Lake on the northern portion of the mine, outside the mine lease boundary. It is also found in some areas intermixed with saltcedar on the mine site. Russian Olive plants will be both mechanically and chemically treated at the same time and in the same manner as saltcedar.

3.B. <u>Halogeton</u>

Halogeton is an annual forb introduced from Russia. It is toxic to grazing animals, especially sheep. It is adapted to alkaline soils and semiarid enviroments. When an infestation occurs, it makes the area less favorable for revegetation with other species. The abundance of halogeton is dependent upon year to year precipitation. Halogeton produces two types of seeds, a brown and a black. The brown seeds are controlled by long photoperiods, have no dormancy, and are viable for one year. The black seeds are produced during short photoperiods, have dormancy and can survive buried up to 10 years. It is not extremely competitive with other plants because it does not grow a large root system early in the growing season.

The main concern for halogeton at BNCC is on older reclaimed plots where it continues to persist. The control plan for halogeton is to mechanically treat an infested area. Infestations will be determined by density which will be calculated by randomly placing ten 1 m^2 frames (if size allows) in areas where halogeton is present. If the density averages 12 individual halogeton plants or more, the area will be deemed infested. These areas will be treated by hand pulling and hoeing halogeton early in the season before seeds are mature.

3.C. <u>Saltcedar</u>

Saltcedar was introduced from Europe and Asia. It is commonly found where water is present such as irrigation canals, springs, seeps, lakes, playas, arroyos, and dirt stock tanks.

Saltcedar's root system is dominated by a root crown that extends about 12-18 inches below the soil surface. Saltcedar has a high evapotranspiration rate. Its consumption of water can dry out springs, drain pools, and even dry up perennial streams.

Saltcedar is well established along the existing Chinde waterway at Navajo Mine. Methods that target and destroy the root crown are the only techniques that truly provide plant control. Mechanical treatments will be applied to young plants for saltcedar control along the planned permanent Chinde waterway. The mechanical method will consist of hand pulling, hoeing, or digging. This method is effective provided the root crown and associated layered roots have entirely been removed from the soil.

Where saltcedar is well established on the current Chinde waterway, chemical treatment will be applied and followed up by the same mechanical treatment mentioned earlier. The herbicide control will be contracted out. Saltcedar control will occur after nesting and fledging time periods have passed, minimizing the impacts to bird species. Native willows or other suitable riparian species will be planted to replace saltcedar to maintain wildlife habitat.